Determinants of Team Effectiveness for Cross-Functional Organizational Design Teams

by

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Dissertation submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

IN

INDUSTRIAL AND SYSTEMS ENGINEERING

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December 1995

Blacksburg, Virginia

Key Words: Team Effectiveness, Cross-Functional Teams, Organizational Redesign

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ABSTRACT

Recent research indicates that teams are an essential element of most leading organizations (Mohrman, Cohen, & Mohrman, 1995). With the proliferation of team use comes the need for research to better define the design and management requirements unique to specific types of teams. This research focused on cross-functional design teams tasked with the organizational redesign of sociotechnical work systems. A design team is a cross-functional multi-level team with the responsibility to create and often implement a plan for work system redesign. The research objective was to develop a deeper understanding of the team characteristics (called design features) that were most related to team effectiveness. Team effectiveness was defined to include both team performance and team member satisfaction. Cross-functional design teams were studied across two large organizations and key learnings were identified from a third large organization with substantial experience in team-based work redesign. Quantitative and qualitative data were collected from team members using survey questionnaires and interviews. The data analysis strategy included Within and Between Analysis (which uses analysis of variance, correlations, and analysis of covariance) and multiple regression techniques to identify design features most related to team effectiveness at the team level. Results indicated that team skills and clarity in team sponsor expectations were significantly related to team performance at the team level ($r= 0.83$, $p< 0.005$, and $r=0.89$, $p< 0.005$, respectively). These design features were the two most significant predictors of team performance ($p< 0.0005$ for both predictors, adjusted $R^2=.97$). Similar results were obtained for a second

team performance measure. Team self-assessment was significantly related to team satisfaction at the team level ($r = 0.84$, $p < 0.005$) and was the most significant predictor of team satisfaction ($p = 0.0001$, adjusted $R^2 = .71$). These results indicate that teams which reported high levels of team performance were not necessarily satisfied teams. In short, the design features which were strongly related to team performance differed from those that related to team satisfaction. This result lends additional support to the main precept of sociotechnical systems theory, which suggests that to optimize any total work system, both the technical system and the social system must be jointly optimized. Viewing a team as a sociotechnical system, this research suggests that in order to have a team that is effective overall, both the technical system (team performance) and the social system (satisfaction) must be considered. Practical implications and areas for future research are offered.

Acknowledgments

This research represents the largest single effort I have ever undertaken and accomplished in my professional career. At times, it felt like I would never arrive at the destination. Having done so, it's quite clear that this is only the start of a life-long journey. There are many to whom I owe a great deal of thanks for their support and sponsorship. I hope that my attempt to thank them here adequately expresses my gratitude.

Scott Sink, who has been my advisor, colleague, and friend for over six years, I thank for believing in me, for challenging me to take risks and to be unconventional, and for creating such tremendous learning and experiential opportunities.

Brian Kleiner, who was also my advisor, significantly contributed to this dissertation and to my learning, both from a research and professional development standpoint. His demonstrations of confidence and support were always well-timed; I look forward to the years ahead and collaborating on many things.

To Steve Markham, I am grateful for his expert guidance navigating through the research methodology ocean. His guidance, patience, and flexibility has made an invaluable contribution to this committee and to this research.

Scott Geller has served on my graduate committee for six years, through both my master's and doctoral programs. I have learned from him what I aspire to be as a teacher and as a mentor to students. Rarely does one find such a dedicated, committed, and supportive person.

Paul Torgersen has also served on my graduate committee for six years, despite ever-increasing administrative responsibilities. I will remember that he always had a kind word for me and that he chose to remain involved as part of this committee. Thank you for your insight and wisdom.

I thank Dom Monetta for his role on my committee. His support and continued advice over the last several years to always "optimize the objective function" served as constant beacon for keeping the end in sight.

I thank the Charles Minor Fellowship Committee here at Virginia Tech and the National Science Foundation for providing the financial support for creating this fellowship. On the Fellowship Committee, I wish to thank Dean Michael Vorster and Dr. Bevlee Watford — their work in mentoring the graduate students funded by this fellowship, including me, has been much appreciated. I also wish to thank the Department of Industrial and Systems Engineering (ISE) for their support, both financial and otherwise, in my fellowship. The ISE Department has contributed to my learning and development by creating unique teaching and research opportunities. In particular, I wish to thank Dr. Patrick Koelling, Dr. Robert Dryden, Dr. Carl Estes, and Dr. John Casali for their support and mentorship during my graduate career.

This research would not have been possible without the willingness and support of people at National Grocers, Virginia Tech, and Eastman Chemical Company. For their sponsorship and for seeing the value in this research, I thank Dave Poirier at National Grocers, John Krallman and Wayne Donald at Virginia Tech, and Nick Grabar at Eastman Chemical Company. Their interest in this research, willingness to spend time with me, and their support to "pave the way" for me to come into their organizations, are much appreciated. There are many others at these three organizations who directly and indirectly supported this research. Although they are too numerous to thank, I am deeply grateful to them for generously sharing their time and insights with me. I owe thanks to the members of all the teams which participated in this research. At National Grocers: the Finance Senior Management Team, the Information Services Division Design and Development Team, the IPCF Design and Development Team, the Distribution System of the Future Design and Development Team, the Peterborough Leadership Team, the Ottawa Leadership Team, the Surveyor Road Leadership Team, the City Farms Leadership Team, and the Slow Moving Warehouse Steering Team. At Virginia Tech:

the Staff Support Team, the Direct Entry Team, the Time Entry/Leave Team, the Business Process Redesign Planning Team, the Direct Lending Team, and the Resource Allocation Team.

I have been fortunate to be associated with the Center for Organizational Performance Improvement, formerly the Virginia Quality and Productivity Center, throughout my graduate career. The individuals in the Center have endorsed my research and created opportunities for me to gain experience and contribute to real organizations. In addition to Scott Sink, I would like to thank Stephen Hacker, Marta Carter, Jyl Smithson, Elizabeth Holmes, Shane McLaughlin, Chris Bohn, and Susan Bixler.

The Statistical Consulting Center, in particular Dr. Bob Schulman and Dan Price, provided valuable feedback and advice on the use of statistical techniques. This service provided by Virginia Tech is invaluable.

There are a number of individuals to whom I wish to acknowledge for leading the way through research of their own in this area. At the Center for Effective Organizations, Susan Cohen, Susan Mohrman, Monty Mohrman, and Ed Lawler; at the Center for the Study of Work Teams, Mike Beyerlein; and elsewhere around the country, Ira Kaplan, Regina Damiano, and David Campbell. At one time or another, I have spoken personally with each about my research, and I have never ceased to be amazed at the sense of collegiality and willingness to share ideas among these individuals.

My friends and colleagues, both at Virginia Tech and elsewhere, were truly collaborators with me by serving as a sounding board for my ideas. Thank you Steve Van Aken, Altyn Clark, Marla Hacker, Kim Beaumariage, John Rudolph, Eva Pang, and Greg Sedrick. You have all contributed to my growth in many ways.

My parents and grandparents — who supported me throughout my journey through the higher education system. Thank you for never doubting me and for being the loving and kind family that you are. Thank you especially to my Grandma Morton who is my role model and who has never stopped learning. Much to my disbelief, she stayed up

almost all night reading my master's thesis because she thought it was fascinating and couldn't put it down!

Steve — my best friend and most staunch supporter, thank you for your patience, and for taking care of our home and family the last several months to make up for my absence, all without a single complaint. You are the anchor pulling me back to reality, reminding me of what is really important in life. Besides being my husband, you have also been my strongest collaborator in this research; I look forward to doing the same for you in the upcoming year.

To my son Corey, who has brought such meaning, joy, and laughter to my life; this dissertation, as a key milestone in my lifelong journey, is my way of "paying forward" for you.

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Chapter 1 Introduction and Scope of Research

The purpose of this chapter is to introduce the research topic and the scope of the research. To achieve this purpose, the chapter includes: background in the topic area of cross-functional design teams and organizational redesign; the research problem, purpose, and objectives; conceptual and research models which helped frame this research; specific research questions and hypotheses about team effectiveness; premises and delimitations to define the scope of the research; desired outputs and outcomes of the research; a justification for the research as an industrial engineering dissertation; and lastly, an overview of the dissertation document.

1.1. Background

In today's business environment, it is increasingly clear that the traditional hierarchical and autocratic organization is no longer able to produce the results necessary to perform in the global marketplace. In seeking ways to improve quality, productivity, and competitive position, organizations are increasingly adopting strategies to tap the creative potential of the workforce, very often through the use of teams. According to a recent survey, a majority of U.S. organizations have formal employee involvement initiatives in place, and teams are often the mechanism to involve employees (Lawler, Mohrman, & Ledford, 1992).

The use of teams in organizations has evolved over the last decades. Throughout the 1970s and early 1980s, many organizations implemented quality circles: intact work groups of employees meeting usually once a week to solve specific quality problems or issues (Lawler, 1986). Quality circles were first adopted from the Japanese in the mid-1970s at Lockheed and Honeywell, and represent probably the most widely undertaken approach to employee involvement (Cotton, 1993; Lawler, Mohrman, & Ledford, 1992). The use of quality circles seems to be on the decline in the U.S. and is considered by many to be a failure due to various reasons (Dumaine, 1994; Lawler, 1986). However, their use is still relatively popular, and the use of teams in general has increased over time (Lawler et al., 1992). Teams are becoming the essential building blocks for organizations, and team-based organizations rely on a variety of teams for different situations. For example, an organization's infrastructure to support improvement efforts may include process improvement teams, cross-functional teams, self-managing core work teams, and virtual teams — all within a single organization.

There have been various typologies and frameworks proposed for classifying types of teams. Hackman (1990) developed detailed case studies of groups organized into seven distinct categories of work groups: top management groups, task forces, professional support groups, performing groups, human service teams, customer service teams, and production teams. Sundstrom, De Meuse, and Futrell (1990) argue that there are four categories of work teams: advice and involvement, production and service, projects and development, and action and negotiation teams. Others have also presented similar lists (e.g., Cornelius, 1993; Dumaine, 1994; Macy, forthcoming).

Mohrman, Cohen, and Mohrman (1995) provide a different approach to classifying teams. They present a three dimensional framework in which a team can be categorized. First, the purpose or mission of a team may be to perform the core work of the organization (work teams which deliver products or services to external customers) or it may be to improve how core work is accomplished (process improvement teams, quality circles, etc.). Second, a team may be permanent or temporary (e.g., a top leadership team vs. an ad-hoc problem-solving team). And third, a team may represent an intact group within the formal organizational structure or it may overlay the formal structure, in other words, it is cross-functional and/or multiple-level (cross-functional problem-solving team). A specific type of team can be classified in a particular cell of this "cube." This framework appears to capture variations in team applications that other lists do not. In referring to this three-dimensional framework, Mohrman (1993, p.120) states:

> "There has been a tendency in the organizational literature to deal with teams as if they were a homogeneous phenomenon, whereas there are actually many kinds of teams, each with its own design and management requirements. Teams that improperly designed and managed will not achieve their

purpose. In the next ten years, organizations will have to become facile at designing and managing different kinds of teams."

In many cases, the use of teams to support improvement strategies has led to significant results. For example, self-managing teams have been shown in many cases to achieve superior performance as compared to traditional work groups (see Cotton, 1993, for a review). Unfortunately, teams do not always produce expected results and are beginning to be criticized as the latest fad achieving disappointing results, in the same way that Total Quality Management has been (Dumaine, 1994). It is possible that the proliferation of teams has influenced organizations to join the frenzy to create teams, regardless of whether a team is the best approach for the given situation, or set up a team haphazardly, failing to ensure that the right group of people is assembled for the task or that the team has the resources (time, information, materials, or money) necessary to succeed.

Requiring more than the disappointing incremental improvements often achieved with disjointed improvement efforts, many organizations are embarking on comprehensive large-scale change efforts to transform, or *redesign*, the organization to be more competitive. Teams play a significant role in these change efforts. In creating a structure for large-scale change, experts advocate assembling a design team — a cross-functional, multi-level team (often a "diagonal slice" of the system) which acts as the architect of large-scale change for a given target system (Mohrman & Cummings, 1989; Pasmore, 1988). Design teams typically are chartered by a top management group — a leadership team or steering team — and given their essential mission, and it is the team's responsibility to develop a "blueprint" — a design or plan for change in a given target system (a functional work system or a core business process). Design teams may also be responsible for implementing the redesigned system or process. Implementing the redesign often requires creating other teams, for example, spin-off task forces to address more specific design issues, or self-managing teams in the case of a design team using the sociotechnical systems approach to redesign[1].

Despite the importance of design teams in these types of change efforts, there is little research on them, either to capture key learnings of organizations in creating and managing design teams or to study what leads to team effectiveness for these types of teams. These two issues are discussed further below.

First, there are few detailed descriptions documenting examples of and learnings about design teams which might serve as benchmark data for other organizations. According to a recent survey of organizations redesigning to self-managing teams, a major research finding was the lack of documentation by respondents of their installation efforts for self-managing teams. Where documentation of design and implementation efforts did exist, it was often simply the minutes of steering committee meetings (Wingfield, 1992). Wingfield recommends that an additional step in the overall transition process is to document the implementation efforts and to disseminate information about the effort to allow other organizations to learn from the design team's experience. Lathin (1986, p. 86) states "...despite the abundance of literature outlining the steps of sociotechnical systems design, little literature is devoted to the process of assembling design team members and preparing them for their task." Lathin claims that there is little if any literature describing the important processes of how to set up design teams and orient the team to its environment.

Although descriptions of actual design teams are scarce, there are prescriptions for starting up and managing design teams such as team composition and orienting activities (such as education and training) in the practitioner literature. Resources providing the most information about design teams and how they should function are Mohrman and Cummings (1989), focused on organizational self-design in general, and Pasmore (1988) and Hitchcock (1994b), focused more specifically on sociotechnical systems redesign.

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[1] The sociotechnical systems perspective considers every organizational system to be made up of "people (the social system) using tools, techniques, and knowledge (the technical system) to produce goods or services valued by customers (who are part of the organization's external environment)" (Pasmore, 1988).

Some information about design teams is provided in practitioner books on self-managing teams (Orsburn, Moran, Musselwhite, & Zenger, 1990; Wellins, Byham, & Wilson, 1991). These authors stress the importance of key "design features" in installing and managing design teams, for example, team composition — the design team should include multiple functions and levels — and design team education through reading and site visits to other companies.

Secondly, there is apparently no research focused on design teams in the group literature to use empirical data to confirm the relationship between design features and team effectiveness suggested by the practitioner literature. While there has been a great deal of research on teams to study what factors contribute to effectiveness (see Goodman, Ravlin, & Argote, 1986 or Goodman, Ravlin, & Schminke, 1987 for reviews), the research has apparently not focused on these types of teams. Using the framework of team types from Mohrman et al. (1995), design teams are distinct from other types of teams studied — very often core work teams — such that focused inquiry is necessary. Group researchers call for further research to test group effectiveness models in the literature with different types of teams in a variety of settings and to better establish the relationships between variables in the models (Goodman et al., 1986; Metley, Kaplan, Heisler, & Weiner, 1991). This position is consistent with Mohrman's (1993) assertion that we must understand the unique design and management requirements of different types of teams used in organizations.

The group effectiveness literature provides further impetus for this research on design teams. Goodman, Ravlin, & Schminke (1987) argue that current models of group effectiveness are too general and that it is impossible to specify one model with general variables that will apply to all types of teams. They advocate idiographic research to study relatively homogeneous types of teams and specify a model, with specific variables that determine effectiveness, for each type of team. An operational research model is presented that specifies variables relating to design teams, although some variables are also seen in more general models of group effectiveness.

Perhaps because of the lack of guidance and research offered in the literature, there seems to be a great deal of variation across organizations in installing and managing design teams. As an example, some design teams tasked with sociotechnical systems redesign spend a great deal of time learning about self-managing teams through reading, attending conferences, and visiting other organizations. Other organizations spend relatively little, or no time, in such educational activities. Additionally, some design teams use a well-defined redesign process, particularly if the team is following the sociotechnical systems approach to redesign (as described in Pasmore, 1988, and as applied in Raab, Perley, & Cafey, 1994), while other teams do not seem to follow a definable process at all. Variation in these areas is expected and necessary; an organization cannot simply copy another organization's approach but must tailor an approach to their specific situation (Lathin, 1986; Wellins, Byham, & Wilson, 1991). However, based on the available literature about design teams and based on the group effectiveness literature, it is reasonable to presume that there are key design features which will influence a design team's effectiveness and should be common in effective design teams across different organizations (Lathin, 1986).

The manner in which "design features" is used in this research is the same as the perspective of research performed at the Center for Effective Organizations (e.g., Mohrman, Cohen, & Mohrman, 1995). Design features include what could be called attributes, characteristics, or factors of teams. The term is used purposefully to reinforce the perspective taken in this research — the need to engineer, or design, cross-functional design teams to be more effective[2]. There may be debate about whether teams can be engineered or designed to achieve their goals; some may argue that something as complex as a team with all the group dynamics and interpersonal processes that exist cannot be modeled or designed. Mohrman et al. (1995) also adopt a design perspective,

[2] The term design feature is used, although the terminology becomes cumbersome when writing about "design features of design teams" or "designing design teams." Later in this document, these design features are more often referred to as the independent variables, where team effectiveness is the dependent variable.

not only to designing teams but to designing team-based organizations. In the preface to their book, the authors respond to this position:

> "In stressing the design of team-based organizations, we may offend those who are more concerned with team dynamics. This book may seem overly rational to those readers. Although we take very seriously the human element of moving to a new way of doing business, the book is fundamentally a design book. There are others who have dealt well with dynamics issues. We are indebted to them, because they help us know that design is not the only focus required of those attempting to effect a transition to team-based organizations." (Mohrman et al., 1995, p. xvii).

1.2. Problem Statement

The practitioner and scholarly literature do not provide much assistance to organizations on creating and managing design teams. There is a lack of documentation on design teams to serve as benchmark data, and there is a lack of empirical research in the group effectiveness literature confirming the relationship between key design features of design teams and team effectiveness.

1.3. Research Purpose

The fundamental purpose of this research is to increase understanding about the relationship between key design features and team effectiveness for cross-functional organizational design teams. Achieving this purpose will contribute to a longer-term goal of the researcher, which is to improve effectiveness of the use of design teams in organizations by sharing these research findings and continuing this research stream.

1.4. Research Objectives

The objectives for this research are:

- to document intact design teams to provide qualitative descriptive data;
- to develop a model of design team effectiveness based on findings in the scholarly literature which identifies key design features relating to team effectiveness;
- to identify those design features that have a significant relationship with design team effectiveness; and

- to identify key learnings from organizations using design teams.

1.5. Conceptual and Operational Research Models

As mentioned earlier, many organizations are embarking on large-scale change efforts to transform the organization and achieve significantly higher levels of performance. Teams have a very important role as the instruments of change in such efforts. Grand Strategy System (GSS) is one approach for managing comprehensive and integrated large-scale change and is a method for plan, do, study, act (PDSA) at the organizational system level (Sink & Morris, 1995; Sink & Poirier, 1994). Figure 1.1 provides an overview of the GSS model. A Grand Strategy System contains four basic components: (1) past, (2) present, (3) future, and (4) fronts. In the GSS approach, design teams perform a critical role in organizational redesign and change. The team works together with the leadership team of the target system to execute the major steps described next[3].

A key step in the GSS approach is to analyze past and current efforts to improve performance, to learn from past failures and build on past successes before developing a plan for the future. A plan for the future addresses vision, plans, strategies, and great performance targets aimed at a number of organizational sub-systems, or fronts. These fronts need to be led, managed, and improved over time. The terms "front" and "sub-system," or more simply, "system," are used interchangeably. As in a battle or war strategy, letting one front get too far ahead of others is not desirable; conversely, allowing a front to lag too far behind others is also undesirable. A challenge for the design team is to ensure that activities and changes along the fronts have alignment and synergy. The nine fronts in the GSS framework are: planning; infrastructure; measurement; culture; education, training, and development; motivation (rewards and recognition); communication; technology; and politics (internal and external). A description of each front is provided in Chapter 2, Body of Knowledge Review. The GSS approach briefly

[3] This section describing the Grand Strategy System (GSS) approach was adapted with permission from Clark (1995).

described here was used as the methodology for organizational transformation at one of the research sites, National Grocers, Inc., described in Chapter 3.

A team-based organization uses a variety of team types to involve employees in different situations, as shown in Figure 1.2. For example, within the formal organization structure, an organization might have management or leadership teams to lead and provide vision and direction to organization members in addition to self-managing teams of employees to perform the core work of the organization. Within the parallel structure, an organization might have process improvement teams to document and improve core work processes, cross-functional teams to address organization-wide issues, design teams to design and implement large-scale change, and affinity groups (Van Aken, Monetta, & Sink, 1994) to involve and build capability in white-collar and knowledge workers.

Teams within the organization's infrastructure (including both the formal organization structure and parallel structure) are interdependent; one team's output or accomplishments impacts other teams. To illustrate, consider a design team tasked with designing and implementing self-managing teams in a particular area of an organization. Design teams do not work on their task in isolation but must manage linkages with other groups in the organization. Specifically, the design team has interactions with what is often called a steering team (this role may be performed by a management or leadership team), other stakeholder groups, and the core work teams. One of the key issues emphasized in the literature on organization self-design is the importance of managing the information flow with the steering team (which often must approve the design team's plan) and with other stakeholder groups, for example, other employees who are the "end-users" of the design team's work (Mohrman & Cummings, 1989).

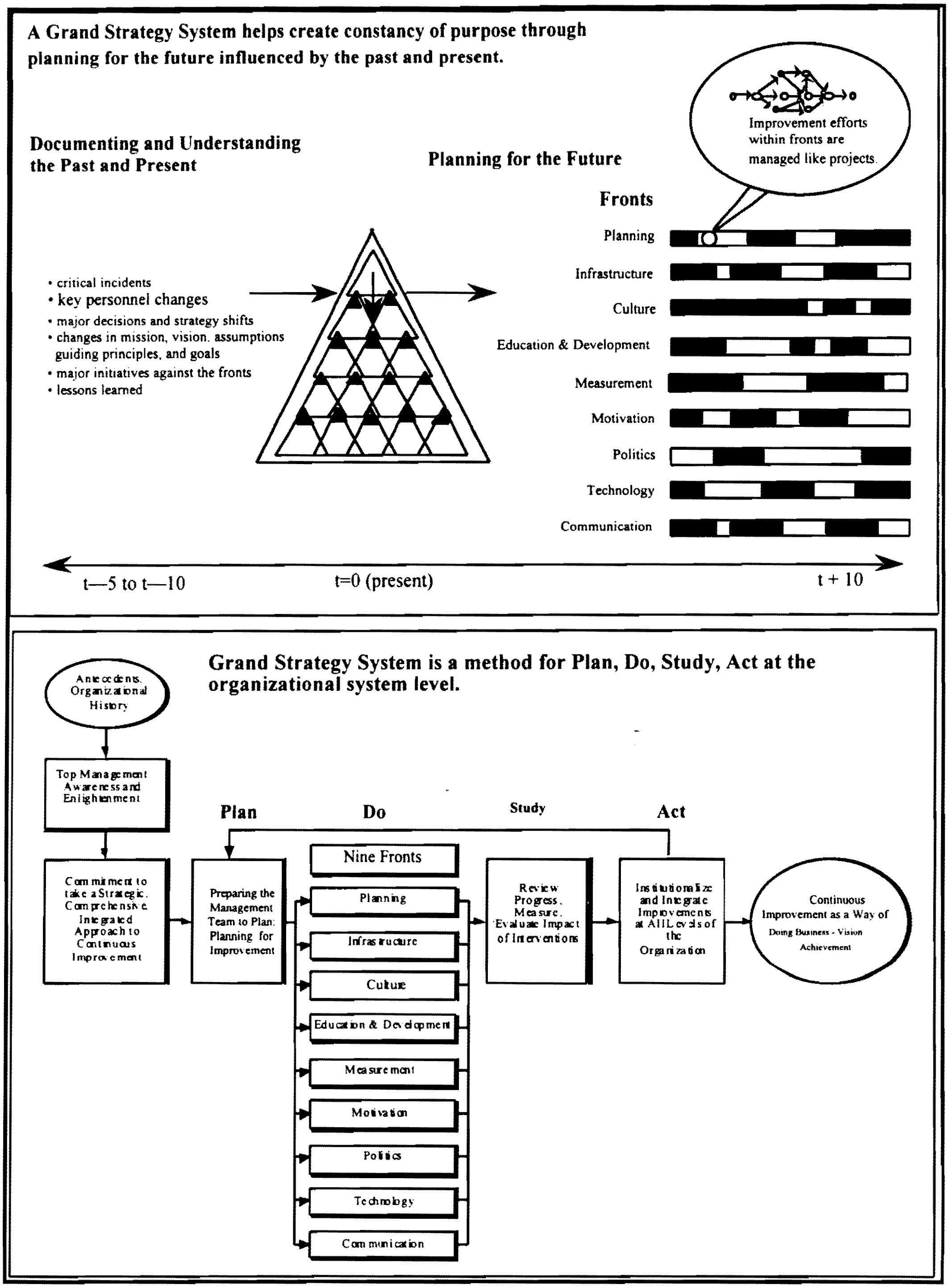

Figure 1.1. Grand Strategy System Components: Past, Present, Future, and Fronts.

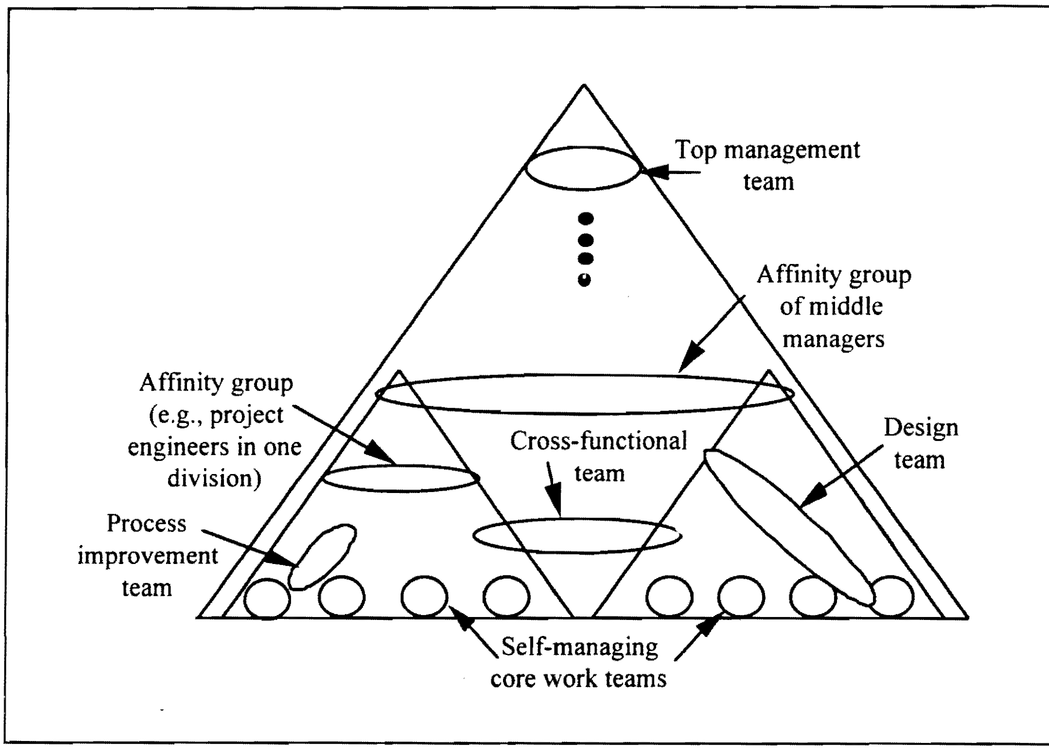

Figure 1.2. Types of Teams Within Organizational Infrastructure.

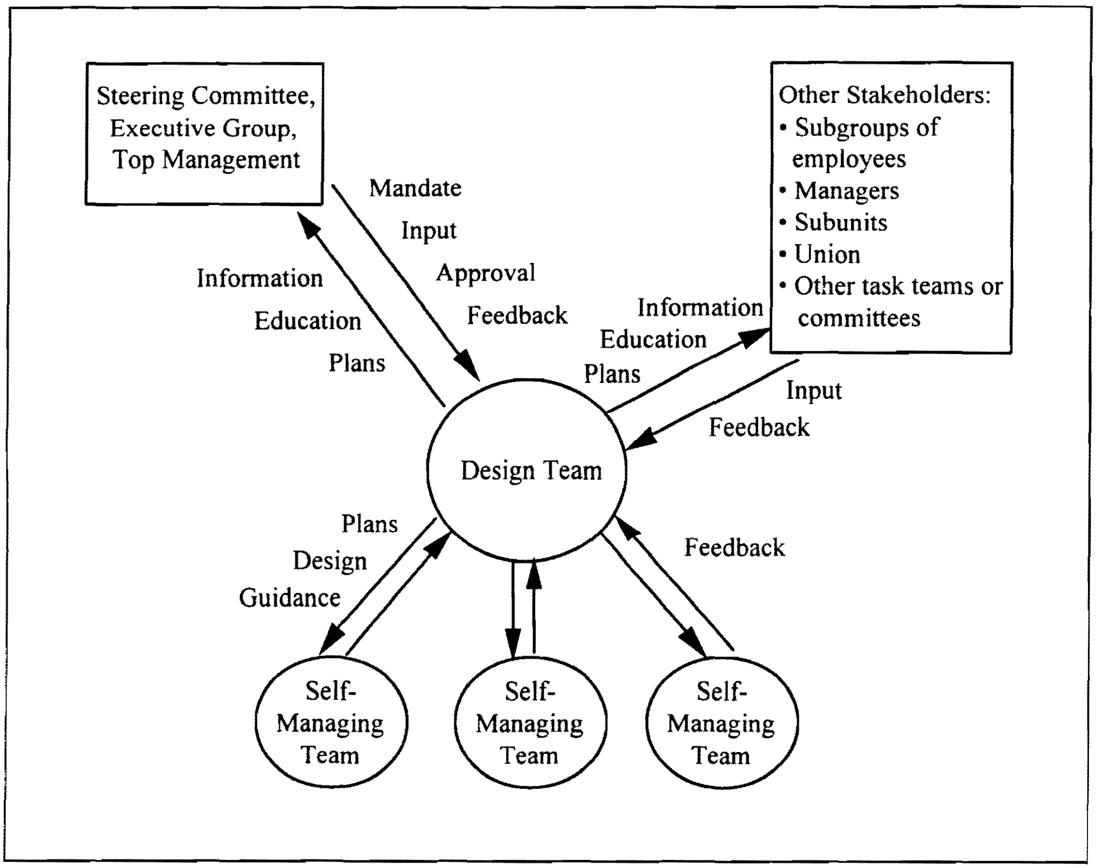

Figure 1.3. Design Team Linkages (adapted from Mohrman and Cummings, 1989)

As shown in Figures 1.4 and 1.5, this research is focused on understanding what leads to effective design teams by studying the relationship between design team "inputs" (composition, technology/task, organizational resources), team processes, and team effectiveness. The shading in the conceptual research model (Figure 1.4) shows the emphasis of this research, that is, studying the relationship between design features of teams and team effectiveness. The focus of the research is not the relationship between team effectiveness and actual business results produced by the organizational system, which is beyond the scope of this research. The operational research model in Figure 1.5 is based on a framework (i.e., inputs-processes-outputs) seen in some of the more current models of group effectiveness (in particular, see Gladstein, 1984; also see Greenbaum, Kaplan, & Damiano, 1991 and Urban, Bowers, Cannon-Bowers & Salas, 1994).

The dependent variable for this research, design team effectiveness, is defined to include both team performance and team satisfaction. Other research has also included team satisfaction or team viability within the team effectiveness construct (for example, Cohen, Mohrman, & Mohrman, 1993; Hackman, 1990). Hackman (1990) argues that it is important to measure team performance and results, in addition to other outcomes of teams, such as team satisfaction or team viability. Not all researchers agree with this viewpoint, however (see Little, 1993).

The two measures used to operationalize team performance are two ways that team members subjectively assessed their team's performance. Team performance in this research is not defined using objective output measures, as with a core work team, nor is it defined using improvements in business results of the target organizational system. Although the purpose of organizational redesign and of design teams is to improve business results, this measure is very distant to the team in terms of time and other factors that may influence business results. For instance, most teams in this research had not yet implemented the team's design and changes, and therefore, had not yet influenced business results. For this research, the operational definition of team performance was aligned very closely to

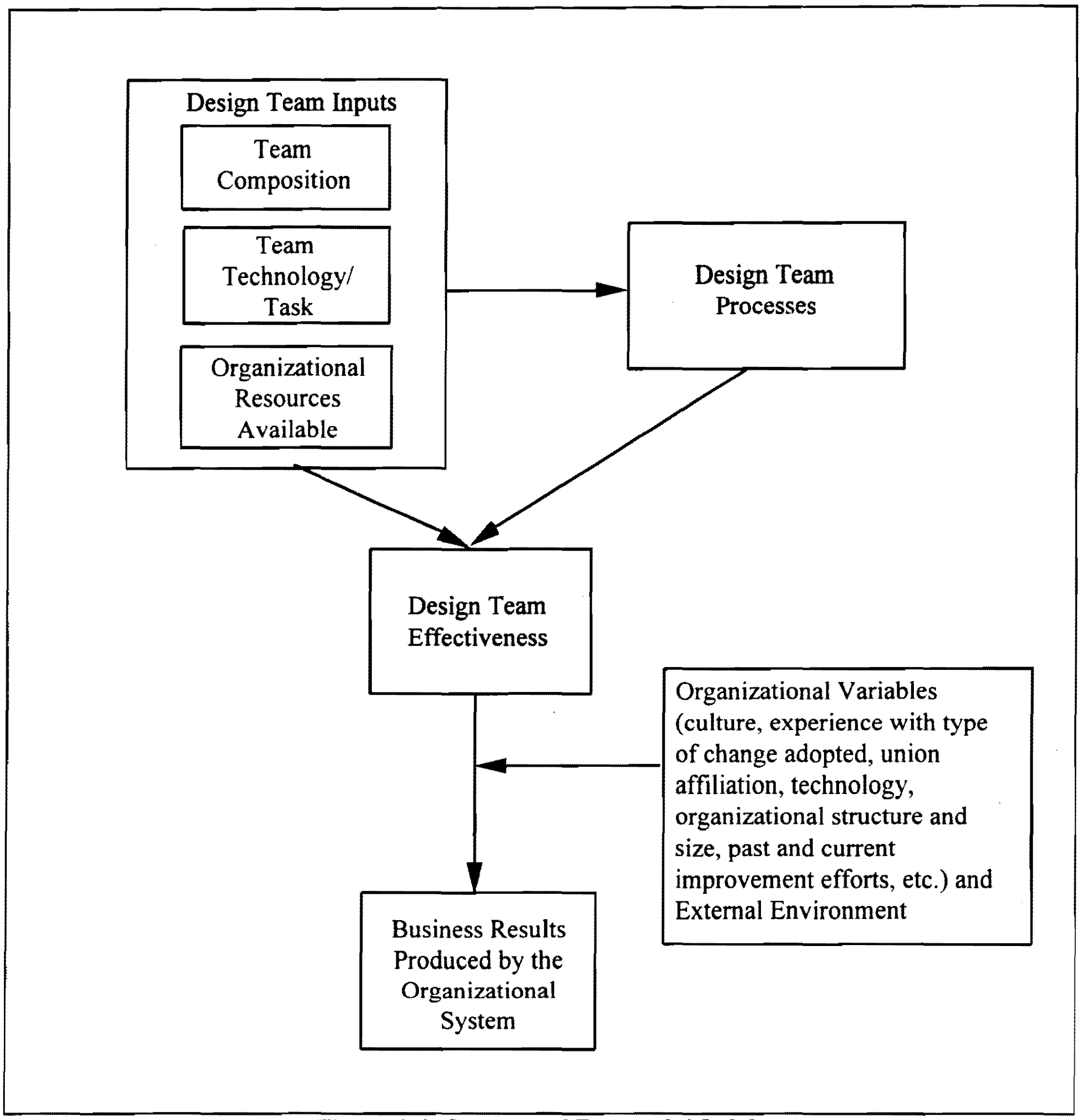

Figure 1.4. Conceptual Research Model.

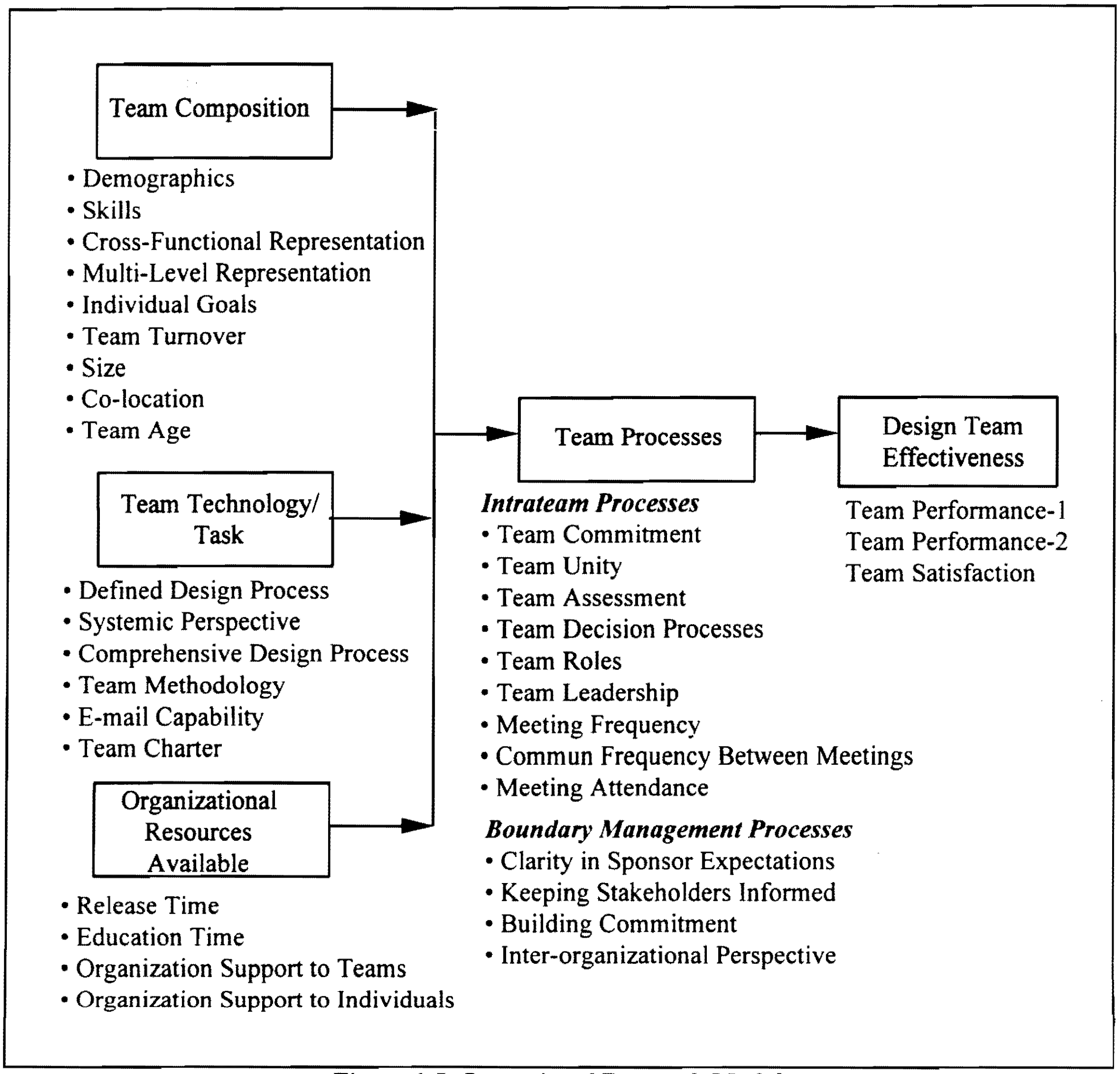

Figure 1.5. Operational Research Model

the team's processes and output (decisions, solutions, plans, reports, etc. — the specific items used to operationally define team performance are discussed in Chapter 3). Future research will seek to develop feasible objective measures of design team performance that can be used across organizational settings.

1.6. Research Questions and Hypotheses

The overall questions this research addresses, and sub-questions or hypotheses, are summarized in Table 1.1. The specific hypotheses/questions are described in more detail in the next section.

Table 1.1. Research Questions and Hypotheses in this Research

Overall Research Questions	Sub-Questions/Hypotheses
Research Question 1: What are the team characteristics and attributes (design features) for design teams in this research?	
Research Question 2: Are there differences in team effectiveness for teams using different redesign methodologies (i.e., Grand Strategy Systems vs. other approaches used by teams in this research)?	-
Research Question 3: Which design features have the greatest variation between design teams?	
Research Question 4: Which design features have a significant relationship with design team effectiveness?	
Team Composition	Research Hypotheses: RH 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 Research Questions: 4.1, 4.2, 4.3
Team Technology/Task	Research Hypotheses: RH 4.7, 4.8, 4.9, 4.10 Research Question: 4.4
Team Processes	Research Hypotheses: 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.18, 4.19, 4.20 Research Questions: 4.5, 4.6, 4.7
Organizational Resources	Research Hypotheses: 4.21, 4.22, 4.23, 4.24
Research Question 5: What are the key learnings from organizations using design teams?	

Research Questions 1, 2, 3, and 5 are not discussed in any more detail here because they are not broken down into more specific hypotheses or questions. Research Question

4 is, however, because it represents the primary focus of this research — increasing understanding of the relationship between design features and team effectiveness. This question was broken down further and developed into research hypotheses and questions which relate to design features, represented by specific variables in the operational research model[4]. The hypotheses and questions are numbered 4.1, 4.2, and so on, because they stem from Research Question 4 above. Based on the scholarly group effectiveness literature, practitioner literature on design teams, expert practitioner input, and the researcher's previous experience with teams, a set of design features believed to contribute to team effectiveness was identified in an operational research model. These design features were clustered into higher-level constructs: team composition, team technology/task, organizational resources, and team processes. Some of these design features relate to design teams specifically and are not typically included in more general models of group effectiveness, for example, use of a systemic design perspective. Other design features relate to groups in general and therefore are seen in other models in the group literature, for example, team commitment. Many of the design features in the research model were included in Hallam and Campbell's (1994) team development model. This model was developed into a Team Development Survey (TDS), which was used in this research.

Accompanying each research hypothesis or question in the following section is a brief discussion of how it relates to the scholarly group effectiveness literature. If no relevant research was found in the scholarly literature, an argument of why that design feature is important to design team effectiveness is presented.

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[4] Within Chapter 1 and throughout the rest of the dissertation, the following order of high-level constructs is used to present and discuss results: team composition variables, team technology/task variables, team process variables, organizational resource variables, and team effectiveness variables. This order is used throughout the dissertation so as to address all variables internal to the team first, then organizational resources to the team.

1.6.1. Team Composition

For this research, there were six variables relating to team composition: demographics, skills, cross-functional representation, multi-level representation, individual goals of team members, team turnover, team size, co-location and team age.

Research Hypothesis 4.1: Design teams that are demographically heterogeneous are more effective.

In a review of the research findings on group composition, Jackson (1992) studied three different types of tasks: performance tasks (clearly defined production tasks), intellective tasks (for which there is a correct answer), and creativity and judgmental decision making. The type of tasks design teams in this research were engaged in most clearly resemble creativity and judgmental decision making. For these types of tasks, the research evidence is fairly consistent in showing that groups that are heterogeneous with respect to personal attributes such as age and gender outperformed homogeneous groups. For this research, demographic variables included were: age, gender, race, education level, job tenure, and organizational tenure.

Research Hypothesis 4.2: Design teams whose members have relevant skills for the team task are more effective.

Jackson (1992) concluded that there is a moderate amount of evidence indicating that heterogeneity in abilities and skills is beneficial as compared to homogeneity for creative/decision-making tasks. Pearce and Ravlin (1987) provided a separate review of the group literature and concluded that homogeneity in abilities has a negative effect on performance. As a related variable, many of the current models of group effectiveness include the variable "adequate skills," or "competence," and not specifically diversity of skills/abilities (Gladstein, 1984; Hackman, 1983; Kolodny & Kiggundu, 1980; Metley, Kaplan, Heisler, & Weiner, 1991; Nieva, Fleishman & Rieck, 1978; Urban, Bowers, Cannon-Bowers, & Salas, 1994). Only research findings from models that were tested are discussed here. Gladstein (1984) did not find support for the hypothesized relationship between "adequate skills" and team performance. Metley, Kaplan, Heisler, and Weiner (1991) found that skills within a group had a significant relationship with the intragroup processes of planning and teamwork and with quality of group output. For a simulated group task in a laboratory experiment, Bowen (1993) found that superior knowledge-skill was the primary determinant of work group performance.

Research Hypothesis 4.3: Design teams that have a higher degree of cross-functional representation are more effective.
Research Hypothesis 4.4: Design teams that have a higher degree of multi-level representation are more effective.

In this research, cross-functional and multi-level representation were included as composition variables, in addition to demographic variables. The practitioner literature on design teams is very consistent, and emphatic, that a design team's composition must reflect the target system for redesign. Therefore, it must have key stakeholder groups represented in the team membership, for example, human resources, production/operations, technical/engineering, and union, if one exists (Mohrman & Cummings, 1989; Orsburn, Moran, Musselwhite, & Zenger, 1990; Pasmore, 1988; Wellins, Byham, & Wilson, 1991). Mohrman and Cummings (1989) also specify that in addition to a diversity of stakeholders and functions represented, a design team must have a diversity of levels represented. There is no directly analogous research finding in the scholarly group literature on a similar composition variable. However, given the complexity of the design team task and the many aspects of an organization the team must address in its redesign task, it is reasonable to presume that a diversity of viewpoints contributes to team effectiveness.

Research Hypothesis 4.5: Design teams whose members have individual goals are more effective.

Individual goals refers to whether team members have clear goals or expectations for their individual contributions and performance on a team (Hallam & Campbell, 1994). Research on goal-setting in general has indicated that performance is highest with difficult and specific goals (Locke & Latham, 1990), and goal setting with the use of feedback was found to have significant effects on behavior (performance) by Reber and Wallin (1984) and by Locke, Shaw, Saari, and Latham (1981). The presence of individual goals was not included specifically in any current model of group effectiveness except for Hallam and Campbell (1994). However, Nieva, Fleishman, and Rieck (1978) included "motivations" as a specific variable in their "member resources" construct. Also, Greenbaum, Kaplan, and Damiano (1991) and Urban, Bowers, Cannon-Bowers, and Salas (1994) specified a class of variables at the individual level in which individual goals would be an appropriate variable.

Research Hypothesis 4.6: Design teams with lower turnover in membership are more effective.

Turnover, or the stability of team membership, is apparently not included explicitly in current models of group effectiveness. The absence of turnover in group models may be due to the fact that changes in membership are more significant — more detrimental — to temporary and shorter-lived teams (which have not been studied as frequently) as compared to permanent teams. The only research finding in support of this hypothesis came from Cohen, Mohrman, and Mohrman (1993), who found that knowledge work teams with more stable membership were more effective.

Research Question 4.1: What effect does design team size have on team effectiveness?

Group size has been found to have an inverted U-shaped relationship with team effectiveness, depending on task diversity and coordination requirements (Nieva, Fleishman, & Rieck, 1978). As reviewed in Goodman, Ravlin, and Schminke (1987), depending on the task, there appears to be some minimal number of group members required to perform the task, beyond which effectiveness will decline as coordination becomes difficult. Size was included in many models of group effectiveness (for example, Gladstein, 1984; Greenbaum, Kaplan & Damiano, 1991; Kolodny & Kiggundu, 1980; Nieva, Fleishman, and Rieck, 1978), although it was included in different categories or classes of variables. The practitioner literature related to design teams suggests that design teams typically range in size from seven to twelve members (e.g., Pasmore, 1988), but there is no prescription on a minimum or maximum number of team members. Therefore, size was included as an exploratory research question.

Research Question 4.2: What effect does co-location have on design team effectiveness?

Co-location refers to whether team members are located in the same physical facility or geographic location. Co-location is not included in other general models of group effectiveness found in the literature, possibly because research has tended to study only teams whose members are in the same facility, such as work teams or targeted improvement teams. A related research finding by Cohen, Mohrman, and Mohrman (1993) was that more effective knowledge worker teams had members who were co-located.

However, the use of virtual teams may make the relationship between co-location and team effectiveness less relevant and/or less clear. A virtual team is defined as a "self-managed knowledge work team, with distributed expertise, that forms and disbands to address specific organizational goals" and is characterized by "fluid human resources in terms of membership, leadership, and boundaries (functional, organizational, and geographical)" (Kristof, Brown, Sims, and Smith, 1994, p. 2). Members of design teams involved in large-scale change within a large corporation may be located in other facilities or geographic areas. The team may be able to compensate by communicating frequently in other ways, e.g., electronic mail and telephone. Because of these alternative means of communication for teams resembling virtual teams, this relationship was posed as a research question, rather than a hypothesis.

Research Question 4.3: What effect does team age have on team effectiveness?

Team age was not found as a variable in other models of group effectiveness, therefore, this relationship was posed as a question rather than as a hypothesis. The teams included in this research varied on the amount of time the team had been in existence. Given the improvement-oriented mission of design teams, the researcher was interested in whether there was a time after which teams became less effective, perhaps due to member burn-out or reduced creativity focused on the task.

1.6.2. Team Technology and Task

In their review of the group literature, Goodman, Ravlin, and Schminke (1987) stated that the role of technology in determining group effectiveness has been understated in the group literature, where technology includes four components: equipment, materials, physical environment, and programs involved in acting on and/or changing an object from one state to another. For this research, this last component of technology was assumed to be the methodology and processes a team uses to accomplish its task. When included as a variable in models of group effectiveness, technology has often been used as a moderator variable, but Goodman et al. (1987) argue that technology has a direct impact on group performance. Variables related to a design team's task and methods/processes were: defined design process, systemic perspective, comprehensive design process, electronic mail capability within the team, and team charter.

Research Hypothesis 4.7: Design teams using a defined process for change/redesign are more effective.

Research Hypothesis 4.8: Design teams using a process with a systemic perspective are more effective.

Research Hypothesis 4.9: Design teams using a comprehensive design process for redesign are more effective.

The three hypotheses above relate specifically to the methodology and processes a team uses to redesign and plan for change in a given target system: the extent to which the process is *defined*, *systemic*, and *comprehensive*. Many of the organizational redesign methodologies, for example, sociotechnical system design, have well-defined steps so that a team can see not only the end result as a goal, but the map for how to get there. Based on this characteristic of methodologies in the literature and based on practitioner input, defined design process was included as a variable in this research.

There were no relevant research findings in the group literature, however, support in the practitioner literature for a systemic and comprehensive design process is extensive. Much of the literature on organizational redesign argues that the design process used must be systemic in nature; that is, it should enable a team to address change on all key organizational sub-systems or components to support large-scale change. This feature of redesign is a pervasive theme in large-scale organizational change and redesign in general (see Chapter 2 for a review of relevant literature). Mohrman and Cummings (1989, p. 31) state that design processes "must address the systemic nature of organizational change...the design of each element must be consistent with the design of the others."

In addition to being systemic, the literature suggests the process should be comprehensive. Comprehensive process refers to the extent to which the process includes steps or activities for the following key stages of redesign: scoping the team's task, acquiring knowledge, analyzing and collecting data about the target system, redesigning the target system, implementing the design, and evaluating/monitoring the design. This macro process is adapted from Mohrman and Cummings (1989) and maps to Deming's Plan-Do-Study-Act cycle (Deming, 1993). Others have also emphasized the importance of these activities (Orsburn, Moran, Musselwhite, & Zenger, 1990, Pasmore, 1988; Wellins, Byham, & Wilson, 1991).

Research Question 4.4: What effect does the capability to communicate with team members using electronic mail have on design team effectiveness?

As mentioned earlier, design teams may resemble virtual teams in that members may not be co-located but instead geographically dispersed over different buildings or across different geographic locations. Given this characteristic, the researcher was interested in determining whether the ability to communicate with other team members using electronic mail was related to team effectiveness. Kristoff et al. (1994) found that the ability for members of virtual teams to communicate over e-mail had no effect on team effectiveness. This relationship was framed as a question rather than as a hypothesis.

Research Hypothesis 4.10: Design teams that have a team-reviewed charter are more effective than those that develop their own charter which are more effective than those that have no charter.

In the practitioner literature, the concept of a team charter as a tool for a team to create understanding and agreement with its sponsor(s) about the team's task is being used more frequently. Hitchcock (1994a,b) and Cupello (1995) discuss the importance of a team charter for design teams and the process of chartering. Cornelius (1994) emphasizes the importance of a sponsor in developing the draft charter, which is reviewed by a team and re-negotiated if necessary.

1.6.3. Team Processes

Team processes include both intrateam processes and boundary management processes. The existing group effectiveness literature was used to define intrateam process variables. A significant finding from Gladstein (1984) was the distinction between intrateam and boundary management processes. The practitioner literature and expert practitioner input were used to define boundary management processes for design teams to interact with their organizational context and environment. No other studies were found that defined boundary management processes for design teams.

Intrateam processes included in this research were: team commitment, team unity, team self-assessment, team decision processes, team roles, internal team leadership, meeting frequency, communication frequency between team meetings, and meeting attendance[5]. Boundary management processes were: clarity in sponsor expectations, keeping stakeholders informed, commitment-building with stakeholders, and maintaining an inter-organizational perspective[6].

Research Hypothesis 4.11: Design teams with higher commitment among team members are more effective.

Commitment within the team was not found to be significantly correlated with team effectiveness or intragroup processes in Metley, Kaplan, Heisler, and Weiner (1991). Pearce and Ravlin (1987) included commitment to the group in their proposed model for self-regulating work groups which was based on research findings on self-regulating

[5] In the dissertation proposal and prior to factor analysis, variables were identified differently. Previously, team coordination and team decision processes were two separate variables, however, factor analysis indicated that question items loaded to create one factor. This result is discussed further in Chapter 3.

[6] In the dissertation proposal and prior to factor analysis, boundary management variables were identified differently: sponsor management, customer management, stakeholder management, improvement team coordination, and inter-organizational impact. Factor analysis indicated that survey items within mission clarity and sponsor management loaded to create one factor (called clarity in sponsor expectations). Also, the survey items comprising the other boundary management variables clustered differently than anticipated, creating the following variables: keeping stakeholders informed, building commitment, and maintaining an inter-organizational perspective. These results are discussed further in Chapter 3.

work groups and groups in general, but was not formally tested. Hallam and Campbell (1994) included commitment in their model of team development. Commitment of individual team members may vary more for design teams than permanent teams because of additional job responsibilities outside the design team, and thus, commitment may be a more important variable relating to design team effectiveness.

Research Hypothesis 4.12: Design teams with higher team unity are more effective.

Team unity is similar to cohesion, a common variable in group research. However, in Hallam and Campbell's (1994) team development model, cohesion was believed to consist of two other variables, commitment and team unity. Therefore, commitment and team unity were both included in this research. Goodman, Ravlin, and Schminke (1987) provide an extensive review of the group research findings on cohesion.

Gladstein (1984) studied "supportiveness," which is similar to team unity and found that it influenced self-reported team effectiveness but had no effect on objective team performance. George, Perkins, Sundstrom, and Myers (1990) found that cohesion had an effect on team performance and viability. In a review of the research relating to self-regulating work groups, Pearce and Ravlin (1987) concluded that cohesiveness had a meaningful relationship with group performance. Metley, Kaplan, Heisler, and Weiner (1991) studied a construct similar to team unity — teamwork — and found that it had a significant relationship with the outcome variables of meeting deadlines and quantity of group output.

Research Hypothesis 4.13: Design teams which perform team self-assessment are more effective.

Team self-assessment is included in Hallam and Campbell's (1994) team development model and refers to a team taking time to monitor and evaluate its process and make any necessary adjustments. Because of the ambiguity of its task, a design team has the potential to become stuck or misguided in its efforts. Cohen, Mohrman, and Mohrman (1993) reported that team self-assessment is an important part of performance management, which was found to be a key design feature for effective knowledge work teams. Team self-assessment was not included explicitly in any other model of group effectiveness in the scholarly literature, however, this monitoring process is believed to be important for design teams.

Research Hypothesis 4.14: Design teams that have effective decision processes are more effective.

Effective decision processes refers to the extent to which the team is able to make decisions, uses relevant data for decisions, and makes decisions with participation from all members. Decision making was used rather than problem solving because the team's methodology for redesign was considered a macro-level problem-solving process, and this overall methodology for redesign was measured using the three variables described earlier. Decision making is the process a team uses to identify, evaluate, and select among alternatives throughout the redesign process.

Gladstein (1984) predicted that teams with good decision-making skills would be more effective and studied the constructs "discussion of performance strategy" and "weighting individual inputs." No significant research findings regarding these constructs were reported. Metley, Kaplan, Heisler, and Weiner (1991) did not explicitly include decision processes in their model, however, they did include meeting effectiveness. Given that teams make decisions in meetings, it is expected that meeting effectiveness and decision processes are very similar and not necessary to include separately. Meeting effectiveness was found to have a significant impact on team effectiveness in Metley et al. (1991), specifically on morale, meeting deadlines, and quantity of group output. Cohen, Mohrman, and Mohrman (1993) reported that decision-making and learning processes had a significant impact on knowledge work team effectiveness. Specifically, teams that used rigorous data-based methods for evaluating alternatives and coming up with solutions, had the right people involved in making decisions, and clarified decision-making responsibilities were more effective.

Team coordination is related to decision processes, and is a function of how well a team plans, organizes, and communicates within the team[7]. It was included in Hallam and Campbell's (1994) team development model and in a group effectiveness model developed by Pearce and Ravlin (1987) based on the scholarly group research findings. Urban, Bowers, Cannon-Bowers, and Salas (1994) included coordination as a team process variable in their model of group effectiveness but did not report any findings to confirm its importance.

Various models of group effectiveness include intragroup communication, an intrateam process variable related to those discussed so far. In a review of the research relating to self-managing teams, Pearce and Ravlin (1987) concluded that communication and coordination both had a meaningful relationship with group performance. Intragroup communication was found by Metley, Kaplan, Heisler, and Weiner (1991) to have a significant influence on morale and quantity of group output and by Gladstein (1984) to have an influence on team self-reported effectiveness. George, Perkins, Sundstrom, and Myers (1990) found that communication correlated significantly with both team performance and viability (defined as team member satisfaction, team member participation, and the team's capacity for future work). Cohen, Mohrman, and Mohrman (1993) found that knowledge work teams having more face-to-face communication were more effective. Intragroup communication was not included in this research model because other, more specific, variables related to processes where communication is necessary were included.

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[7] In the dissertation proposal and prior to factor analysis, team coordination was included as a separate variable. Factor analysis indicated that survey items part of team coordination and decision processes loaded onto one factor. This result is discussed further in Chapter 3.

Research Hypothesis 4.15: Design teams that have effective team roles are more effective.

Team roles refers to the extent to which a team has formal, defined, and functioning roles that enable the team to divide its work and have shared, or distributed, leadership. Other models of group effectiveness have a similar construct "group roles" (George, Perkins, Sundstrom, & Myers, 1990; Sundstrom, DeMeuse, & Futrell, 1990). George et al. (1990) found that group roles (specialized roles that allow members to divide their work efficiently) was significantly correlated with team performance and viability (viability was defined as team member satisfaction, team member participation, and the team's capacity for future work). The importance of shared leadership roles for members of self-managing project and problem-solving teams is discussed by Barry (1991).

Research Hypothesis 4.16: Design teams that have effective team leadership are more effective.

Team leadership refers to the extent to which a team has effective team leadership within the team, to help define the team's vision, provide feedback to team members, and encourage members to express ideas freely. Team leadership was included in Hallam and Campbell's (1994) model of team development. Gladstein (1984) found that "formal leadership" had a significant effect on self-reported team effectiveness but not on objective team effectiveness. Kolodny and Kiggundu (1980) also included leadership and supervision in a model of work group effectiveness, but the model was not formally tested.

Research Question 4.5: What effect does meeting frequency have on design team effectiveness?

Meeting frequency for teams has apparently not been studied in models of group effectiveness. Because this variable is more relevant to teams that are part of the parallel structure, as design teams are, one would not expect to see meeting frequency in general models of group effectiveness. Furthermore, there are apparently no explicit prescriptions in the practitioner literature on design teams about how frequently teams should meet. The researcher's personal experience and feedback from practitioner-experts indicate that meeting frequency may have a positive influence on a team's effectiveness.

However, as mentioned previously, design teams may be virtual teams in that team members are not co-located, particularly if the change effort exists within a large corporation. This geographic dispersion makes meeting frequently as a group very difficult. The team may be able to compensate by communicating frequently in other ways, e.g., electronic mail and telephone. Because of these alternative means of communication for teams resembling virtual teams, this relationship was framed as a research question, rather than as a hypothesis.

Research Question 4.6: What effect does the frequency of communication within the team between team meetings have on design team effectiveness?

There is no research finding in the group effectiveness literature that relates to this variable. Frequency of communication within the team between team meetings was included as a way to assess the extent to which members interact with each other to perform work for the team outside of team meetings. Because there is no relevant research finding to support this variable, and no compelling reason from the practitioner literature, this relationship was framed as a research question rather than as a hypothesis.

Research Question 4.7: What effect does attendance at team meetings have on design team effectiveness?

There is apparently no research finding in the group effectiveness literature that includes meeting attendance as a variable. For permanent core work teams, much of the team's actual work is done outside of team meetings, and attendance at meetings may not be a critical factor. However, for teams outside the formal organizational structure, meetings may be the only way, or the most frequent way, the team actually performs work. In these cases, attendance at meetings may be more critical. Because there is not strong support for this variable in the literature, the relationship was framed as a question rather than as a hypothesis.

Research Hypothesis 4.17: Design teams with higher clarity in sponsor expectations are more effective.

This variable is the combination of two previous variables that were found to cluster together: mission clarity and sponsor management. Results from the group effectiveness literature related to mission clarity are reported here. Mission, or goal, clarity has been studied in a number of models of group effectiveness. Gladstein (1984) found that the construct "structuring of activities," which included role and goal clarity, had an effect on intragroup processes but did not directly impact self-reported team effectiveness. Metley, Kaplan, Heisler, and Weiner (1991) also found that goal clarity had a significant influence on group process, specifically on planning, and thus, indirectly affected group performance. George, Perkins, Sundstrom, and Myers (1990) found that role and goal clarity was positively correlated with team performance. These studies all consisted of permanent teams. Sundstrom, De Meuse, and Futrell (1990) included mission clarity as a variable within organizational context, although the model was not tested. Given the temporary nature of design teams and the non-routine, often ambiguous, task they perform, clarity in the team's mission and expectations from sponsor(s) seems particularly important.

Research Hypothesis 4.18: Design teams which are more effective at keeping stakeholders informed are more effective.
Research Hypothesis 4.19: Design teams which are more effective at building commitment from stakeholders are more effective.
Research Hypothesis 4.20: Design teams which maintain an inter-organizational perspective are more effective.

The above three variables are boundary management processes (in addition to clarity in sponsor expectations) that define a team's interaction with stakeholders other than sponsors. Design teams in general exist within an organization's parallel structure but must also interact with groups *and* individuals (stakeholders) in the formal structure. Boundary management processes to define these interactions may perhaps be even more important for design teams than other types of teams. Design teams not only need to obtain information from external groups and individuals to support their task, but they must also share information to keep others informed about and committed to team decisions and plans. The group literature does not provide much support for these boundary management processes; very few studies even included such a construct (see Gladstein, 1984). As discussed in Parker (1994), a focus on boundary management is relatively recent: Hastings, Bixby, and Chaudhry-Lawton (1987) found that "managing the outside" was a factor in successful teamwork, and Ancona and Caldwell's (1990) study of product development teams emphasized the importance of boundary management.

A related construct, intergroup cooperation, was included in the general model proposed by Greenbaum, Kaplan, and Damiano (1991), although the model was not tested. Drawing from the practitioner literature, the need to manage communication with stakeholder groups, such as a steering team, is strongly emphasized in Mohrman and Cummings (1989). Parker (1994, p. 45) also states: "my own work with cross-functional teams tells me that the teams need to develop strong relationships with senior management, build bridges to functional department managers, fashion positive interfaces with key support groups, and successfully involve customers and suppliers."

Gladstein's (1984) model of task group effectiveness included and tested a similar construct. Gladstein predicted that groups that exhibited communication with external groups with which they were interdependent would be more effective. Boundary management was not found to have a significant relationship with self-reported team effectiveness. A significant finding from the research, however, was that boundary management activities were viewed by group members as distinct from intragroup processes, such as problem solving and decision making. Gladstein concluded that future research should focus more on these interactions with external groups.

1.6.4. Organizational Resources Available

Variables representing resources available to a design team were: release time for design team efforts, time spent in educational activities, organizational support to teams, and organizational support to individuals[8].

Research Hypothesis 4.21: Design teams whose members have sufficient release time for work on the team are more effective.

Based on practitioner input, a critical factor in ad-hoc teams, including design teams, is the amount of time that team members are able to devote to team efforts, including meetings and time spent outside of team meetings. If design team members are not given "release time" from other responsibilities and are unable to devote a sufficient amount of

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[8] In the dissertation proposal and prior to factor analysis, variables were identified differently. Previously, variables within the higher-level construct of organizational resources and context were: time for the team, educational activities, access to information, rewards for work on the team, feedback on team performance, and general organizational support. All but one variable (educational activities) were measured using the Campbell-Hallam Team Development Survey and had at least three survey question items to measure the variable. Factor analysis indicated that survey question items did not cluster as defined by the TDS, but instead clustered into release time (a single question item), organizational support to team, and organizational support to individuals. These results are discussed more in Chapter 3.

time, or if the time commitment varies considerably within the team, it may be difficult for the team to be effective. Cohen, Mohrman, and Mohrman (1993) found that more effective knowledge worker teams had members who had a greater percentage of time dedicated to the team. Hallam and Campbell (1994) included a related variable "time and staffing" in their model of team development, although the model is not tested. No other models of group effectiveness included availability of time for members' contribution to the team.

Research Hypothesis 4.22: Design teams whose members spend more time in relevant education and training are more effective.

One of the most widely prescribed activities for design teams in the practitioner literature is a significant amount of education for team members to learn concepts and applications related to large-scale change and organizational redesign (Mohrman & Cummings, 1989; Orsburn, Moran, Musselwhite, & Zenger, 1990; Pasmore, 1988; Wellins, Byham, & Wilson, 1991). Typical activities include visiting other organizations to benchmark and learn about applications, attending conferences and seminars, and reading books on the topic. Generally, design team members engage in these educational activities prior to the design stage, however, there may be overlap such that there is ongoing education as a team designs and implements change. In addition, education and training may not be provided to the team as a whole; some members, may receive relevant education/training because of membership on other teams or functional areas.

Education and training was included in a number of group effectiveness models (George, Perkins, Sundstrom, & Myers, 1990; Gladstein, 1984; Hackman, 1983; Pearce & Ravlin, 1987; and Sundstrom, De Meuse, & Futrell, 1990) and was found to be significantly correlated with team performance by George et al. (1990).

Research Hypothesis 4.23: Design teams which have support for the team from the organization are more effective.

Research Hypothesis 4.24: Design teams whose members perceive individual support from the organization are more effective.

For the above two hypotheses, "organizational support" is defined to include access to information the team needs, feedback on team performance, rewards for team performance, and a general supportive context from the organization and top leadership in the organization. No other models of group effectiveness defined organizational support/context variables in this manner (i.e., for the team vs. for the individuals on the team), however, many models included the specific variables mentioned above (information, feedback, rewards). Findings related to these variables are summarized below.

The complexity and interdisciplinary nature of the design team's task requires that the team has the information needed as input to design. Cohen, Mohrman, and Mohrman (1993) reported that knowledge work teams having information about the team's goals were more effective. Hackman (1990) includes the information system as an organizational context variable which supports accomplishment of task. Pearce and Ravlin (1987) included information necessary for decisions as a necessary precondition for team effectiveness, but it is not tested. Hallam and Campbell (1994) team development model includes information as a resource to teams.

Feedback from stakeholders, including internal customers, helps a design team ensure that they are meeting customer expectations and needs. Feedback was included as a component in Greenbaum, Kaplan, & Damiano (1991), Hallam and Campbell's (1994) team development model, and Sundstrom, De Meuse, and Futrell (1990). However, the relationship between feedback and team effectiveness was not statistically tested in these models. George, Perkins, Perkins, Sundstrom, and Myers (1990) found that feedback was correlated with work team viability but not team performance. Cohen, Mohrman, and Mohrman (1993) found that performance management processes, including providing feedback, had a significant effect on knowledge worker team effectiveness.

In a team that is outside of most individual's regular job duties, receiving rewards and recognition for contributions may be a powerful influence on team members' commitment to the team, and therefore, on the team's effectiveness. Gladstein (1984) found that rewards for group performance had an indirect effect on team effectiveness through group leader behavior. George, Perkins, Sundstrom, and Myers (1990) found that rewards were correlated with team viability but not team performance. Although the relationship with team effectiveness was not statistically tested, reward systems were included in several models of group effectiveness: as an environmental (organizational) input variable in Greenbaum, Kaplan, and Damiano (1991), in Hallam and Campbell's (1994) team development model, and as an organizational context variable in both Hackman (1990) and Sundstrom, De Meuse, and Futrell (1990). Rewards were also included in Pearce and Ravlin (1987) as a design variable, and although their model was not tested, it was based on findings from the group literature.

Lastly, the perceived support and commitment from the organization, including top leadership, can have a significant influence on team effectiveness. Again, this variable is more applicable to a design team than to permanent work teams, because a design team's activities are outside the formal organizational structure and core work processes. If the organization does not visibly support the design team's efforts, team members may have low commitment, and the team may be ineffective. Although this variable was not included in any of the models of group effectiveness that were formally tested, there is support for it in the practitioner literature on design teams and, based on practitioner-expert input, it is believed to be important for a successful design team.

1.6.5. Variables Considered for this Research

Clearly, there are other design features that could have been selected for study in this research that were included in other group effectiveness models. The design features described here were selected on the basis of their prominence in the scholarly group effectiveness literature and/or their emphasized importance in the practitioner literature relevant to design teams. For example, one common variable from the group literature that was not included here is cohesion within a group (Goodman, Ravlin, & Schminke, 1987 review the research findings on cohesion). As mentioned earlier, in Hallam and Campbell's (1994) team development model, cohesion is believed to consist of team unity and commitment, which were both included in this research.

Another common variable in group models is intragroup communication. Intragroup communication was not included here because variables describing other group processes related to communication were included instead. Some of the question items included as part of team decision processes are directly related to communication processes. Conflict management was also not included explicitly in the research model because it is part of the operational measure (scale) for team unity.

In addition to justifying why certain variables were not included in the operational research model, it is useful to discuss in general the importance of including the variables that were specified in the operational research model. One might argue that some of the variables, for example, team skills and commitment, have strong support in the group literature, therefore, they need not be included here. Although there is support for such variables, as discussed earlier, research has not focused on these types of teams. The research has often focused on core work teams or simulated teams in laboratory experiments. Therefore, it is important to discover whether the variables which tend to appear in models in the group literature have the same relationship with design team effectiveness.

1.7. Premises and Delimitations

Premises represent assumptions made in order to conduct this research, while delimitations help focus and define the scope of the research. Another way to view delimitations is that they identify what the research did not attempt to accomplish.

1.7.1. Premises

- There is a need for research on design teams described in this document which the group effectiveness, self-managing team, sociotechnical systems design, and organizational redesign literature do not fulfill.
- Disappointing results obtained from teams and from organizational redesign efforts may be a result of poorly-engineered design teams.

1.7.2. Delimitations

- This research did not focus on operationalizing or quantitatively studying the linkage between design team effectiveness and improvements in business results from changes introduced by the team (or by an implementation team). This delimitation is shown in the conceptual research model (Figure 1.4) by shaded vs. non-shaded areas.
- This research did not study design teams in greenfield, or new design, settings, but only design teams in redesign settings. Although the process of redesign is similar in both situations, design teams performing redesign face difficulties not present in greenfield settings, which make them unique (Pasmore, 1988).
- This research only studied teams performing redesign and whose resulting decisions and plans impact multiple organizational sub-systems, as opposed to teams that address more narrow improvement tasks, such as focused process improvement projects.

1.8. Desired Outputs and Outcomes

Desired outputs identify what this research produced (where outputs are located in the dissertation is indicated in parentheses):

- Qualitative descriptive data to provide examples of design teams (Chapter 4 and Appendix).
- A model of design team effectiveness (Chapters 1 and 3).

- Identification of design features having the most significant relationship with design team effectiveness (Chapter 4 and discussion in Chapter 5).
- Practical implications and recommendations for installing and managing design teams in organizations (Chapter 6).

Desired outcomes represent what is hoped will occur as a result of this research:

- Contribution to the body of knowledge on group effectiveness in general, and design teams in particular, through scholarly publications from this dissertation.
- Improved effectiveness of design teams in organizations undertaking large-scale change.

1.9. Justification for this Research

To justify this research as an industrial engineering dissertation, three issues must be addressed: this research contributes to industrial engineering knowledge, this research is unique, and this research is appropriate for a dissertation. Each of these areas is discussed in the following sections.

1.9.1. This Research Contributes to Industrial Engineering Knowledge

This research contributes to industrial engineering knowledge because:

1. The teams that are the focus of study are doing design work; the common element of all teams in the research sample is the redesign of a sociotechnical work system.
2. Many of the specific redesign problems and issues which teams in the sample addressed are common industrial engineering problems.
3. The approach taken to understanding team effectiveness in this research is a sociotechnical approach, where the fundamental question was: how can we engineer, or design, more effective teams considering both the technical and social component of teams?
4. The focus on large-scale systems and team architecture is consistent with recent trends in industrial engineering research and activity.

First, teams studied in this research had the common element of organizational redesign for a sociotechnical work system. Design is the distinguishing role of engineers, and industrial engineers in particular design human activity systems, or integrated systems of people, equipment, energy, materials, and information (see Turner, Mize, Case, & Nazemetz, 1993). Consider the design process, or system life-cycle process, described by Blanchard and Fabrycky (1990), which can be applied to any type of work system, for example, a physical facility, a production system, or a distribution system. The overall steps of the process are: definition of the need for the system, conceptual design, preliminary design (with generation, evaluation, and selection of alternative design configurations), detail design and development, production and/or construction, utilization and support, and phaseout and disposal. This type of general process can also describe the organizational redesign process used by teams in this research sample: defining the purpose and mission of the work system, conceptual and detailed design (specific initiatives and change efforts), implementation of the new design, and continual adjustment and support for the design over time. Because the system being designed is a permanent work system, there is no analogous step for phaseout and disposal.

Another justification for the role of industrial engineering in organizational redesign of sociotechnical systems can be found from industry. Eastman Chemical Company, one of the sponsoring organizations for this research, has a long history with sociotechnical systems work redesign using design teams. The role of industrial engineering in these efforts is very strong and very important to this leading-edge organization. In fact, the individual who can best be described as the strategy designer for the use of design teams to support organizational redesign and improvement is an industrial engineer.

Second, besides performing design at a macro level (for a total work system), many of the specific redesign issues and problems which teams in this sample addressed are common industrial engineering problems. For instance, a number of teams were involved with redesigning information technology to provide necessary information to internal customers. Many teams were involved with the design and implementation of a performance measurement system to provide information to internal customers to support decision-making. One team was focused on redesigning processes within a division to locate, acquire, and manage store properties. Four teams were focused on the redesign of their respective distribution warehouses, which included redesigning the layout of the warehouse and core work processes such as loading and assembly of customer orders, the education and training system, and safety management processes.

Third, this research contributes to industrial engineering knowledge because of the approach taken to understanding cross-functional design teams. The focal question was: how can we engineer more effective design teams? In other words, what are the levers that can be designed or managed which have the most significant relationship with team effectiveness? In the same way that the work system a team is redesigning is viewed as a sociotechnical system, a team itself is viewed as a sociotechnical system. As a sociotechnical system, a team can also be designed, considering the technical component of the team (its task, objectives, and technologies to convert inputs to outputs) and the social component (the composition of people on the team, their roles, etc.). This approach to studying teams has been taken by others (see Goodman, 1986; Kolodny & Kiggundu, 1980), however, it is not common. Earlier in this chapter, variables (design features) were specified in a model of group effectiveness that encompass the team's technology and task (e.g., "systemic perspective" and "defined design process") and the social system within the team (e.g., "team commitment" and "team roles"). Sociotechnical systems theory has long been claimed by the industrial engineering profession, which has the essential mission of the design, development, implementation of integrated systems of people and technology — a direct parallel to sociotechnical systems perspective can be drawn.

There is debate in the group literature about whether teams can be "engineered." However, it is this researcher's belief that while we may not be able to fully understand or model team effectiveness because of interpersonal processes and dynamics, there are design features of teams that if managed, will increase the likelihood of success and creating desired results.

A fourth way to place this research in the context of industrial engineering is to examine recent developments within industrial engineering. In recent years, a thrust of industrial engineering activity and research has been organizational design issues. Turner, Mize, Case, & Nazemetz (1993, p. 456) state "...one of the functions that many experienced ISEs perform is organizational design...analyzing the total programs and activities of a company and determining the most effective arrangement of these activities." In a recent presentation, Mize (1995) identified the evolution of industrial engineering focus throughout the 20th century and emerging industrial engineering trends, including "enterprise architecture," "wholistic system design" and "distributed work groups." An inference to be made from these themes is that industrial engineers will be increasingly concerned with the design, or architecture, of total systems, and that teams will have an important role in system design. This research makes an important contribution to understanding what leads to team effectiveness for teams involved in the design of large-scale sociotechnical systems.

1.9.2. This Research is Unique

This research provides a unique contribution to the body of knowledge because:

1. The research findings are based on empirical results of actual teams in context, a need identified in the group literature (McGrath, 1986).
2. The research focused on a single type of team not previously studied to develop a more in-depth understanding of what leads to team effectiveness for cross-functional design teams.
3. The research methodology (described in Chapter 3) enables the researcher to develop a more complete understanding about which design features are related to team effectiveness at the team level, a need identified in the group literature (McGrath, 1986).

First, the research sample (described in Chapter 3) includes fifteen teams across two organizations. Much of the group effectiveness literature is based on studies of laboratory teams, or simulated teams. In defining critical needs for future group research, McGrath (1986) identified the need to study actual teams in context. Gladstein (1984) and Sundstrom, De Meuse, and Futrell (1990) emphasize the need to study teams in their organizational context because of the importance of the interaction between a team and its environment.

Second, as discussed earlier in this chapter, cross-functional design teams have not previously been studied, either to understand what leads to effectiveness for these types of teams based on empirical results or to provide descriptive data about team experiences and results. This research has addressed both of these needs because of the use of empirical quantitative data and the use of qualitative data to describe experiences, learnings, and results as benchmark data to other organizations.

Third, the group literature has not addressed the problem of differing levels of analysis (individuals, groups, organizations, etc.) for theory, measurement, and statistical analysis. For example, a research study may specify a theory based on the group or team level (as was done earlier in this chapter), collect data from individuals within teams (as was done in this research), and analyze data, for example, at the group level without confirming the validity of this aggregation. The research methodology in this dissertation called for the use of Within and Between Analysis, a set of statistical and inferential techniques to address the potential problem of having different levels for theory, measurement, and statistical analysis (Klein, Dansereau, & Hall, 1994). Within and Between Analysis enables the researcher to use more complete information about the relationship between variables to identify those that are related to team effectiveness at the team level.

1.9.3. This Research is Appropriate For a Dissertation

Creswell (1994) identifies criteria that a research topic must meet to be appropriate for a dissertation:

1. Is there a personal interest in the topic in order to sustain attention?
2. Will the project contribute to career goals?

3. Is the topic researchable, given time, resources, and availability of data?
4. Will the results from the study be of interest to others (e.g., in the state, region, nation)?
5. Does the study a) fill a void b) replicate c) extend or d) develop new ideas in the scholarly literature?
6. Is the topic likely to be publishable in a scholarly journal?

Some of these criteria must be addressed from the researcher's personal point of view, that is, points 1 and 2. From the researcher's perspective, this topic clearly met these two criteria. The content and methodology of the research also met the third criteria; the research was executed within time and other resource constraints. The earlier part of this chapter addressed points 4 and 5, which in particular asks whether the research makes a unique contribution to the body of knowledge. Practitioner and academic experts have expressed an interest in this research and have acknowledged that it is necessary and important. The last criteria addresses the ability to publish results of the research in scholarly journals. Based on the topic, the research methodology, and the results obtained, this research will be fruitful in terms of contributing to the published body of knowledge.

1.10. About This Dissertation

Figure 1.6 is a research process model which portrays at a macro level the overall dissertation and research process. Steps in the model which correspond to dissertation chapters are shaded in the figure. The content of chapters and appendices in this document are briefly described in this section.

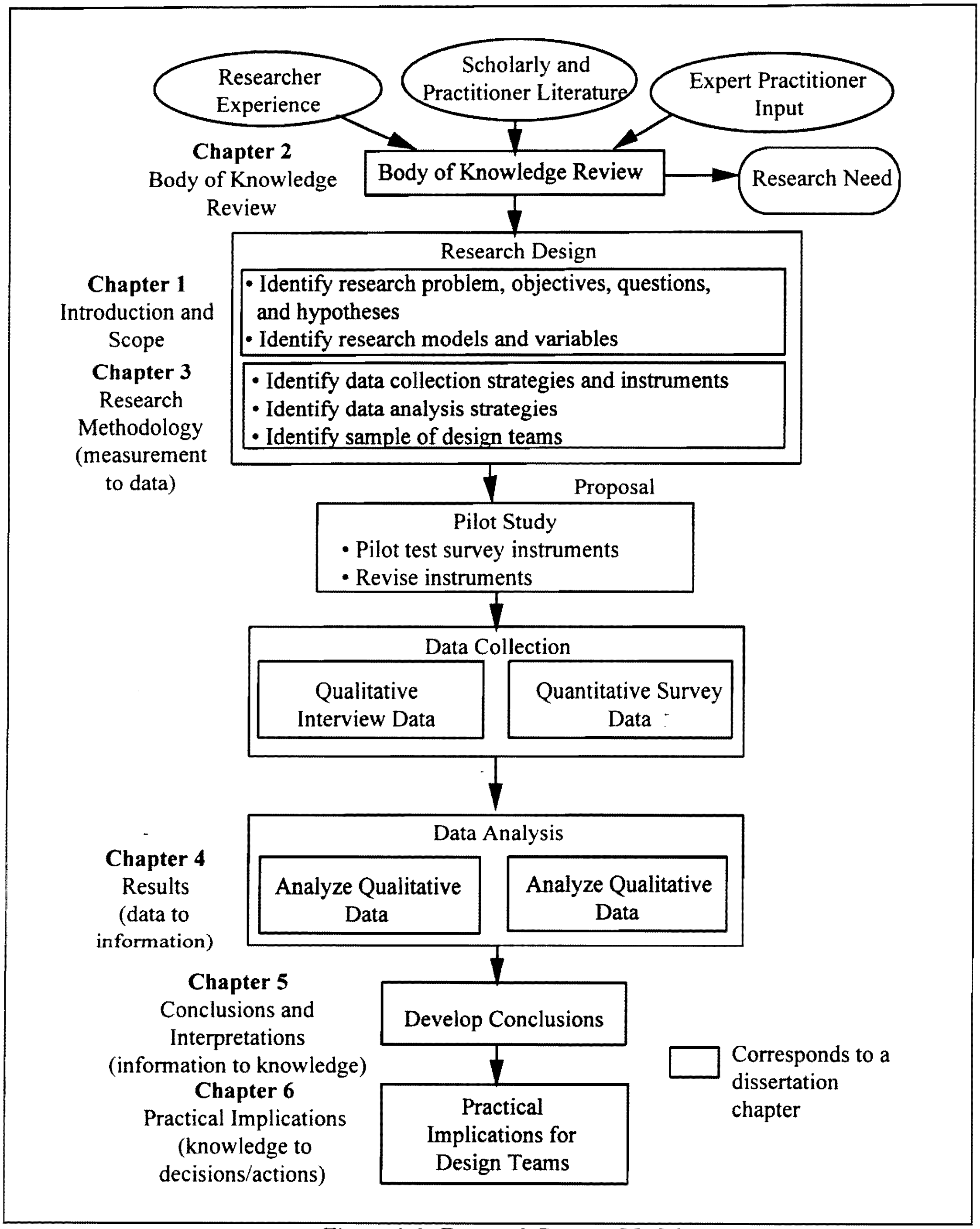

Figure 1.6. Research Process Model.

Chapter 1 introduced the research topic and defined the research scope and focus. Chapter 2 reviews the body of knowledge, which includes the scholarly and practitioner literature, in addition to practitioner input and the researcher's knowledge and experience. Chapter 3 outlines the research methodology used to execute this study. Chapter 4 contains the results from data collection and analysis, while Chapter 5 contains conclusions and interpretations from the data analysis. Lastly, Chapter 6 identifies practical implications of the research findings for installing design teams in practice.

The appendices of this dissertation contain supplemental information and materials that were not central to describing the research method, results, or conclusions. Included in the appendices are: an additional review of the body of knowledge, data collection instruments, results from the pilot study, analysis of the scales used to operationalize constructs, and supporting quantitative and qualitative data and analysis.

Chapter 2 Review of the Body of Knowledge

In reviewing existing knowledge about a research topic, it is useful to not only review findings presented in the literature, but also to learn from people having knowledge and experience in the topic area. For example, practitioners often implement new and innovative employee involvement techniques, but few have the time to document their findings. This chapter, therefore, includes information from the scholarly and practitioner literature and information obtained through dialogue with practitioners, researchers, and consultants.

The aim of this research is to study teams responsible for designing and implementing large-scale organizational change. This chapter includes reviews of the literature and the body of knowledge in a number of areas related to this research topic:

1. Group effectiveness models and results from the literature that were most used to frame this research in Chapter 1.
2. Organization redesign, including reviews of redesign process, the concept of organizational subsystems, and a comparison of various conceptualizations of organizational subsystems.
3. Employee involvement and teams as the broad phenomenon which encompasses this research topic.
4. Self-managing teams, including reviews of definitions and characteristics of self-managing teams, which are a common outcome of organizational redesign, and results achieved by redesigning to a self-managed team environment.

2.1. Group Effectiveness Models

The purpose of this section is to briefly review the models of group effectiveness in the literature that were most cited in Chapter 1. For more extensive reviews of the group effectiveness literature, the reader should refer to Goodman, Ravlin, and Argote (1986), Goodman, Ravlin, and Schminke (1987), and Bettenhausen (1991). The following models, which represent some of the most frequently-cited research studies in the group effectiveness literature, are reviewed briefly: Gladstein (1984), Hackman (1990), Shea and Guzzo (1987), Pearce and Ravlin (1987), and Sundstrom, DeMeuse, and Futrell (1990).

Gladstein (1984) integrated previous research on groups (in particular, McGrath, 1964) into a comprehensive model of group effectiveness. Gladstein's model was based on an input-process-output framework, which is now increasingly common in group research (e.g., Urban, Bowers, Cannon-Bowers, & Salas, 1994; Greenbaum, Kaplan, & Damiano, 1991). This framework was adopted for the operational research model in this research, as described in Chapter 1. Variables in Gladstein's model were clustered into higher-level constructs. That is, the inputs to a group are group composition, group structure, resources available, and organizational structure. The effect of these inputs on group effectiveness is mediated through group process variables, such as communication, supportiveness, and boundary management, and moderated by group task. LISREL was used to test the model with 100 sales teams. Group effectiveness was defined as group performance (using objective output measures and subjective assessment), satisfaction of group member needs, and the ability of the group to exist over time.

Two findings were particularly relevant to this research. Although Gladstein found that the variables shown to influence self-reported effectiveness "read like a textbook on team building," she also found that these primarily group process variables had little or negative impact on actual sales revenue. In Gladstein's words (1984, p. 511):

> *"It appears that individuals have implicit models of how certain modes of group process 'should' benefit performance and attribute good outcomes to the group when the appropriate process has been instituted."*

The second finding relevant to this research is that the group process construct formed two distinct components: intragroup processes and boundary management processes, which was unexpected. In other words, individuals perceived these two types of processes as distinctly different. In offering recommendations for future research, Gladstein (1984, p. 515) states:

> *"Much of the earlier research on groups used a theoretical lens that rested on the group's boundary and focused inward. This study has integrated some of these traditional theories and*

tested them with intact teams in an organization. The results underscore the necessity of studying groups in context. When the lens is moved outward, internal group behaviors are seen as a complement to cross-boundary behaviors that help teams to meet environmental demands."

This finding about the importance of boundary management and interaction with external groups/individuals formed in great part, the justification for the inclusion of specific boundary management processes in this research.

Pearce and Ravlin (1987) developed a model of group effectiveness, specifically targeted for self-managing teams (called self-regulating work groups by Pearce and Ravlin). The focus of the study was to evaluate the outcome of self-regulating work group design and implementation in U.S. industrial organizations based on empirical results, and to identify the design characteristics of an effective self-regulating work group design. Although their model was not tested, it was based on empirical results from other research. Because of the lack of studies on self-regulating work groups, Pearce and Ravlin relied on research on laboratory groups and on non-SRWG research, which reduces to some extent the applicability of their model to the intended focus. The model was organized into three categories: preconditions for design, design and activation conditions for process, and process criteria for self-regulating work groups (commitment, coordination, and variety). The outcomes included in this model were satisfaction, absenteeism, turnover, safety, innovation, and productivity.

Shea and Guzzo (1987) specified a less complex model of group effectiveness than many other researchers. Their model was intended to be applicable to any kind of formal group within an organization. The authors identified three determinants of group effectiveness: task interdependence (how closely group members work together), outcome interdependence (whether, and how, group performance is rewarded), and potency (members' belief that the group can be effective). This article examined why groups succeed or fail and drew on a detailed case study. The authors found that outcome interdependence and potency were strongly correlated with group member evaluation of performance (customer service for teams in this study), but there was not a relationship between these variables and a more objective measure in group performance. Little (1993) further explores the concept of potency, or group efficacy, in research on manufacturing work teams.

Hackman (1990) defined a normative model of effectiveness for work groups which has three dimensions. In Hackman's model, an effective group or team, produces an output which meets the standards of quality, quantity, and timeliness of the people who receive, review, and/or use that output; uses a process that ensures the capability of members of the group to work together interdependently in the future; and meets more than frustrates the needs of members. These outcomes in a sense represent a way to define group effectiveness: performance, viability, and satisfaction. George, Perkins, Sundstrom, and Myers (1990) used viability to define a dimension of group effectiveness very similar to Hackman's second outcome measure.

The three group outcomes defined above are accomplished through three process criteria of effectiveness: the effort applied to the group's task, having adequate knowledge and skill for the task, and employing appropriate performance strategies to the task and setting. These process criteria are supported by certain conditions: the design of the group (task, structure, composition, and norms) and the organizational context of the group (rewards, education, and information systems). The design/structure of a group and the organizational context create the process criteria to the extent that the group is able to capture synergy and avoid negative synergy or process losses associated with interacting as a group.

Sundstrom, DeMeuse, and Futrell (1990) took what the authors call an "ecological" approach to analyze factors in the effectiveness of work teams. After specifying a classification of teams (advice and involvement, production and service, projects and development, and action and negotiation teams), the authors provided a framework for analysis of team effectiveness. The authors argued the importance of understanding teams in the context of their surroundings, and their model depicted team effectiveness as dynamically interrelated with external surroundings and internal team processes. The major dimensions in the framework were organizational context (culture, task design, mission clarity, autonomy, performance feedback, rewards, training and consultation, and physical environment), boundaries (work team differentiation and external integration), and team development (interpersonal processes, norms, cohesion, and roles). Team effectiveness was defined as performance and viability (similar to Hackman's outcome measures of groups). Sundstrom et al. identified several needs for future research: to study work teams in context, to study teams over time, and to study teams using a variety of methods.

In summary, there are a number of reviews of the group effectiveness literature which are more exhaustive than presented here (Goodman, Ravlin, & Argote, 1986; Goodman, Ravlin, & Schminke, 1987). In his attempt to influence future group research, McGrath (1986) identified ten critical needs for future research:

1. The use of better methodological tools, primarily data collection tools (not relying entirely on self-reports)
2. To use broadband strategies that are multivariate, multi-method, and multi-occasion.
3. To put more emphasis on theory to approach defining a research problem.
4. To study groups as intact social systems and to do so at a group level of analysis.
5. To build a conception of how groups vary in type.
6. To build a conception of how group tasks vary in type.
7. To use a broader conception of the range of content to be included in a study.
8. To study groups in context.
9. To take seriously the idea of temporal patterns in groups.
10. To take seriously the idea of group process.

How this research addressed several of these needs is discussed in Chapter 5.

2.2. Organizational Redesign

This section reviews a process for organization redesign with a focus on the sociotechnical systems approach (Pasmore, 1988) and reviews a general organization redesign process (Mohrman and Cummings, 1989). Secondly, the concept of organizational subsystems, as a key element in organizational redesign is discussed and a review of the literature and various conceptualizations of organizational subsystems is presented. Third, a comparison between these conceptualizations is made.

2.2.1. The Process of Organizational Redesign

Pasmore (1988) provides a process for redesign based on the sociotechnical systems approach. The steps, shown in Table 2.1, encompass activities for defining the purpose for redesign, examining the external and internal organizational environment, creating a structure to support redesign, and developing, implementing, and monitoring recommended changes to the target system. Pasmore also provides specific recommendations and techniques for conducting the social and technical analyses.

Mohrman and Cummings (1989) also outline a process for change, which they call self-design. The process is not as detailed as Pasmore's and has fewer steps, however, it includes similar stages (see Figure 2.1).

Table 2.1. Sociotechnical Systems Redesign Process.
(taken from Pasmore, 1988)

1. Define scope of system to be redesigned • Define the need for change • Define the target organization • Identify the key stakeholders • Determine the stakeholder's expectations • Determine the potential for success • Form steering committee • Agree on change model • Define rough parameters of the change effort • Clarify expectations among parties • Finalize contract
2. Determine Environmental Demands • Identify key external stakeholders, e.g., corporate management, international union, competitors • Determine current and future stakeholder demands • Decide on appropriate responses to demands • Derive organizational goals
3. Create Vision Statement and Charter • State philosophy and values • Clarify desired outcomes • Draft vision statement • Charter the change effort • Review charter with sponsors
4. Educate Organizational Members • Develop plan for educating all organizational members about redesign process • Develop skills: technical skills, interpersonal skills, problem-solving skills
5. Create Change Structure • Educate organizational members • Create the design team • Hold intergroup meeting between design team and steering committee • Develop communication strategy • Educate design team and steering committee • Develop involvement strategy • Develop researching strategy • Develop change strategy
6. Conduct Sociotechnical Analyses • Identify resources to assist in the analyses • Provide training in the analytical methods • Analyze systems • Review with steering committee • Share with rest of organization
7. Formulate Redesign Proposals • Review design inputs • Clarify desired outcomes • Formulate specific proposals • Examine systemic impact • Perform cost-benefit analysis • Select most viable proposals • Review with steering committee

Table 2.1 (cont'd) Sociotechnical Systems Redesign Process.
(taken from Pasmore, 1988)

8. Implement Recommended Changes • Communicate and review proposals with rest of organization • Communicate and review proposals with upper management • Create implementation plan • Train employees and supervisors • Execute implementation plan
9. Evaluate Changes and Redesign • Develop evaluation methodology • Collect and review data against goals • Communicate results • Redesign as needed • Diffuse learnings

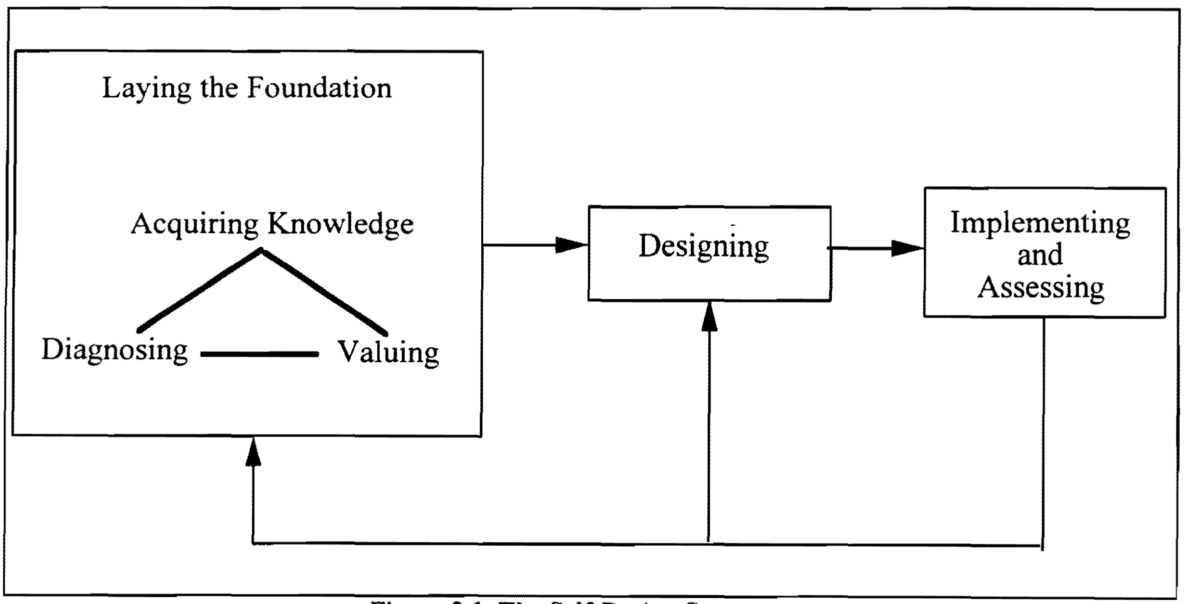

Figure 2.1. The Self-Design Strategy.
(taken from Mohrman and Cummings, 1989)

The two redesign models are similar and have steps for preparation and laying a foundation for change (development of vision and goals, education, etc.) in addition to design, implementation, and monitoring. However, there are some differences worth noting. First, the model proposed by Mohrman and Cummings includes feedback loops between the stages. For example, a design team may cycle back through some of the activities in Laying the Foundation, if necessary, before finalizing a recommended design. Secondly, Mohrman and Cummings include a step in the first stage for diagnosing and assessing the current functioning of the organization. This diagnosis serves as an additional input to design, along with knowledge and values identified in the first stage.

2.2.2. Guidelines for Installing and Managing Design Teams

Pasmore (1988) and Mohrman and Cummings (1989) provide some specific suggestions about the design teams that serve as the architects for large-scale change. Other resources have provided input to these recommended characteristics (Hitchcock, 1994a; Lathin, 1986; Orsburn, Moran, Musselwhite, & Zenger, 1990; Wellins, Byham, & Wilson, 1991). Based on these resources, recommended characteristics and activities for design teams are:

2.2.2.1. Composition of the Design Team

- The team's composition should represent multiple perspectives and key stakeholders (i.e., cross-functional membership), reflecting the target system (Lathin, 1986; Mohrman & Cummings, 1989; Orsburn et al., 1990; Pasmore, 1988; Wellins et al, 1991).
- The team should range from 7-15 in size (Lathin, 1986; Orsburn et al., 1990; Pasmore, 1988).
- Team members should be selected on the basis of their expertise for the task, influence to gain acceptance to and implement plans, willingness to learn, ability to communicate and work in a team, tolerance for ambiguity and risk-taking (Lathin, 1986; Mohrman & Cummings, 1989; Orsburn et al., 1990; Pasmore, 1988).
- The team should have overlapping membership with steering committee or executive team by one or two design team members (Pasmore, 1988).

2.2.2.2. Structure of the Design Team

- The design team must establish a clear charter or mission outlining the team's purpose, outcomes, and constraints (Hitchcock, 1994a; Lathin, 1986; Pasmore, 1988).
- Leadership within the team should be shared (Pasmore, 1988).

2.2.2.3. Resources of the Design Team

- Design team members should serve full-time or at least spend a considerable amount of time on redesign, for example, ten to twenty-five percent of their working time (Mohrman & Cummings, 1989; Orsburn et al., 1990; Pasmore, 1988).
- The design team should engage in a variety of educational activities to learn about redesign concepts: reading cases, books, and articles; attending seminars and conferences; and visiting other companies (Lathin, 1986; Mohrman & Cummings, 1989; Pasmore, 1988; Wellins et al., 1990).

2.2.2.4. Change/Redesign Process

- The process for change and redesign the team follows should be comprehensive and include steps for: education and preparation, visioning, designing, implementing, and monitoring (Lathin, 1986; Mohrman & Cummings, 1989; Wellins et al., 1991).
- The process must enable the team to adopt a systemic perspective and address all key organizational subsystems (Mohrman & Cummings, 1989; Orsburn et al., 1990; Raab, Perley, & Cafey, 1994; Wellins et al., 1990).
- The design team must establish frequent and high quality communication with key stakeholders, including the steering committee or top management group chartering the team (Mohrman & Cummings, 1989; Pasmore, 1988).

Hitchcock (1994a) provides a useful checklist of questions regarding the design team and its role that top management, or the steering committee, must address when installing a design team. Examples of these questions are: does the team have a budget? what can the team decide and what can they only recommend? what are the team's deadlines, if any? In addition, Hitchcock describes some of the most common problems design teams implementing self-managing teams, in particular, face. These recommendations represent the key lessons learned described in the practitioner literature and were used as input to define variables in the operational research model for this dissertation.

2.2.3. The Concept of Organizational Subsystems

There are numerous conceptions of organizational subsystems, or more simply organizational systems, in the literature. They have been called change levers (Mohrman & Lawler, 1984); organizational design components (Galbraith, 1977; Mohrman & Cummings, 1989); management sub-systems (Maciariello, Burke, & Tilley, 1989); action levers (Cummings & Molloy, 1977); fronts (Sink & Poirier, 1994); organizational elements (Dillingham & Delaney, 1990); and tracks (Kilmann, 1986). All of these terms refer to essentially the same concept — these systems represent an aspect of the organization on which the change agent can operate in order to achieve a change in organizational outcomes (Cummings & Molloy, 1977).

This section contains a review of lists of organizational systems proposed in the literature. These lists were identified from the group effectiveness literature, organizational self-design literature, and self-managing team literature, among others. They are not presented in a specific order.

2.2.3.1. Mohrman and Cummings, 1989

Mohrman and Cummings (1989) identify six organizational design components, based on Galbraith (1977) necessary to create self-designing organizations. There are two key inputs that influence organizational design: strategy, which is the plan of action defining how an organization will use its resources to gain a competitive advantage in the environment, and task environment which consists of those elements affecting the organization's ability to implement its strategy including suppliers, customers, competitors, and regulators. The six organizational design components are (Galbraith, 1977; Mohrman & Cummings, 1989):

1. Task/Technology - the activities that organizations perform to transform raw materials into products or services and to relate to their environment.

2. People - the individuals working for the organization, including their demographic characteristics, skills, experience, expectations, values, attitudes, and personalities.

3. Information/Decision Systems - those activities aimed at processing information and making decisions, including communication, goal-setting, and feedback measurement processes.

4. Human Resource Systems - the practices for integrating people into the organization, including selection and hiring, training and development, performance appraisal, reward systems, and work design.

5. Structure - the grouping of task activities into departments and coordinating relationships among those groups, including hierarchy, spans of control, task forces, and special integrating roles.

6. Organizational Norms and Values - the shared meanings among organizational members about what is important and how members should behave. They signal how work is to be done and evaluated, and how employees are to relate to each other and to significant outsiders, such as customers and suppliers. Shared values and norms are expressions of the organization's culture, and they affect the way the other elements are designed.

With regard to the organizational design components as a whole, Mohrman and Cummings state that they must fit with one another to achieve high performance, and be designed to reinforce the kinds of behaviors that are needed to implement the organization's strategy.

2.2.3.2. Maciariello, Burke, and Tilley, 1989

Maciariello et al. (1989) propose what they call a mutually supportive sub-systems framework for the design of management systems. In this framework, there are five subsystems:

1. Style and Culture - the prevailing method of "doing things" in an organization and the way people make decisions; corporate culture consists of shared values, common perceptions, common decision premises applied by organizational participants to the activities and problems of the organization.

2. Infrastructure - the formal organization to establish communication and coordination links among various sub-units and the informal organization that evolves to enhance further communication and coordination.

3. Rewards - material inducements, organizational purpose, desirable associations, status, increased autonomy, and desirable physical conditions; reward systems should emphasize both individual and group performance as well as short-term (operating) and long-term (strategic) performance.

4. Communication Systems - the communication vehicles necessary for building identification with the organization and its goals and objectives, for coordination, for conflict resolution, and for resource allocation decision-making; the formal system of communication can be identified by the structure of the organization while informal systems evolve as people develop working relationships.

5. Formal Control Processes - there are two distinct interrelated control processes: one for long-term (strategic planning) and one for short-term (operations planning).

Maciariello et al. (p. 294) comment that "there are many potential designs for management systems; the key is that the elements should be designed to be consistent with management style and organizational culture, mutually supportive, and reinforcing."

2.2.3.3. Mohrman and Lawler, 1984

Mohrman and Lawler (1984) identify seven change levers, which are aspects of the organization a change agent can operate on. These change levers are:

1. Participation in Decision-making - providing individuals at lower levels in the organization with opportunities to participate in decisions which impact their work.
2. The Design of Work - two streams of theory and research provide information here: job design literature and sociotechnical systems theory. Job design has as the basic proposition that the motivating potential of work depends on its ability to meet the needs of people for meaningfulness, knowledge of results, and personal responsibility for work outcomes. Job attributes are: variety, identity, significance, autonomy, and feedback. Sociotechnical systems theory involves systematic participative design or redesign of work systems using principles and steps which address both technical demands of work and social needs of individuals.
3. Organizational Structure and Design - the parallel or collateral organizational structures often established to attend to communications and problem-solving functions which are not adequately addressed in the primary structure (Zand, 1984).
4. Reward Systems - sharing the financial outcomes of productivity improvement with those who have contributed to it.
5. Data feedback - information feedback in general and survey-guided feedback and development.
6. Group and Intergroup Norms - the need to create organizational settings where the needs and goals of people are more fully integrated with those of the organization.
7. Training - training in interpersonal processes, group dynamics, and problem-solving techniques; also content-oriented training in business concepts and techniques.

Mohrman and Lawler discuss at some length the issue of congruence, or fit, between these change levers. For instance, they argue that "as a general rule, the more aspects of the organization that are altered to be congruent with the desired end-state, the more likely it is that the change will take hold" (p. 250). Furthermore, "new design organizations are characterized by congruent, non-traditional designs for most available change levers in the organizational unit" (p. 252). This observation is consistent with the experiences that new design plants have — all organizational sub-systems are aligned with self-managing teams, and the problems that redesign organizations experience with non-supportive systems are typically absent.

2.2.3.4. Cummings and Molloy, 1977

Action levers, as defined by Cummings and Molloy (1977), are those things which are manipulated or changed, in experiments and represent specific organizational changes. Cummings and Molloy (1977) identify nine action levers:

1. Pay/reward systems - changes in financial rewards.
2. Autonomy/discretion - examples include being permitted to pace work and to determine own work methods, having influence over production layouts, work schedules, and goal setting.
3. Support - relationships to other groups providing support services such as raw materials, maintenance, and technical assistance.
4. Training - training provided to job holders in order to perform work that is more varied and skilled and that carries more responsibility than previous jobs.
5. Organizational Structure - formal organization as it would appear in a typical organization chart.
6. Technical/physical - changes having to do with the work layout and technical equipment.
7. Task variety - work design requiring a variety of tasks rather than narrow, focused tasks.
8. Information/feedback - information or feedback that individuals receive about their work and organization; at least four different kinds of information are needed: information needed to perform a specific task; feedback about one's performance; knowledge about other individuals or groups upon which one's own performance is

dependent; and information about the department, company, or environment which is not necessarily task-related.

9. Interpersonal/group process - changes in patterns of interaction or contact among individuals and groups

One thing that is interesting to note about Cummings and Molloy's change levers is that they are defined by describing *changes* necessary to a system, for example "changes in financial rewards" under pay/reward systems. Others have defined the equivalent of change levers simply as the organizational system itself, and not necessarily a particular configuration of the system.

2.2.3.5. Hackman, 1990

Hackman (1990; Hackman & Walton, 1986) identifies three organizational systems that are important to creating a supportive organizational context, one of the necessary conditions for creating effective groups. Hackman does not provide definitions for the three systems, however, they appear to represent essentially the same systems that others propose.

1. Information System
2. Education System
3. Reward System

2.2.3.6. Sink and Poirier, 1994

Sink identifies nine fronts - major management sub-systems that must be managed in a strategic, integrated and comprehensive fashion in order to achieve successful continuous improvement. Definitions of the fronts are (Sink and Poirier, 1994):

1. Planning - all planning systems: strategic, performance improvement, business, marketing, operations, and daily planning; most importantly reflecting the entire planning cycle, that is, planning and implementation and evaluation and revision over time (PDSA).

2. Measurement - the system for sharing information about multiple levels of performance (individual, group, organizational), systematic identification of information requirements to support problem-solving aimed at performance improvement, creation of visibility, and motivation for ongoing performance improvement.

3. Culture - the system for managing culture (the organization's shared values, beliefs, and norms) to support organizational improvement efforts.

4. Motivation/Rewards and Recognition - the system of inducements, recognition, and rewards that is created by the organization to maintain that willingness of people to cooperate toward organizational aims and to permit and encourage everyone to do their very best in a system that ensures that their best will mean organizational success.

5. Education, Training, and Development - the system of sharing knowledge and skills by which all individuals in the organization are improving personally and professionally. Extends far beyond the traditional domain of training departments, concentrates on an understanding of system-wide knowledge and skills for doing the job and for improving performance.

6. Infrastructure - the system by which the organization is structured to do business, reflected in the organizational chart, position descriptions, functional responsibilities; also how the organization is structured, outside the formal organization, to support improvement performance.

7. Technology - the system for managing "how we accomplish things." Technology is broadly defined as a way of getting something done. This includes methods, procedures, protocol, hardware and software, and tools.

8. Politics - the informal aspects of performance management. This front includes the proactive management of key stakeholders' needs and expectations, anticipation of critics, boundary spanning, internal communication, and working with various bases of power.

9. Communication - the system of sharing information among groups and individuals such that coordination, understanding, and cooperation exist.

Fronts are one element of a Grand Strategy System for large-scale organizational change, which also includes a clear understanding of an organization's past and present, in addition to a clear vision and strategies for the future.

2.2.3.7. Delaney and Dillingham, 1990

Delaney and Dillingham (1990) define a process which can be used specifically to transition to self-managing teams. This process is based on the Organization Technology Framework which has seven organizational elements:

1. Purposing System - goals, strategies, vision, and values; this element uses environmental data to look at "what is our purpose for being?" (mission) and "where do we want to go?" (vision)

2. Work/Technology System - work flow, technology, and methods; the work system is based on the purposing system and the question is asked "are we doing any work that doesn't get us to our purposing system?"

3. Structural System - division of labor, reporting relationships, hierarchy, and physical layout; the question is asked "what kind of structure will best get the necessary work done?"

4. Human System - linkages, norms, quantity, skills of people, and careers.

5. Decision/Information System - decision processes, information needs, and information sources; given the type of work, the structure, and the decisions to be made, what are the information needs of teams? Information needs will be driven by types of decisions to be made.

6. Reward System - desired behavior, types of rewards, and distribution methods; the reward system needs to be flexible and reward people for contributing to organizational change.

7. Essential Processes - leadership, learning, information gathering, resource utilization, renewal, communication, and problem-solving processes; the question is asked "how

can the organization continue to move forward?" includes business, social, and technical development.

Delaney and Dillingham also argue the need for mutually supportive and aligned organizational elements. They portray organizational elements as arrows, or vectors, where all elements must point in the same direction. Delaney and Dillingham observe that many organizations spend all their time on structure, and neglect support components, such as the reward system or decision/information system.

2.2.3.8. Kilmann, 1986

Kilmann (1986) presents a completely integrated approach to large-scale change within an organization. There are five stages in Kilmann's approach to planned change: initiating the program, diagnosing the problems, scheduling the tracks, implementing the tracks, and evaluating the results. The five tracks along which change must be planned are (Kilmann, 1986, p. 317):

1. Culture Track - Establishing trust, information sharing and adaptiveness; being receptive to change and improvement.
2. Strategy-Structure Track - Aligning all work units and resources with new strategic direction.
3. Management Skills Track - Augmenting skills to cope with complexity; exposing and updating assumptions.
4. Teambuilding Track - Infusing new cultural norms and assumptions into each work unit; fostering cooperative efforts.
5. Reward System Track - Establishing a performance-based reward system; sustaining the whole improvement effort.

Kilmann also identifies a sixth, "shadow track," which essentially represents the parallel structure to support improvement along the five tracks.

2.2.3.9. Lawler, 1992

In *The Ultimate Advantage*, Lawler (1992) describes how to move toward high-involvement organizations. In transforming organizations to high-involvement and empowerment, Lawler argues that the following five systems must change:

1. Work structures
2. Reward systems
3. Decision-making processes
4. Information systems
5. Human resources management practices

2.2.3.10. Covey, 1990

In his book, *Principle-Centered Leadership*, Covey (1990) identifies six systems common to organizations:

1. Information - A stakeholder information system which has accurate, balanced and unbiased information that tells executives what is happening inside the organization.

2. Compensation - Money, recognition, responsibility, opportunity, and other perks of position and office. The system should include both financial and psychic rewards and should reward synergistic cooperation and create team spirit.

3. Training and Development - Responsibility for learning lies with the learner and the instructor and institution are resources. Training is learner-controlled, and the learner is required to teach what is learned to reinforce knowledge gained.

4. Recruiting and selecting - Candidates' abilities, aptitudes, and interests are matched with the job requirements so that what people enjoy doing and do well is closely linked to their job.

5. Job design - Jobs are designed to tap the interests and skills of people. Jobs should provide a clear sense of what the job is about, how it relates to the overall mission of the company, and what individuals' personal contribution can be.

6. Communication - Should include one-on-one communication and staff meetings held as needed, employee suggestion systems that reward ideas resulting in savings, open-door and due-process policies and procedures, annual skip-level interviews, anonymous opinion surveys, and ad hoc committee brainstorming.

Covey provides a useful metaphor of organizational systems to the human body (p. 184):

> *"In organizations, we relate with many people in interdependent ways, and interaction requires some kind of structure and certain kinds of systems. The body is the best metaphor; it is the model organization. For example, the nervous system transfers messages (information); the circulatory system passes nutrients (compensation); the skeletal system (structure) supports the stature; and the respiratory systems supplies oxygen (feedback)."*

Covey also discusses the interdependence of these systems (p. 184):

> *"A significant change in one may upset the equilibrium of the whole. Organizations, like bodies, also have equilibrium states. When they are operating in a state of equilibrium, they are relatively free of distress and pain; however they may be operating at very different levels of productivity. One organization might be highly creative; synergistic; filled with team spirit, a sense of mission, passion, purpose, excitement, and innovation; and relatively free of painful handicaps. Another organization may be characterized by a strong adversarial or political climate, protective or defensive behaviors, low productivity, low profit. It, too, is in a state of equilibrium, but at a low level of performance."*

2.2.3.11. Kelly, 1991

In his book, *Adventures of a Self-Managing Team*, Kelly (1991) specifies organizational design issues which must be carefully considered when designing or redesigning an organization using self-managing teams:

1. External factors - Markets, customer requirements, vendors, competitors, owners, organization history, and resources.

2. Strategy - Organization mission, management philosophy, key goals and objectives, operating strategies, and long-term and short-term plans.

3. Technical Systems - The way products and services are produced and the methods and systems needed to do it, including tasks, technologies, and facilities.

4. Structural Systems - How people are organized including both formal and informal systems.

5. Decision-Making and Information Systems - How decisions are made and how information flows throughout the organization.

6. People Systems - How people are recruited, selected, trained, evaluated, disciplined, promoted, and developed.

7. Reward Systems - How people and their contributions are recognized and rewarded, both formally and informally.

8. Renewal Systems - How the organization evaluates and improves itself.

9. Results - How the organization performs in terms of customer satisfaction, technical performance, people performance, and business results.

2.2.3.12. George, Perkins, Sundstrom, and Myers, 1990

George, Perkins, Sundstrom, and Myers (1990) conducted research to identify factors influencing work team effectiveness. Their research draws upon the group effectiveness literature and models of work team effectiveness (Gladstein, 1984; Hackman, 1987; Pearce & Ravlin, 1987; Shea & Guzzo, 1987; Sundstrom, DeMeuse, & Futrell, 1990) to identify organizational context factors, external to the work team, which may enhance team effectiveness by providing resources to the team. The factors George et al. identify are:

1. Organizational Culture - Reinforcing such shared values as participative decision-making and recognition of team efforts.

2. Task design - Can support team effectiveness by ensuring that the task is appropriate for team work.

3. Technology and Equipment - Can support team effectiveness through an optimal fit among features of equipment, task, and social organization.

4. Role clarity - Explicitly defined purpose within the organization.

5. Autonomy - Authority concerning methods of work and division of labor.

6. Rewards - Rewards contingent on team performance.

7. Accurate Timely Feedback on Performance - May be a crucial factor in team performance.

8. Training - Includes both technical and interpersonal skills.

9. Physical Environment - Support team interaction and boundary management.

2.2.3.13. Wellins, Byham and Wilson, 1991

In one of the early books on implementing self-managing teams, Wellins, Byham, and Wilson (1991) provide many guidelines and information to organizations considering or beginning the transition. In the design phase, Wellins et al. state that "in almost all cases, in-place organizational systems will work counter to team implementation" (p. 116). The authors identify systems and practices which they assert must be modified, and they provide some brief guidelines on how they should be altered (p. 117). Those guidelines that relate to organizational systems as discussed in this chapter are:

1. Selection and Promotion - Teaching teams to select their own members and leaders.
2. Training and Development - Planning on extensive social and technical skills training to be phased in over time.
3. Compensation and Recognition - Exploring alternative compensation forms, such as pay-for-skills and gainsharing, that reward team performance.
4. Communication - Opening lines of communication.
5. Organizational "symbols" - Eliminating status symbols.
6. Physical Facilities - Designing with an eye toward effective teamwork (creating physical layouts that encourage interaction, allow for meeting space, etc.).
7. Budgeting - Planning to involve teams in the budgeting process, allowing for team capital expense decisions.
8. Performance Management - Exploring team-based appraisal processes and team member involvement in performance feedback.
9. Strategic and Long-range Planning - Allowing teams to make contributions to department and company direction.

2.2.3.14. Orsburn, Musselwhite, Moran, and Zenger, 1990

While Orsburn, Musselwhite, Moran, and Zenger (1990) do not explicitly identify a framework of organizational systems as detailed as Wellins et al. (1990), they do address the need for change in most, if not all, organizational systems. They claim that self-managing teams "will not flourish in the rocky soil of most rigid management systems" (p. 67). When a design team is drafting a preliminary plan and recommendations, Orsburn et al. state that the team must look at every system: operational, social, planning, tracking, and communication. For each system, the question must be asked: "will this system promote responsible involvement among work team members?" and if not, the design team needs to change the system (p. 67). The authors identify the following systems the design team must address:

1. Planning
2. Quality
3. Communication
4. Budgeting
5. Forecasting
6. Compensation
7. Performance Review

2.2.4. Comparing and Contrasting Organizational Subsystems

Table 2.2 compares and contrasts these various lists of organizational systems. Across the columns, the fourteen sources reviewed in this section are listed, and down the rows are listed the most common subsystems appearing across the different authors' lists. Based on this comparison, the most common organizational systems specified by the literature as important to address in organization redesign and change are defined (see below).

- Technology - The equipment, materials, work methods, and physical environment (arrangement of physical equipment and facilities) people working in the system use to deliver products and/or services to customers.
- Decision-making System - The decision rules and decision processes, including the autonomy level of people in the system, how decisions are made, and who makes what types of decisions, for example, work scheduling, quality control, training needs, performance assessment, budgeting, personnel issues, compensation, maintenance, safety, and dealing with customer/suppliers.
- Information and Communication Systems - The information provided to people working in the system to support decision-making and the mechanisms used to convey this information.

Table 2.2. Comparison of Organizational Subsystems.

Subsystem	Mohrman & Cummings (1989) (based on Galbraith, 1977)	Maciariello et al. (1989)	Mohrman & Lawler (1984)	Cummings & Molloy (1977)	Hackman (1990)
Technology	✓ (Task/ Technology)		✓ (Design of Work)	✓ (Technical/ Physical and Task Design separate)	
Decision-Making System	✓ (part of: Information/ Decision Systems)		✓ (Participation in Decision-making)	✓ (Autonomy/ Discretion)	
Information & Communication Systems	✓ (part of: Information/ Decision Systems)	✓ (Communication Systems)	✓ (Data Feedback)	✓ (Information/ Feedback)	✓
Selection & Placement	✓ (part of: Human Resource Systems)				
Education, Training, & Development	✓ (part of: Human Resource Systems)		✓	✓	✓
Performance Measurement & Appraisal	✓ (part of: Human Resource Systems)				
Rewards & Recognition	✓ (part of: Human Resource Systems)	✓	✓	✓	✓
Organizational Structure	✓	✓ (Infrastructure)	✓	✓	
Organizational Culture	✓ (Organization Norms and Values)	✓ (Style and Culture)	✓ (Group & Intergroup Norms)	✓ (Interpersonal & Group Process)	
Strategy and Planning		✓ (Formal Control Systems)			
Other(s)	People			Support: from maintenance, materials, technical, etc.	

Table 2.2. (cont'd) Comparison of Organizational Subsystems.

Subsystem	Sink and Poirier (1994)	Delaney & Dillingham (1990)	Kilmann (1986)	Lawler (1992)	Covey (1990)
Technology	✓	✓ (Work/ Technology System)		✓ (part of: Work Structures)	✓ (Job Design)
Decision-Making System		✓ (part of: Decision/ Information Systems)		✓	
Information & Communication Systems	✓	✓ (part of: Decision/ Information Systems)		✓ (Information Systems)	✓ (Information and Communication separate)
Selection & Placement				✓ (part of: Human Resource Management)	
Education, Training, & Development	✓	✓ (part of: Human System - skills)	✓ (Management Skills)	✓ (part of: Human Resource Management)	✓ (Training and Development)
Performance Measurement & Appraisal	✓ (Measurement)			✓ (part of: Human Resource Management)	
Rewards & Recognition	✓ (Motivation)	✓	✓	✓	✓ (Compen-sation)
Organizational Structure	✓ (Infrastructure)	✓	✓ (part of: Strategy Structure)	✓ (part of: Work Structures)	
Organizational Culture	✓	✓ (part of: Human System - norms)	✓		
Strategy and Planning	✓ (Planning)	✓ (Purposing System)	✓ (part of: Strategy Structure)		
Other(s)	Politics	Essential Processes: learning, problem-solving, leadership, etc.)	Teambuilding		

Table 2.2. (cont'd) Comparison of Organizational Subsystems

Subsystem	Kelly (1991)	George et al. (1990)	Wellins et al. (1991)	Orsburn et al. (1990)
Technology	✓ (Technical Systems)	✓ (Task Design, Technology & Equipment, and Physical Environment all separate)	✓ (Physical Facilities)	
Decision-Making System	✓ (part of: Decision-Making/ Information Systems)	✓ (Autonomy and Role Clarity separate)		
Information & Communication Systems	✓ (part of: Decision-Making/ Information Systems)	✓ (Feedback)	✓ (Communication)	✓ (Communication)
Selection & Placement	✓ (part of: People Systems)		✓	
Education & Training	✓ (part of: People Systems)	✓	✓	
Performance Measurement & Appraisal	✓ (part of: People Systems)		✓	✓ (Performance Review)
Rewards & Recognition	✓	✓	✓ (Compensation and Recognition)	✓ (Compensation)
Organizational Structure	✓			
Organizational Culture		✓	✓ (Organizational Symbols)	
Strategy and Planning	✓		✓ (Strategic & Long-Range Planning and Budgeting separate)	✓ (Planning, Budgeting, Forecasting all separate)
Other(s)	External Factors, Renewal Systems, and Results			Quality

- Human Resource Systems:
  - Selection and Placement - How people are selected and who is involved in selection decisions.
  - Training and Development - The planning and coordination of education/training provided to increase the skill and knowledge base of people working in the system.
  - Performance Measurement and Appraisal - How the performance of people, groups, and the entire system is measured and evaluated.
  - Reward and Recognition System - How people working in the system are rewarded, including financial and non-financial, formal and informal, individual and group rewards.
- Organizational Structure - The formal organizational structure, including how people working in the system are grouped into teams and other units, hierarchical relationships, and span of control; and the parallel structure created to support improvement efforts, including process improvement teams, committees, and task forces.
- Organizational Culture - The prevailing values, norms, and beliefs about what is important in the organization and how members should relate to each other and to those outside the organization, including customers and suppliers.
- Strategy and Planning - The different kinds of plans for the system and how they are developed, such as business plans, marketing plans, and improvement plans, which include mission and vision, long-term and short-term goals, and objectives for the system.

As mentioned earlier, this list represents the key organizational systems that must be considered in organization redesign and large-scale change efforts. Many of the authors reviewed in this section emphasize the need for key systems within the organization to be modified and aligned so that all systems support the planned change and redesign. This list formed the basis for the operational measure of the design feature "systemic perspective" as seen in the Design and Leadership Team Survey, questions 49 through 56.

2.3. Employee Involvement and Teams

One important requirement of conducting a research study is to review the literature on the specific research topic, however, it is also useful to review the literature on the broader phenomenon encompassing the specific research topic. For this research, these related phenomenon are: employee involvement and teams (Section 2.3 of this chapter) and self-managing teams (Section 2.4 of this chapter). In addition, a discussion of types of research and research methods is provided to demonstrate the researcher's knowledge in this area (Appendix A).

This section, in particular, provides background on the topic of employee involvement. First, definitions of involvement are discussed. Terms commonly used, such as participative management and empowerment, are clarified. Second, a discussion of the evolution of participative management is presented including theories of management. Third, various classifications are presented for types of teams, a predominant employee involvement initiative. And lastly, reasons organizations adopt employee involvement practices are presented.

2.3.1. Defining Employee Involvement

Employee involvement, participation, participative management, empowerment, and participative decision-making are all used in industry and in the literature, often interchangeably. There does not seem to be a clear or consistent theoretical distinction or difference between the terms. One distinction to note between some of these terms is that participative decision-making, participative management, participation, and empowerment tend to be used to refer to involvement and influence over *decision making*. The term employee involvement is often used to refer more generally to all forms of involvement initiatives — for example, information sharing techniques and training — and not just those sharing decision making responsibility. Cotton (1993) also notes this distinction and uses the term employee involvement as a general label for the numerous techniques and practices to gain employees' involvement and participation. It is interesting to note that participative management, participative decision-making, and simply, participation tend to be used in the scholarly literature, while the practitioner literature, practitioners, and consultants tend to use the terms employee involvement and empowerment. In this dissertation, the broad term "employee involvement" is used, however, when referring to a specific research study, the author's term is used.

2.3.1.1. Review of Definitions in the Literature

Perhaps the best known and most often-quoted definition of *participation decision-making* is "joint decision making" (Locke & Schweiger, 1979). This definition is rather narrow in that it excludes delegation of decisions as a way for employees to participate, and as the authors point out, it also excludes job enrichment. A definition similar to Locke and Schweiger's, but not as limiting, is that *employee involvement* is including those who will execute decisions in the making of those decisions (Cotton, 1993). Cotton (1993) offers another definition, adapted from Lawler and Mohrman (1989): *employee involvement* is a "participative process to use the entire capacity of workers, designed to encourage employee commitment to organizational success" (p. 3). Other, more simple, definitions of participation reviewed by Locke and Schweiger are "active involvement" and a "feeling of obligation to work for the best interests of the group."

Lawler (1986) approaches the issue of defining terms somewhat differently, by identifying elements of involvement: sharing information, knowledge, power, and rewards with employees. Any participative management effort can be characterized by the extent to which it moves these four elements downward in the organization. A high involvement organization is very effective at moving all four, in that order, downward into the hands of employees performing the basic work of the organization.

2.3.1.2. Dimensions of Involvement

Another way to examine participation is to define dimensions of participation. In a meta-review, Cotton, Vollrath, Froggatt, Lengnick-Hall, and Jennings (1988) combine dimensions identified in earlier research by Dachler and Wilpert (1978) and Locke and Schweiger (1979). The dimensions, described in the paragraphs which follow, are: formal/informal, direct/indirect, level of influence, content, and duration of participation. Although Cotton et al. specifically use these dimensions either as polar scales (i.e., formal or informal) or scales having a finite number of points, the dimensions clearly could be represented by a continuum.

A *formal* approach to participation includes a system of rules and procedures for involving employees, such as with quality circles and suggestion systems. An *informal* approach consists of casual subordinate-superior interactions, where a supervisor might consult with employees as part of their personal style of management.

Employees participate *directly* when they are personally involved with decision-making, for example, when they are a member of a cross-functional team. They participate *indirectly* when their function or their position is represented through one of a few representatives on a committee or team. For example, in an organization having union-management committees to address joint issues, the majority of the employees participate indirectly in decision-making through their representatives, while only the few representatives participate directly.

A third dimension of participation is the *level of influence* employees have. Dachler and Wilpert (1978) call this dimension "access" to decisions. The points on this dimension are: a) no advance information is given to employees about a decision; b) employees are informed in advance; c) employees can give their opinion about the decision to be made; d) employees' opinions are taken into account; e) employees can negatively or positively veto a decision; and f) the decision is completely in the hands of the employees. Essentially, the scale goes from "no influence" through "shared influence" to "complete influence/control" over decisions.

The *content* of decisions in which employees participate can vary. Locke and Schweiger (1979) propose four content categories: a) routine personnel functions, such as hiring, training, discipline, performance evaluation; b) work itself, including task assignments, job design, and speed of work; c) working conditions, including rest pauses, hours of work, placement of equipment; and d) company policies, such as layoffs, profit sharing, capital investments, and general company-wide policies.

A dimension which Cotton et al. (1988) added to those initially used by Dachler and Wilpert (1978) and Locke and Schweiger (1979) is *duration.* Participation from employees may last several minutes (as with a single decision), several days, several months (for instance, a task force), or years.

2.3.2. Evolution of Participative Management

It seems safe to say that employee involvement and participation have become a common element of many organizations' improvement efforts. Yet it is only in the last two decades that these concepts have been institutionalized, beginning with quality of work life programs, quality circles, problem-solving teams, ad-hoc task forces, and now self-managing teams. However, the concepts underlying participation and employee involvement actually had their origins in the late 1930s and 1940s. Probably the most influential researcher in the area of employee involvement is Kurt Lewin (Cotton, 1993). Lewin and his colleagues conducted studies comparing different styles of management (authoritarian, democratic, etc.) with boys groups (Lewin, Lippitt & White, 1939) and housewives during World War II (Lewin, 1947, 1951). A core principle Lewin discovered was that "we are likely to modify our own behavior when we participate in problem analysis and solution and likely to carry out decisions we have helped make" (Weisbord, 1987, p. 89). Participation research was extended to industry, in Harwood Manufacturing, a pajama factory in Virginia, where findings were consistent with earlier research. In an experimental group that decided together how to improve output through consensus, the group set (and achieved) goals higher than the industrial engineers' standards, while no other groups' output increased (Weisbord, 1987). Elements of Lewin's practical theories developed from his research are shown in Table 2.3; these elements are very evident today in current employee involvement practices. Others who have had significant influence on employee involvement today are Eric Trist and Fred Emery, and more recently, Edward E. Lawler (Cotton, 1993).

2.3.2.1. Theories of Management and Participation

The purpose of this section is to briefly review theories of management that have developed and influenced management thought and action, particularly with regard to participative approaches. A more thorough review of participation models can be found in Cotton (1993).

Table 2.3. Lewin's Practical Theories.
(taken from Weisbord, 1987)

Theory	*Management Implications*
You can understand behavior only in relation to all forces acting on a person at a given moment.	To change a system, you must take into account economics, technology, and the people who are stakeholders.
The best way to advance knowledge is having experts *and* workers study together the relations among person, tools, job, and situation.	Successful work design requires teams of engineers, managers, supervisors, and workers starting together from scratch.
Only freely chosen work has the meaning and life value needed to motivate high performance.	People should have as much elbow room as possible in their own jobs.
Democratic leadership leads to higher achievement and better relationships than hands-off or authoritarian behavior.	Leading people to set goals, choose methods, and make decisions is *learned.* Nobody is born knowing participative management.
It is easier to change behavior in a group than one-on-one because norms (unwritten rules) strongly affect individual actions.	Talking over important decisions in groups *before* implementation leads to higher commitment to change.
People are more committed to solutions they have helped to design than to carrying out "expert" advice.	It is better to give people a few boundary conditions and let them solve the problem than to hand them ready-made solutions.
Every unsolved problem represents forces pushing for and against resolution. Easier and effective solutions come by reducing restraints rather than adding pressure.	Force field analysis quickly identifies restraints to be reduced. It is effective as a group exercise because it helps people see all at once what can be done, and builds group support for follow through.
No two force fields or problem diagnoses will ever be the same. Every situation is different.	The solution, package, design, policy, or system that worked well for someone else may *not* work for you.

McGregor (1960) believed there were two approaches a manager could take to managing subordinates, each of which was based on a separate set of bi-polar assumptions about human behavior. In other words, the extent to which managers either tightly control or share decision-making depends upon the set of assumptions a manager has about human behavior and how it should be controlled, influenced, and managed (Sink, 1982). Theory X assumes that: people inherently dislike work and will avoid it;

they therefore must be coerced, controlled, directed, and threatened with punishment to do work; and the average person prefers to be directed and wishes to avoid responsibility, has little ambition and wants security. A belief in Theory X assumptions will result in tight organizational control and an autocratic management style.

Theory Y has opposite assumptions: work is as natural as play; people will exercise self-direction and self-control in the service of objectives to which they are committed; commitment is a function of rewards associated with goal achievement; and the average person seeks responsibility and has a high degree of imagination and ingenuity (McGregor, 1960). A belief in Theory Y will result in generous power-sharing and participative and delegative management styles. Of course, the two extremes are rare in reality; most managers will be somewhere in between. Variables that moderate whether decision-making power will be shared are: manager psychological type, the specific situation, manager preferences, subordinate characteristics, and the environment, to name a few (Sink, 1982). An important point to make is that neither end of the continuum, autocratic (Theory X) or democratic (Theory Y) management style, is inherently "bad." Depending upon the situational variables, different management styles may be appropriate.

2.3.3. Classifying Types of Team Initiatives

Organizations can choose to adopt a variety of employee involvement initiatives — techniques or practices — to increase the level of information, knowledge, power, and rewards shared with employees at all levels. While there are a number of employee involvement techniques aimed at increasing participation of *individuals*, such as suggestion systems and job redesign, increasingly, *teams* are becoming the building block of organizational improvement efforts, as discussed in Chapter 1. The appropriateness and implementation issues associated with teams are also the focus of much debate in the literature (e.g., Dumaine, 1994). Teams can and do play a significant role in an organization's overall improvement efforts, and there are different types of teams that can be used. Several classification schemes and frameworks that have been proposed for categorizing types of teams will be presented. One basic distinction between different types of teams that appears commonly in the employee involvement/team literature is whether a team is intended to supplement or replace the formal organization structure. The more common types of teams are supplemental *initiatives*[1], which are part of the parallel organization structure, for example, suggestion systems, quality circles, ad-hoc problem-solving teams, and cross-functional task forces, to name a few examples. While the purpose of the formal organization structure is "production" of products or services, the purpose of the parallel organization structure is change and improvement (Goldstein, 1985; Miller, 1978; Stein & Kanter, 1980). Initiatives within the parallel structure are separate from, yet co-exist with, the formal organization structure and regular job responsibilities. These team initiatives are intended to facilitate communication, coordination, and opportunities for change.

Alternatively, teams can represent *replacement initiatives* which modify or replace the formal organization structure. These initiatives become institutionalized by involving employees in daily decision making regarding how work is performed *and* how work can be improved. An example of a replacement initiative which significantly modifies the organizational structure is self-managing teams. Self-managing teams represent a significant change from quality circles and other problem-solving groups in that they make problem solving, decision making, and managing work processes part of the day-to-day job.

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[1] Dr. Steven Markham of the Department of Management at Virginia Tech suggested the use of the terms supplemental and replacement initiatives.

Some supplemental teams may remain a permanent part of an employee involvement strategy. For example, a quality management effort may include a permanent quality council and quality management boards. Other teams, such as task forces, may be formed, accomplish their mission, and then dissolve, with team members going on to work on other improvement projects. Yet other teams may evolve to more sophisticated and complex forms of participation, for example, a quality circle evolving to a self-managing team.

There are many classification schemes for the numerous types of teams used in organizations. In studying several dozen different work groups, Hackman (1990) organized the groups into seven distinct categories:

- Top management group - A group of senior managers, who collectively have responsibility for setting organizational directions and making decisions that are of greatest consequence to the organization.
- Task force - A group formed specifically to solve a particular problem or perform a specific task. Task forces have the following characteristics: Members do not normally work closely together but come from different jobs; the work of the team is non-routine, often a one-of-a-kind project; and, members have the flexibility to perform the task in whatever way they find appropriate but at the same time must consider client preferences.
- Professional support group - A group that provides expert assistance to those who directly generate the organization's primary task or service. A group's work is defined and objectives are specified by those whom the group serves.
- Performing group - The product of this group's work is an actual performance, whether it is musical, theatrical, or athletic, and the client of the work is usually an audience.
- Human service team - A group that provides human services to clients needing some kind of therapy or rehabilitation. For this group, people are processed, as opposed to ideas or things.

- Customer service team - A group that provides clients with services of sufficient quality that customers will want to continue to do business with the team and its organization.
- Production team - A group that directly produces the products that are the main business of the organization. Members perform their work routinely and continuously.

Sundstrom, De Meuse, and Futrell (1990) argue that there are four categories of work teams:

- Advice and involvement - A team that enables various types of employees to provide input to decisions. Examples are: quality circles, employee involvement groups, advisory councils, and other types of committees.
- Production and service - A team that uses technology to generate products or services for customers.
- Projects and development - A group of white-collar professionals such as researchers, engineers, designers, and programmers who collaborate on assigned or original projects. Outputs may be complex and unique, and the cycle of work may be longer than in production/service teams.
- Action and negotiation - A group of highly skilled specialists cooperating in brief performance events that require improvisation in unpredictable circumstances. Examples are sports teams, military combat units, flight crews, surgery teams, and musical groups.

Dumaine (1994) presents a classification of five different types of teams:

- Work team - A team that performs daily the core work processes of the organization.
- Management team - A group of managers from various functions such as sales and production which coordinates work among other teams.
- Problem-solving teams - A group of knowledge workers who gather to solve a specific problem and then disband.

- Quality circle - A group of workers and supervisors which meets intermittently to air workplace problems.
- Virtual team - A group whose members are not co-located in the same facility or geographic area and communicates through electronic mail.

Cornelius (1994) presents the simplest classification of teams:

- Standing team - A permanent team whose members generally do not work full time on team efforts but have regular job responsibilities in addition to the team's work.
- Ad-hoc team - A temporary team whose members do not work full time on the team, and who disband once the team has accomplished its mission.
- Natural team - A permanent team whose members are a dedicated resource and perform the core work of the organization.

In a forthcoming book, Macy studies the prevalence of different types of teams used in organizations. Macy divides all work teams into two categories — those which do not change the organizational structure and those which do require a change in structure. This distinction is the same as the one noted earlier to describe supplemental versus replacement team initiatives. Macy portrays the types of teams studied in a continuum of reduced hierarchy and span of control, increased decision-making accountability and responsibility, and how the work is organized (in small versus identifiable components). The types of teams are (descriptions of each type were not available):

No Significant Structural Change Necessary:

- Traditional Work Group
- Natural Work Team
- Quality Circle

- Ad-Hoc Problem-Solving Team
- Quality Improvement Team
- Process Improvement Team
- Manufacturing Cell Team

Structural Change Necessary:

- Semi-autonomous Team
- Autonomous Team
- Cross-functional Team
- Supply Chain Team
- Virtual Team

Mohrman, Cohen and Mohrman (1995) take a different approach to classifying teams. Rather than labeling specific types of teams, they present a three dimensional framework in which a team can be categorized. First, a team can be permanent or temporary (e.g., core work team vs. task force). Second, a team can be focused on task flow — core work processes — or on improvement issues (e.g., self-managing team vs. process improvement team). And third, a team can represent an intact group within the formal organizational structure or it may overlay the formal structure, in other words, it is cross-functional and/or multiple-level (e.g., quality circle vs. design team). A specific type of team can be classified in a particular cell of this "cube." This framework appears to capture variations in team applications that others do not.

2.3.4. Why Involvement?

Employee involvement is viewed as a critical element of an organization's overall improvement effort. It is important enough that it is a criteria used to evaluate quality and productivity improvement efforts in many national award programs, including the

Malcolm Baldrige National Quality Award. Why is it that employee involvement is viewed as so critical? Several reasons are offered by Lawler (1986) and Sashkin (1984): a changing business environment, differences in products and technology, a changing workforce with different expectations and needs, and lastly, for ethical reasons.

First, a changing business environment characterized by global competition and marketplace, has necessitated that American managers take a serious look at alternative ways to improve performance (Cheney, 1990; Macy, Norton, Bliese, & Izumi, 1990). The survival of many organizations depends on effective utilization of labor (the U.S. has the highest labor costs in the world), which in turn depends on how people are organized and managed (Lawler, 1986).

Secondly, differences in products and technology have necessitated changes in how people are managed. During the last several decades, the American economy has shifted more toward a service economy and toward work which requires specialized knowledge (Lawler, 1986). Prior to this, from the turn of the century through the middle decades of the century, work was divided into simple repetitive tasks, for which a control-oriented paradigm is appropriate (Lawler, 1988) and is probably why this paradigm existed and worked well for so long. Lawler (1988) predicts that: 1) the more interdependent the work of individuals is, the more effective the involvement-oriented paradigm is likely to be; and 2) the more dynamic the environment in which the organization operates, the more effective the involvement paradigm is likely to be. Evidence suggests that more jobs in American are shifting toward complex work and away from simple and repetitive work. Growth in the service sector has produced more and more jobs where people are working with words, symbols, numbers, and personal services (Lawler, 1986). Based on these trends toward more complex, interdependent, and dynamic knowledge work (Cetron, Rocha, & Luckins, 1988; Lawler, 1988), the involvement approach is likely to be most effective.

A third reason for adopting employee involvement is to meet the needs of a dramatically changing workforce. One of the most important changes is the increasing level of education in society, where people are more willing and able to use their intellectual as well as their physical capabilities to perform work. Employees often have expectations to have more input into decisions in the workplace, particularly when the outcomes of decisions will directly affect them (Lawler, 1986).

Lastly, some organizations are becoming, or have always been, involvement-oriented because their managers believe involvement is an ethical imperative. In other words, managers use participative management styles not because they believe it will improve quality and productivity, but because they believe it's simply the right thing to do and an ethically superior way of managing people (Sashkin, 1984, 1986; Semler, 1989). This argument falls very low on managers' list of reasons for using employee involvement practices (Lawler, Mohrman, & Ledford, 1992).

2.3.5. Summary

Employee involvement is not another fad, but "an important and increasingly popular approach to management" (Lawler, Ledford, & Mohrman, 1989). The majority of Fortune 1000 companies have some form of involvement initiatives in practice, and the overriding reason they have done so is to improve quality, productivity, or some other measure of performance (Lawler, Mohrman, & Ledford, 1992). As organizations seek to find ways to survive and thrive in the competitive marketplace, managers increasingly implement employee involvement practices, often teams, in order to fully utilize the capabilities of all employees.

2.4. Self-Managing Teams

This section of Chapter 2 specifically focuses on self-managing teams, including definitions, characteristics of self-managing teams, results of using self-managing teams, and future trends. This review is included in the dissertation because self-managing teams are a frequent outcome of organizational redesign efforts, particularly using the sociotechnical systems approach to redesign. Additionally, the focus of redesign efforts at one of the research sites is transitioning to a high-performance work system using self-managing teams.

2.4.1. Defining Self-Managing Teams

In order to fully understand the phenomenon of self-managing teams, it is necessary to review and clarify distinctions (if any) in the various terms used. The most common terms used in industry and in the literature are: self-managing teams, self-regulating groups, self-directing (or self-directed) work teams, autonomous work groups, semi-autonomous work groups, high performance teams, and empowered teams. A key related term is high performance work system which utilizes work teams. The term self-managing teams is used here because it is one of the more common ones; in addition, it is the term adopted by the Interdisciplinary Center for the Study of Work Teams for their annual international conference.

2.4.1.1. Definitions and Terminology

Rather than individually reviewing various definitions researchers and consultants have offered, definitions from some of the better-known resources on self-managing teams are summarized in Table 2.4. These definitions primarily represent the practitioner-oriented literature, although some are from the scholarly literature. The definition adopted here, which borrows from elements of other definitions, is shown below. Many of the definitions in Table 2.4 have similar components.

> *A self-managing team is a group of eight to fifteen employees organized around a relatively whole task; the team is responsible for planning, performing, monitoring, and improving work processes to deliver products/services to internal or external customers.*

An approach to defining self-managing teams that Hackman (1986) uses focuses on the functions a team performs. Hackman uses an "authority matrix" to distinguish between groups with varying control over what are traditionally management functions (see Figure 2.2). Hackman proposes four functions that must be performed in work: executing the task; monitoring and managing work processes; designing the performing unit and its context; and setting overall direction. Hackman identifies four types of performing units — a group or individual — based on how many of the management functions the performing unit has responsibility for. Although Figure 2.2 portrays the types of performing units as if there were clear distinctions between each, distinctions between different types of teams are blurred.

Table 2.4. Definitions of Self-Managing Teams.

Author	Definition
Wellins, Byham & Wilson, 1991, p. 238	A self-directed team is a group of employees who have day-to-day responsibility for managing themselves and the work they do. Members of self-directed teams typically handle job assignments, plan and schedule work, make production-related decisions, and take action on problems. Employees on SDTs work with a minimum of direct supervision.
Orsburn, Musselwhite, Moran, & Zenger, 1990, p. 8	A self-directed work team is a highly trained group of employees, from 6 to 18, on average, fully responsible for turning out a well-defined segment of finished work.
Fisher, 1993, p. 15	A self-directed team is a group of employees who have day-to-day responsibility for managing themselves and the work they do with a minimum of direct supervision. Members of self-directed teams typically handle job assignments, plan and schedule work, make production and/or service related decisions, and take action on problems. (adapted from Wellins et al., 1991)
Torres & Spiegel, 1990, p. 3	A self-directed work team is a functional group of employees (usually between eight and fifteen) members who share the responsibility for a particular unit of production. The work team consists of trained individuals who possess the technical skills and abilities necessary to complete all assigned tasks. Management has delegated to the self-directed work team the authority to plan, implement, control, and improve all work processes.
Hoerr, 1989, p. 57	A self-managing team is usually five to fifteen employees who produce an entire product instead of sub-units. Members learn all tasks and rotate from job to job. Teams take over managerial duties, including work and vacation scheduling, ordering materials, etc.
Goodman, Devadas, & Hughson, 1988, p. 297	Self-managing teams are groups of individuals who can self-regulate work on their interdependent tasks. The key elements of such teams are (1) groups (versus dyads or organizations) in which there typically is face-to-face interaction, (2) a physically defined area, (3) a whole set of interdependent tasks, and (4) group members who have control over the management and execution of these tasks. Management refers to activities such as planning, directing, organizing, staffing, and monitoring. Control means that group members have authority and responsibility to initiate the management activities.
Raab & Alexander, 1991, p. 5	A self-managing team is a group which contains all the essential capabilities and responsibilities necessary to do a whole piece of work. Self-managing teams typically make decisions about methods of work, task schedules and assignments.
Cummings, 1978, p. 627	The design of self-regulating work groups depends on at least three conditions that enhance technically required cooperation and employees' capacity to control variance from goal attainment: task differentiation, boundary control, and task control.

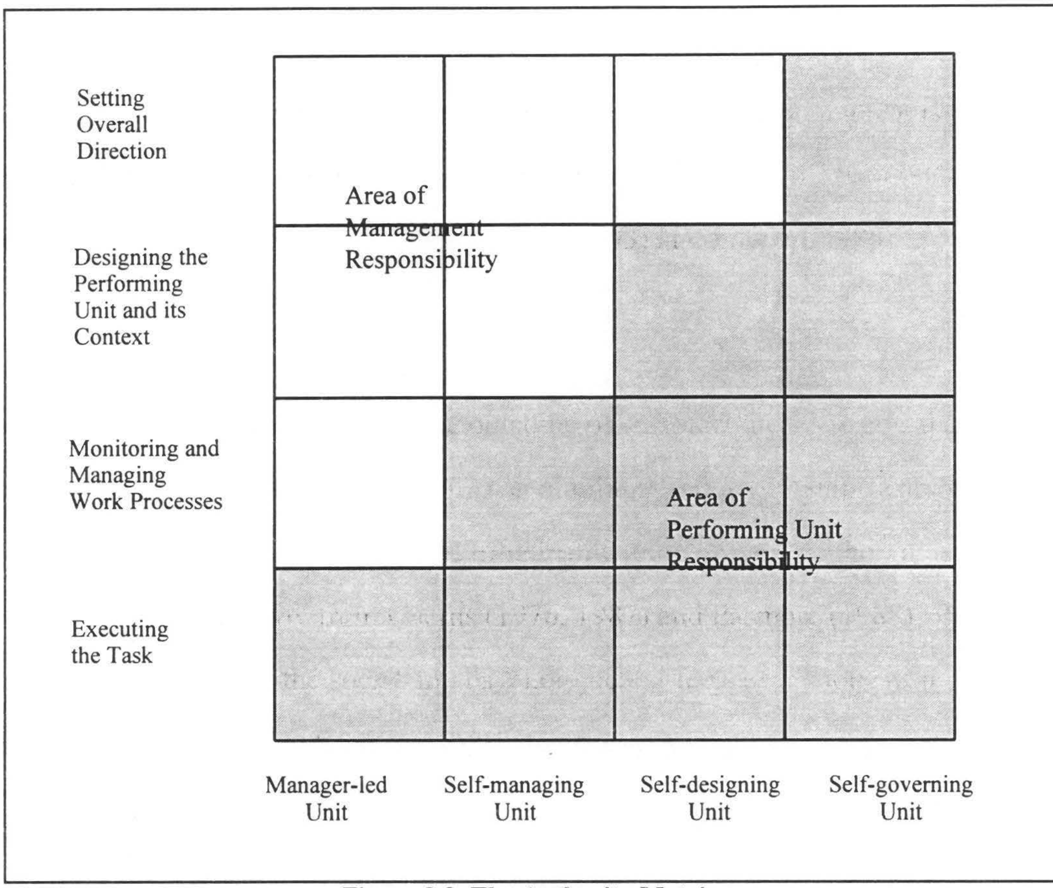

Figure 2.2. The Authority Matrix.
(taken from Hackman, 1986)

A *manager-led performing unit* represents the traditional work group or individual where the only function the unit performs is actually executing the task(s) (producing the product or service). The most common kind of work groups found in organizations are "coacting" groups, where members of the group report to the same supervisor and work close to one another, but they have individually-defined tasks. A different type of a manager-led performing unit is a *natural work team*, which consists of employees organized around a single work process or product, who are interdependent in their functioning and have a common supervisor (Belcher, 1987). A *self-managing performing unit* monitors and manages work processes in addition to executing the task(s). These are common in managerial and professional work — an example is a team of research assistants who share responsibility for collecting a set of interviews and observations (Hackman, 1986). A *self-designing performing unit* has responsibility for executing the task, managing the work, and designing the unit and its context. Managers still set the overall direction for the performing unit. An example of a self-designing unit is a top management task force or an individual given autonomous responsibility for some task with the right to call on organizational resources to get the job done (Hackman, 1986). A *self-governing unit* has responsibility for all four of the functions — group members decide what is to be done, structure the unit to accomplish it, monitor and manage how it is done, and actually perform the task(s). Examples of self-governing units are boards of directors for corporations, worker cooperatives, and sole proprietorships (Hackman, 1986).

The terms *autonomous work groups* and *semi-autonomous work groups* make a further distinction in the amount of autonomy work teams have. Macy, Norton, Bliese, and Izumi (1990) define a semi-autonomous work group as a "transition step" an organization goes through in the journey toward truly autonomous work groups. In semi-autonomous work groups, the team is responsible for task-related decisions, such as production schedules and work methods. Team members may also begin to take on some administrative decisions, such as hiring, firing and pay decisions, while managers may still make many administrative decisions. Truly autonomous work groups have no supervision and make all task-related and administrative decisions, including quality standards, production schedules, work methods, hiring, firing, pay, and scheduling vacations (Goodman, Devadas, & Hughson, 1988). Autonomous work groups also make strategic decisions for the group. For example, an autonomous work group might decide whether to produce a new product or whether to contract out for inputs they need.

Therefore, using Hackman's terminology, autonomous work groups approach being self-governing performing units.

The term "self-managing teams" is used in the generic sense, and not in the specific sense of Hackman's "self-managing performing unit" — his use of the term implies a group that only executes the task and manages work processes. For this research, self-managing teams may refer to any of the types of teams discussed so far (semi-autonomous work group, autonomous work group, etc.). A group's level of autonomy is further characterized, if necessary, by using a more specific term.

Other terms in use are *self-regulating groups* (Cummings, 1978), *self-directing* (or *self-directed*) *work teams* (Fisher, 1993; Orsburn, Moran, Musselwhite, & Zenger, 1990; Wellins, Byham, & Wilson, 1991), *high performance teams*, and *high commitment teams* (Easton, 1990). No distinction is noted between these four terms and "self-managing team" as they have been used in the literature.

There are several other terms related to self-managing teams which should be clarified. A *natural work team* is created around a single product or process where employees are interdependent in their functioning. Self-managing teams are natural work teams, but the reverse is not necessarily true. An example of a natural work team is a customer service team organized around an insurance service to consumers, where the team is responsible from the first to the last process of providing the service (Myers, 1985).

A *new design plant*, or *greenfield plant,* is one in which self-managing teams are used throughout the entire organization from its inception. A *redesign plant* is one in which a transition from traditional work groups to self-managing teams is made, without shutting down the plant or starting from scratch as in a greenfield plant. Another term used for this type of organization is a *brownfield plant*. In redesign plants, the transition may be made gradually, beginning with a pilot department or division, or on a very large scale, an approach recommended by Dillingham and Delaney (1990). With this second approach, all key organizational sub-systems can be redesigned to support self-managing teams, rather than supporting teams in one area and traditional groups in the rest of the organization. The term *high involvement organization,* or *high involvement plant*, refers to a site that uses self-managing teams system-wide. The site may have been either a new design or a redesign plant.

2.4.1.2. Behavioral Characteristics of Self-Managing Teams

Hackman (1986) identifies behavioral signs of self-management which serve to further describe characteristics of self-managing teams (see below). These behavioral signs are arranged from the most basic self-managing behaviors to those that one would find only in relatively mature self-managing groups or individuals. These behavioral signs of self-management apply to any performing unit — a group or individual providing a product or service.

1. People take personal responsibility for the outcomes of their work and show in their behavior that they feel personally accountable for the results of what they do.
2. People monitor their own performance continuously, actively seeking data and feedback to learn how well they are accomplishing their tasks.
3. People manage their own performance, taking corrective action at their own initiative to improve their performance.
4. When people do not have what they need to perform well, they actively seek from the organization the guidance, help or resources they need for excellent performance - and they do so assertively and constructively.
5. People take initiatives to help people in other areas improve their performance, making sure that their own responsibilities are being met before reaching out to help others.

2.4.1.3. Related Fields and Concepts

The design of self-managing teams are based on two key related fields and concepts. The first, sociotechnical systems theory, is an outcome of research done in the British coal mining industry in the 1950s. The second related field is job redesign, or job enrichment, using the job characteristics approach. This section briefly describes these two fields and their contributions to the development of self-managing teams. A more thorough review for sociotechnical systems theory can be found in Trist (1981), while reviews of job redesign can be found in Cotton (1993) and Lawler (1986).

2.4.1.3.1. Sociotechnical Systems Theory

Self-managing teams are a concrete outcome of sociotechnical systems theory, which grew out of research by Trist in the British coal mining industry. Significant influence in this field comes from Trist, Emery, and Bamforth with their work at the Tavistock Institute, and more recently from Cherns (1976, 1987) and Pasmore (1988). Trist and Bamforth (1951) studied the social and psychological effects of the long-wall method of mining, which was found to have dysfunctional consequences on the cohesiveness of teams. Previously, men worked in small, cohesive teams in close proximity and had to rely on each other for their lives. The mechanized long-wall method isolated team members and "destroyed the camaraderie of the face-to-face group" (Glaser, 1990, p. 4). Results of this method were lowered productivity in addition to tension and anxiety for the miners.

Rice (1958), in a desire to test whether sociotechnical systems (STS) theory would produce similar results elsewhere, conducted the first planned STS intervention in the weaving sheds of an Indian textile mill (Barko & Pasmore, 1986). Implementation of STS concepts then expanded to Scandinavia, where eventually laws were changed to support STS interventions in Norwegian industry (Emery & Thorsrud, 1964, 1969). STS reached the United States with the success of the General Foods Topeka plant (Walton, 1972). A review of the development of sociotechnical systems theory is provided by Trist (1981).

The sociotechnical systems approach recognizes that every organization is a system, made up of people organized into groups (the social system) using tools, materials, equipment, methods, and knowledge (the technical system) to produce products or services for customers who are part of the organization's external environment (Pasmore, 1988). The primary aim of sociotechnical systems theory is to "design a work structure that is responsive to the task requirements of the technology and the social and psychological needs of employees" (Cummings, 1978, p. 261). Any work design must consider both the technical and social system, and sociotechnical designers structure work such that variance is controlled *within* the work system rather than external to it. The sociotechnical principles used in job redesign (shown below) were developed by Emery from research findings of several investigations through the Tavistock Institute (Trist, 1973).

> *"The judgment that it is possible to redesign jobs in this way rests upon the evidence that men have requirements of their work other than those usually specified in a contract of employment (i.e., other than wages, hours, safety, security of tenure, etc.). The following list represents at least some of the general psychological requirements that pertain to the content of a job (to what a person is called upon to carry out in his job from hour to hour and from year to year):*
>
> 1. *The need for the content of a job to be reasonably demanding in terms other than sheer endurance and yet providing a minimum of variety (not necessarily novelty);*
> 2. *The need for being able to learn on the job and go on learning: again it is a question of neither too much nor too little;*
> 3. *The need for some minimal area of decision-making that the individual can call his own;*
> 4. *The need for some minimal degree of social support and recognition in the workplace;*
> 5. *The need to be able to relate what he does and what he produces to his social life;*
> 6. *The need to feel that the job leads to some sort of desirable future (not necessarily promotion)."*

Cherns (1976, 1987) identifies principles of sociotechnical design, shown below, consistent with Emery and Trist's principles:

- Compatibility - compatibility between the design process and the design.
- Minimal Critical Specification - specify no more than what is essential.

- Variance Control - variances should not be exported across unit, departmental, or other organizational boundaries.
- Boundary Location - boundaries should not be drawn so as to impede the sharing of information, knowledge, and learning.
- Information Flow - information for action should be directed first to those whose task it is to act.
- Power and Authority - those who need equipment, materials, or other resources to carry out their responsibilities should have access to them and authority to command them.
- The Multi-functional Principle - organizations need to adapt to their environment by enlarging roles through training.
- Support Congruence - congruence between teams and support functions including reward and information systems, financial control, marketing, sales, purchasing, and planning.
- Transitional Organization - planning and design associated with how to maintain production in the "old" system while training people to operate in the "new" system and start-up.
- Incompletion of the Forth Bridge Principle - evaluation and feedback loop to redesign.

Pasmore (1988) describes a process for organizational redesign of any target system (group, department, organization) using the sociotechnical systems approach. This process includes steps for environmental analysis (a key assumption of STS theory is that organizations are open systems), social system analysis, technical system analysis, as well as steps for creating a structure for change to support redesign. This process was reviewed earlier in this chapter.

The sociotechnical systems approach has proven to be effective in various applications across different countries (Pasmore, Francis, Haldeman, & Shani, 1978). Results of STS interventions are integrated with the discussion of results and benefits from self-managing teams later in this section.

2.4.1.3.2. Job Redesign

The job characteristics approach to job (task) design is an alternative approach to designing work to be simplified, specialized, and routine — all characteristics of work in the earlier part of this century. Although job characteristics approach has been criticized for not evolving from exploratory to confirmatory stages (Roberts & Glick, 1981), it is the most popular approach to task design. Task design theory should "deal simultaneously with definitions of task content, how to change jobs in the interests of improving responses people make to those jobs, whether perceptions or other aspects of tasks contribute more to responses, and how tasks and responses to them are influenced by contexts in which they are done" (Roberts & Glick, 1981, p. 211).

The job characteristics model examines individual responses to jobs as a function of job characteristics moderated by individual characteristics. Job responses include satisfaction, turnover, and absenteeism (Roberts & Glick, 1981). Hackman and Lawler argue that jobs must be high on the following characteristics to achieve positive job responses: skill variety, autonomy, task identity, feedback, and task significance (Hackman, 1986; Hackman & Lawler, 1971). To evaluate jobs, these five characteristics are combined into one Motivating Potential Score (MPS) which can be high overall even if one of the characteristics is low (Roberts & Glick, 1981). Both Cotton (1993) and Lawler (1986) devote a chapter to reviewing job redesign (they both use "job enrichment") theory, applications, and results.

The design and properties of self-managing teams "parallel the hallmarks of the job characteristics approach to job design" (Wall, Kemp, Jackson, & Clegg, 1986). Hackman suggests that of the two approaches (self-managing teams vs. job characteristics approach to job design), the use of self-managing teams is the more "powerful approach because groups can undertake much larger pieces of work than individuals can and so allow more fundamental manipulation of work characteristics" (Wall et al., 1986). The main difference between the job characteristics approach and self-managing teams is the level of application and analysis; in self-managing teams job characteristics are attributes of group work rather than individual work.

2.4.2. Characteristics of Self-Managing Teams

Some of the most common key issues and questions addressed in the self-managing team literature are leadership of self-managing teams (what role does the supervisor perform?); structure of teams (what formal roles are needed within a team?); types of decisions and responsibilities teams take on (what decisions can and should a team make?); the information needs of teams (what information does a team need to support decision making?); training needed by teams (what skills and training do team members need?); and the pay system for teams (how should teams be paid?). This section reviews research findings relating to these key issues of self-managing teams. Responses to these issues and questions provide guidance to design teams tasked with designing self-managing teams.

2.4.2.1. Leadership of Self-Managing Teams

Supervisors (leaders of self-managing teams) have been one of the biggest sources of resistance to involvement and self-managing teams, primarily because they are often excluded from the design and implementation of teams (Katz & Laughlin, 1990; Klein, 1984, 1988; Walton & Schlesinger, 1979). An inherent paradox in self-managing teams is: if a team is self-managing, why is a supervisor needed? If one is needed, what is the supervisor's role and how does it change?

In reality, very few organizations using self-managing teams have no supervisors at all (generally, the word supervisor is changed to coach, facilitator, or team leader). Only the most mature teams (truly autonomous work groups) operate without any source of external leadership. In most organizations using self-managing teams, the supervisor role changes to that of a coach. The role of the coach is significantly different from the traditional supervisor. Rather than the primary responsibility being monitoring and managing work processes, the coach's primary responsibility is to get the team to be self-managing as quickly as possible, through process guidance and facilitation. This includes facilitating team meetings if necessary, being a role model, not jumping in to solve problems as in the past, and reinforcing self-managing behavior by the team (Manz & Angle, 1986; Manz & Sims, 1980, 1984, 1986). This process of "letting go" can be very difficult for many supervisors.

Knowing that the supervisor's role must change is the easy part; defining the new role is much more difficult. Supervisors must feel secure that they are still valued by the organization and must learn to understand and accept their new role. The organization must find new and meaningful things for them to do. Many organizations have former supervisors work on projects put on the back burner because there was no time or no one available to work on them. Because they have technical expertise, supervisors are very well qualified to work on development-type projects, working with new product development, other technical projects, and organization-wide task forces. One organization defines the role of the coach as continuously learning new skills, such as engineering skills and counseling skills, and transferring those skills to teams. Initially, supervisors will still have to spend a great deal of time working directly with teams coaching and advising them until they are fully trained. When teams are able to take on more responsibilities, much of the supervisor's time is freed up. Listed below are specific examples of activities supervisors became involved with throughout the transition to teams (Van Aken, 1991):

Supervisor activities directly involved with teams:

- training team members on administrative and technical skills;
- providing support to team members and encouraging them to make decisions and rewarding them when they do so;
- acquiring resources teams need, including bringing information to teams and acquiring training resources if needed;
- assisting teams with particularly difficult technical problems;
- helping the team with some of the difficult interpersonal tasks such as performing self-evaluation and peer evaluation;
- continuing to learn new skills and transferring them to teams; and
- longer-range planning for the department or division of which teams are a part.

Supervisor activities *not* directly involved with teams:

- participating on new product development committee and development engineering projects;
- becoming the personal computer expert;
- participating on process improvement projects; and
- participating in an environmental improvement project.

Orsburn, Moran, Musselwhite, & Zenger (1990) also provide examples of some activities supervisors become involved with during the transition to self-managing teams:

- coaching the teams;
- developing an overall strategy for the teams;
- interfacing between the teams and the larger organization;
- championing innovative ideas;
- paying more attention to the technology side of the business;
- attending to team resource needs;
- working with vendors and customers; and
- making critical improvements long left on the back burner.

Manz and Sims (1990) call leaders of self-managing teams "superleaders," and their main behavior is leading others to lead themselves (self-leadership). Self-leadership is the "influence we exert over ourselves to help us achieve the self-motivation and self-direction we need to behave in desirable ways" (Manz & Sims, 1990). Becoming a self-leader is the first step to being a superleader and leading others to self-leadership. The overall steps involved in superleadership are: become an effective self-leader; model self-leadership; encourage self-set goals; create positive thought patterns; reward self-leadership; promote self-leadership through teamwork; and facilitate a self-leadership culture (Manz & Sims, 1990).

According to some former supervisors, the self-managing team environment is twice as difficult, because it is often easier to tell someone what to do or do it yourself than it is to get someone to understand what to do and teach them what to do. Training and organizational support for learning how to be a coach and facilitator are critical to helping supervisors make this journey. In sum, the key elements for gaining commitment and support from supervisors are: their involvement in the transition to self-managing teams, helping them understand and define their new role (rather than only telling them what their role *is not*), providing training and support to perform the new role, and providing meaningful opportunities for them when their time spent coaching and training teams is freed up. An important resource in this area is Fisher (1993), an entire book devoted to providing guidance to leaders of self-managing teams.

The previous paragraphs discuss the role of coaches or external team leaders. Another type of leadership role often used in self-managing teams is an internal team leader. Common characteristics of an internal team leader are: they are also a team member; they are generally elected; different people rotate through the role; they may be paid a little more; and they also coach and facilitate the group in self-leadership (Dillingham & Delaney, 1990; Van Aken, 1991). Not all organizations use internal team leaders or facilitators, as they may be called. Instead, they may rely on emergent or shared leadership in different situations. In other words, different people will have expertise in different situations and that expertise and leadership will emerge as needed.

2.4.2.2. Structure of Self-Managing Teams

A common way to structure a self-managing team is to create coordinator roles. These coordinator roles essentially take the responsibilities previously performed by supervisors, divide them into smaller pieces, and distribute them among the team. The complexity of the internal structure of a team generally depends on how large the organization is, how large the team is, and the amount of new responsibilities the team takes on. In other words, a small organizational system may not need designated coordinator roles, while a larger and more complex organizational system may have anywhere from three to eleven coordinator roles. The most coordinator roles and typical responsibilities are (Van Aken, 1991):

- **quality coordinator** - addresses customer complaints, internal quality problems, coordinates quality improvements, fills out control charts.
- **production (or scheduling) coordinator** - determines work assignments and how product flows throughout work area, makes adjustments to work flow.
- **administrative (or labor) coordinator** - keeps attendance for team, overtime tracking, provides information to payroll, coordinates vacation scheduling.
- **training coordinator** - identifies training needs for team and coordinates training resources.
- **maintenance, safety coordinator** - addresses safety problems, coordinates maintenance for equipment in work area, may also include housekeeping for work area.

Some organizations have more coordinator roles than are listed above. A Boeing greenfield plant designed teams to have significant administrative responsibility, so it was necessary to create more roles to distribute the work load evenly among team members. Examples of these additional coordinator roles are: methods coordinator, material/parts supply coordinator, and customer relations coordinator. Generally, team members are elected by the team to fill the coordinator roles, which may be rotated every four, six , twelve or even up to eighteen months. Coordinators are generally not paid any extra, however, some organizations are experimenting with adding these roles to the pay-for-skills design.

Creating and defining coordinator roles provides an in-depth understanding of the team's roles and responsibilities. Organizations using coordinator roles must develop clear responsibilities for each role to prevent any misunderstandings between the team and their supervisor/coach. This way, each party understands their responsibilities and can avoid miscommunication.

2.4.2.3. Decisions and Responsibilities of Self-Managing Teams

Self-managing teams have the authority and power to make many more and different types of decisions than traditional work groups. Since the work is designed differently, this work design drives the type of decisions teams must make. Self-managing teams typically have the authority to make *task-related decisions* (e.g., work methods, production schedule, quality standards, and output) and *administrative decisions* (e.g., vacation scheduling, work assignments, hiring and firing, and break scheduling) (Cummings, 1978; Goodman, Devadas, & Hughson, 1989; Hoerr, 1989; Wellins, Byham, Wilson, 1991).

Below is a list of examples of specific decisions and/or responsibilities of self-managing teams (Katz & Laughlin, 1990). This list provides some specific examples of the types of decisions mentioned earlier.

- assign daily tasks to work team members;
- determine and address training needs;
- handle individual performance problems/disciplining team members;
- handle technical problems;
- handle performance appraisals;
- handle vacation scheduling;
- implement process improvements;
- maintain safety and housekeeping;

- make compensation decisions;
- perform routine equipment maintenance;
- prepare and manage cost budgets;
- select production/work methods;
- set production/team goals (output, quality, productivity);
- stop production line or work process to address quality concerns;
- work with external customers and suppliers;
- work with internal customers and suppliers;
- select new team members;
- fire team members if necessary; and
- make enhancements to work environment/QWL.

Some teams have evolved and matured such that they have taken decision-making responsibility far beyond even what is listed above. For example, teams at Johnsonville Foods made the decision to proceed with a major plant expansion (Dumaine, 1990), and teams at Semco in Brazil made the decision for a new plant site which management didn't fully agree with but abided by (Semler, 1989). Volvo is so advanced at empowerment and involvement that teams in their new Uddavalle plant assemble entire cars (Hoerr, 1989).

2.4.2.4. Information Requirements of Self-Managing Teams

To make management decisions, self-managing teams must have management information — much different information than what is typically provided to traditional work groups. The "willingness to share information is a key ingredient for success...teams need detailed information on overall operations, including financial information...To manage themselves, work teams need management information" (Orsburn, Moran, Musselwhite, & Zenger, 1990, p. 24). There has not been as much research on the issue of information requirements of self-managing teams, as there has been, for example, on the role of the supervisor or training needs of teams. In previous research (Van Aken, 1991), seven types of information needs were identified, which broadly fall into two categories — team management information and overall business information.

Team management information directly supports the team's production process and is necessary for the team to perform its daily responsibilities. Team management information includes five specific types: feedback on team performance, team production information, team development information , technical product/process information, and how the team's performance compares to other teams. Overall business information indirectly supports the team's production process and includes the performance of and issues related to larger systems, such as the department in which the teams operate, or the division, company/plant, or even corporation if appropriate. Each of the seven types of information needs is listed in Table 2.5, along with a definition and examples.

The most common mechanism for teams to receive these types of information, particularly team management information, is daily team meetings. These daily meetings may be shift exchange meetings in a manufacturing plant for one shift to "hand off" to the next and report any necessary information, or they may be more informal meetings so that all members touch base before beginning work. Common mechanisms for teams to receive overall business information are through a computer network; through company-wide meetings; and memos, charts, and graphs posted on company bulletin boards.

2.4.2.5. Training for Self-Managing Teams

Training is a critical element of making self-managing teams succeed and is an issue many organizations find all too easy to cut short; lack of training is one of the biggest barriers to the success of self-managing teams (Katz & Laughlin, 1990). Teams receive training in the following areas: technical skills, administrative skills, interpersonal skills, group process skills, and quality skills. These categories represent the most common

Table 2.5. Information Needs of Self-Managing Teams.
(from Van Aken, 1992)

TEAM MANAGEMENT INFORMATION
1. **Feedback on Team Performance** - regular and frequent information to the team which assesses either quantitatively or qualitatively how the team performed over some time period; the feedback relates to the team's performance on producing their product/service and may cover any of the following performance criteria: effectiveness, efficiency, quality, productivity, innovation, quality of work life, and profitability (Sink, 1989a). Examples are feedback on number of units produced, number of defects, percentage of direct labor, and internal and external customer feedback. 2. **Team Production Information** - information which changes relatively frequently (hourly, daily, weekly) which the team needs on a *frequent regular* basis to *directly* support producing the product/service for which the team is responsible. Examples are production goals, equipment or other production problems, changes in production schedule, and overtime needs. 3. **Team Development Information** - information on problems, concerns, activities of the team which have to do with the team's functioning, growth, development and improving how the team functions; not necessarily received on a regular basis but as needed, and *indirectly* supports producing the team product/service. Examples are status of action items for team, interpersonal problems and conflicts, status of team improvement projects, and future changes in policies/procedures. 4. **Technical product/process information** - specific technical information provided as needed to solve technical problems. Examples are technical information on new products or new processes, operating instructions, and procedures manuals. 5. **Performance of other teams** - information on how other self-managing teams in the area, or in other areas, performed over some time period; feedback may cover any of the performance criteria.
OVERALL BUSINESS INFORMATION
6. **Performance of larger systems** - information on performance of systems encompassing the team, including the department, division, company/plant, and corporation in which the teams exist; may cover any of the performance criteria. Examples are quantitative information such as profitability, quality performance, and costs, as well as qualitative information such as subjective customer satisfaction and new markets penetrated. 7. **Issues for larger systems** - information on problems, concerns, activities of systems encompassing the team, including the department, division, company/plant, and corporation in which the teams exist. Examples are business goals and objectives, changes in company/plant procedures, and status of improvement efforts.

training areas; some organizations may provide additional training in other areas, for example, business analysis.

Technical training is directly related to the cross-training feature of self-managing teams. For team members to be cross-trained in all the technical tasks for which the team is responsible, they must receive the training to do so. Work team productivity and flexibility come from having team members cross-trained in team tasks rather than being trained only in one specialized task as with traditional work groups (Musselwhite & Moran, 1990). Technical training is most often provided by supervisors, more experienced team members, and/or engineers.

Administrative training is necessary so the team can perform the coordinator roles mentioned earlier, which represent tasks previously performed by supervisors or other support functions. Administrative training can include: how to plan and schedule work; filling out attendance records; purchasing; preparing budgets; accounting; interviewing skills and knowledge of EEO guidelines necessary for interviewing and hiring new team members; and how to do performance appraisals; to name just a few. Administrative training is generally provided by supervisors and people in support functions (such as personnel for filling out personnel records).

Interpersonal training is necessary so the team can effectively communicate with one another. Team members need to "talk with, explain to, agree with, disagree with, decide, listen to, and convince more people than they probably ever have before....they need to be skilled communicators, both one-on-one and in group settings" (Musselwhite & Moran, 1990). Examples of interpersonal training are: conflict resolution, effective listening and communication, giving and receiving feedback, reaching consensus, how to teach, how to be a good learner, negotiation, disciplining team members, stress management, and knowledge of different personality types and different leadership styles (Van Aken & Sink, 1992). Interpersonal training is often provided by an external consultant. If the organization is large and has many resources, this training may be provided by internal consultants from Human Resources.

Group process training provides skills team members need to understand groups and how they function. Some examples of group process training are: group dynamics which includes group roles and group development, problem-solving, brainstorming, and running effective meetings. Group process training is also generally provided by either an internal or external consultant.

Quality training may include the use of quality tools, quality management concepts and philosophies, statistical process control, and process capability studies. This training is important so a team can measure and improve the quality of its output.

A common question regarding training is how much time should team members spend in training? In previous research (Van Aken, 1991), the percentage of time that the teams studied spent in training varied from six to ten percent. For new design organizations, once start-up was complete, the budgeted time for training was similar. In the start-up stages, team members may spend as much as twenty to twenty-five percent of time in training. In one redesign manufacturing organization, the time budgeted for training for each individual was nine percent. If an individual had a better than average attendance record, they could spend more time in training, which in turn translates to more pay under a pay-for-knowledge system.

2.4.2.6. Pay System for Self-Managing Teams

How members of self-managing teams are compensated (the reward system) is a very prevalent topic in the self-managing team literature. A frequent characteristic of the compensation system for self-managing teams is a pay-for-skills, or pay-for-knowledge (PFK) system, where team members' compensation is based on their cumulative skill level (Ledford, 1989). Necessary skills are identified and team members are paid more for every skill they acquire and maintain proficiency. A common feature of a PFK system is to rely on peer evaluation and certification to determine when a team member has sufficiently mastered a skill to be paid for it. The PFK system generally has two types of skills — technical skills and a second type which may be called "social" or "business management" skills, depending on the PFK design.

A PFK system may have up to three dimensions. A *breadth* dimension reflects having a variety of skills obtained through cross-training. A *depth* dimension reflects the ability of a team member to become an expert in an area, such as learning engineering and technology skills. A *vertical* "leadership" dimension represents adding coordinator roles to the PFK system. Coordinator roles are usually unpaid, but some organizations are adding these roles to the PFK system. Therefore, the PFK system can be thought of as a cube with breadth, depth, and vertical dimensions. A common time period for evaluation and certification of skills is every six to twelve months. Some organizations, however, allow team members to decide when they will be evaluated (i.e., when they feel ready), and certification can occur at any time.

A department in one redesign plant has developed an innovative and unique PFK system. A departmental PFK design team designed a system having six levels, where the first four represent breadth of skills and vertical leadership skills. Beginning in the fourth level, team members then make a choice of "career path" and can specialize in and master one technical area, while still maintaining the breadth of skills achieved in earlier levels. Team members can also acquire and be paid for skills reflecting their personal interests, such as photography, narrating, ergonomics, and making presentations.

A PFK system can be designed to take anywhere from five to ten, or even twenty, years for a team member to reach the highest pay level. When this "topping out" occurs, a team member can no longer receive additional pay, which may lead to frustration and lack of motivation to perform. For this reason, some organizations have added the depth and vertical dimensions mentioned earlier, which prolongs topping out. Another way to prolong topping out is to require team members to teach skills once they have learned them. Adding some form of gainsharing to the PFK system allows team members to keep earning additional pay through outstanding team and/or organizational performance.

In addition to topping out, another potential problem of PFK is that the pay system does not address consistently low or high performers or team members with high absenteeism. In other words, someone who does not perform as well (e.g., in quality, quantity of outputs, number of suggested improvements) as another team member and is absent frequently gets paid just as much as someone who is a high performer and is present all the time, provided they have the same skills. Although PFK does not differentiate those who excel at their work, it does reward members who proactively take all the training available who might quickly by-pass more senior people learning new skills at a more leisurely rate. A pay-for-knowledge system is designed specifically not to reward people just for their presence or for their seniority, but instead for acquiring and using knowledge and skills.

2.4.3. Results and Outcomes of Self-Managing Teams

The purpose of this section is to review results and outcomes from self-managing teams. Results include how widespread the use of self-managing teams is, benefits associated with self-managing teams, and problems with implementing self-managing teams.

2.4.3.1. How Widespread is the Use of Self-Managing Teams?

Organizations of all types have experienced success in implementing self-managing teams — manufacturing and service, private sector and public sector, large and small organizations, and union and non-union. Some examples of applications in manufacturing organizations are in coal mines (Trist, Susman, & Brown, 1977), pet food manufacturing plant (Walton, 1977), paper mill, steel mill (Dumaine, 1990), chemicals and plastics plant, engine plant, electronics assembly plant, automotive components plant, and a food processing (sausage) plant, to name just a few. The examples represent both union and non-union plants, as well as new design plants and redesign plants.

Some examples of companies experimenting with the self-managing teams in the service sector are a cable TV service company; a mutual life insurance firm (Myers, 1985; Hoerr, Pollock, & Whiteside, 1986); AT&T Transtech, a credit financing company (Hoerr, 1989; Micossi, 1990); AT&T credit corporation (Micossi, 1990); IDS, an American Express subsidiary in mutual funds services (Micossi, 1990); Aid Association for Lutherans, a benefit society (Micossi, 1990); and Aetna Life and Casualty (Dumaine, 1990). There are more applications in manufacturing than service, although the number of cases in the service industry is increasing, and there is evidence that self-managing teams in service organizations will work just as well as in manufacturing organizations (Macy, Norton, Bliese, & Izumi, 1990; Goodman, Devadas, & Hughson, 1988; Lawler, Ledford, & Mohrman, 1989). One reason offered for the fewer number of applications in the service sector is that this sector has not yet experienced the same kind of competitive pressures the manufacturing sector has (Micossi, 1990).

There are also many more applications in the private sector than the public sector, although, again, there is no reason to believe that teams will not work in the public sector. The Defense Logistics Agency has approximately half of its field offices experimenting with self-managing teams. City governments are also beginning to look into self-managing teams.

There have been successful applications in both non-union and union plants. Corning has been using self-managing teams in a small automotive components manufacturing union plant in Blacksburg, Virginia since 1988. However, Corning is a new design plant, which is a much different environment in which to implement self-managing teams than a redesign unionized environment. Provided that union representatives are involved from the very beginning stages of design and implementation and provided management can clearly communicate the benefits for all parties, self-managing teams can be successful in a union plant, in spite of the seemingly insurmountable barriers.

Lawler estimates the number of new design plants in the range of 300-500 plants (Lawler, 1990b). In terms of the use of self-managing teams, Lawler, Mohrman, & Ledford (1992) found that 48% of Fortune 1000 organizations surveyed are experimenting with self-managing teams, where most of the experimentation is being done on a small scale, in a small fraction of the total work force. Additionally, the majority of the companies experimenting with self-managing teams has only been doing so for several years. Another research study found that twenty-eight percent of organizations use self-managing teams (Wellins and others, 1991). In forthcoming research, Macy found that only 7% of North American organizations have in place either autonomous or semi-autonomous work groups. This discrepancy in the prevalence of self-managing teams may be due to a number of factors, for instance, differing definitions of self-managing teams across organizations, a different sample of organizations, and having different types of employees complete the surveys.

2.4.3.2. Benefits from Self-Managing Teams

Many managers are interested in the outcomes of using self-managing teams. One of the main questions is, is it worth the effort? After all, the promise of improved performance is the number one reason organizations are moving toward self-managing teams, so the interest in and research on performance outcomes are understandable. In this section, research findings from individual case studies, reviews of case studies, quasi-experiments, and meta-analyses are discussed. The organization of this section was modeled after Cotton (1993) who provides an extensive review of scholarly research in this area. Many of the specific references from Cotton (1993) also appear in this section.

2.4.3.2.1. Individual Case Studies

The "original study of self-directed work teams and the genesis of sociotechnical systems was an examination of British coal mining teams" (Cotton, 1993, p. 177) by Trist and Bamforth (1951). The authors studied the impact of a modern mine where management had invested in machinery and designed specialist jobs. To their surprise, productivity declined, rather than improved, as compared to the "old-fashioned" mine where workers had determined their own method of job rotation, could see each other working and adjust their own work accordingly. There were no statistical tests performed to test the significance of the difference in productivity between the older mine and the modern mine, but miners in the modern mine appeared less satisfied, less productive, and had higher absenteeism than the self-directed work teams in the older mine (Trist, 1981). The results of this study led to studies conducted by the Tavistock Institute in Great Britain, India, Norway, and the United States. With self-managing teams in a weaving shed in India, increases in productivity were found (Rice, 1953, 1958), however, there were so many other changes associated with the teams, such as increased pay, that it was difficult to isolate the effect of teams (Cotton, 1993).

One of the earliest known experiments with self-managing teams in the United States is the Topeka work system implemented by General Foods (Walton, 1972; 1977; 1982). The dry dog food facility was designed as a new design plant to avoid many of the negative attitudes and problems that were present in an existing General Foods manufacturing facility. The dry plant was started up in 1971 and consisted of self-managing teams of between 7 and 14 members each. Results included:

- It was estimated that annual savings due to work innovations were approximately one million dollars (the capital investment for the plant was 10-15 million dollars) (Walton, 1977).
- Commitment was very high in initial years but declined in later years, due to a surplus of problem-solving capabilities available as compared to the technology requirements; once new products were introduced, commitment began rising again (Goodman, Devadas, & Hughson, 1988).
- There was an increase in productivity in every year except one, product quality was high, and overhead costs were low (Goodman et al., 1988).
- Satisfaction followed a trend similar to commitment — initially high, followed by a decline, then an increase (Goodman et al., 1988).
- Indirect effects that were positive included higher pay and job security than comparable organizations, while negative indirect effects were friction between Topeka managers and corporate managers, resulting in all but one of the Topeka managers leaving (Goodman et al., 1988).

Another case study is the Rushton Quality of Work Experiment (Goodman, 1979) in a coal mine. Results from this field study were:

- Positive job attitudes increased during the first 20 months, after which they gradually decreased toward baseline levels when self-managing teams were extended to the entire mine.
- Safety, specifically accidents, safety violations, and independent ratings of safety improved.
- Job skills increased substantially in all sections using self-managing teams.
- There was a slight positive increase in productivity, about 3-4 percent, which was not statistically significant.
- An analysis of production benefits versus investment costs for self-managing teams indicated benefits slightly exceeded costs.
- Indirect positive effects included improvements in communication and coordination, promotion and recognition of talent among employees, and improved labor-management relations. Indirect negative effects included increased stress levels for first line and middle managers and greater conflict within union.

2.4.3.2.2. Case Study Reviews

In his chapter on self-managing teams, Cotton (1993) reviews individual case studies as well as reviews of multiple case studies. Cotton's review is summarized in this section. In a review of 16 studies all using self-managing teams, Cummings and Molloy (1977) found that nine of ten studies measuring productivity showed increases while one showed a decrease. The magnitude or statistical significance of these differences is not reported, although Cummings and Molloy report that the changes made to implement self-managing teams appeared to "lead to improved performance and human satisfaction" (Cummings & Molloy, 1977, p. 48).

Pasmore, Francis, Haldeman and Shani (1982) reviewed 134 studies of sociotechnical interventions from the 1970s, 71 of which involved self-managing teams. The authors found that teams were "extremely successful" in terms of employee attitudes, safety, and quality. All of the studies that measured these variables found improvements. Of those studies measuring the following outcomes, 89% found productivity improvements, 85% showed decreased costs, 86% found decreased absenteeism, and 81% found decreased turnover (Pasmore et al., 1982). The magnitude of these improvements, however, is not reported.

In an evaluation of the effectiveness of self-managing teams, Goodman, Devadas, and Hughson (1988) reviewed and summarized three field studies: the Topeka plant case study, the Rushton Experiment case study (both of these were already discussed in the previous section), and a quasi-experiment in a confectionery plant (discussed in a later section). Considering these three studies together, Goodman et al. (1988) report four research findings. First, self-managing teams do affect organizational effectiveness outcomes. Second, the effects are greater on the attitude or quality of life indicators than on business outcomes such as productivity. Third, effects on attitudes are not uniform.

Lastly, the rigor of the research design affects the reported results. In other words, more rigorously designed studies showed more modest or no results.

2.4.3.2.3. Quasi-Experiments

A quasi-experiment differs from a correlational study in that cause-and-effect can often be inferred between an intervention and outcomes due to the use of a control, or comparison, group. It differs from a true experiment because subjects are not randomly assigned to groups (Cook & Campbell, 1979; Leedy, 1985). Trist, Susman and Brown (1977) compared coal mining sections in an American coal mine. One section used autonomous work groups while two other sections in the same mine functioned without autonomous work groups. Trist noted that comparisons were difficult because the sections varied in terms of environmental conditions as well as the availability of back up equipment (Cotton, 1993). In addition there was "contamination" of the experiment, as the control sections learned about the autonomous section and felt resentment and competition. For example, one foreman in the non-autonomous section considered the autonomous experimental section as "throwing down the gauntlet, saying 'I'll be damned if I'll let (autonomous A) best us!'" (Trist et al., 1977, p. 223). Nonetheless, it was found that:

- Safety violations decreased in the autonomous section
- Accidents decreased as compared to control sections
- Absenteeism for the autonomous section was lower than one of the control sections (although it was extremely low for all three sections as compared to the industry average of 12.8% as reported by Trist).
- There were no clear differences in productivity — all that could be concluded from the data was that productivity did not worsen as a result of the experimental section. Trist notes, however, that it is a currently accepted belief in the coal industry that one of these goals — production or safety — must be sacrificed for the other.

- A downward trend in costs was found within the autonomous section as compared to the control sections (Cotton, 1993), and overall, the financial benefits slightly exceeded costs (Goodman, 1982).
- There were differences in attitudes across the sections; men in the autonomous section perceived themselves as making more decisions concerning the work, they recognized the interdependence they had with the other men and believed their coworkers had many good ideas to contribute to improved performance, and they viewed their supervisors as making fewer decisions affecting work (Trist et al., 1977).

Wall, Kemp, Jackson, and Clegg (1986) studied the use of autonomous work groups in a confectionery plant in Britain. The authors compared autonomous work groups in a new design facility to employees in a similar, traditionally-managed facility, making similar products for the same company (Cotton, 1993). Results from this study as reported in Wall, Kemp, Jackson, and Clegg (1986) were:

- Self-managing team members reported higher levels of work complexity and involvement, in addition to higher levels of consideration and tolerance for freedom.
- Self-managing team members expressed greater levels of intrinsic satisfaction, and extrinsic satisfaction increased for the short term rather than long term. There were no clear effects for intrinsic job motivation, organizational commitment, or mental health.
- The researchers were not able to systematically compare productivity measures across self-managing teams and conventional groups, however, qualitative data indicated no differences.
- There was higher turnover in self-managing teams.
- Positive indirect effects included employees preferring self-managing teams to conventional work and preferred their new working conditions. A negative indirect effect was that managers experienced more stress. Also, cost savings were achieved through the elimination of supervisory positions (Cotton, 1993).

In a longitudinal field study spanning four years, Griffin (1991) investigated the long-term effects of work redesign on a number of perceptual, attitudinal, and behavioral variables. The experimental group included 526 bank tellers across various banks whose jobs were enriched, enhancing responsibility, authority, and accountability. Tellers had a wider range of activities than previously, had more autonomy over routine decisions, and received feedback from customers. Although tellers did not work closely as teams and this experiment did not represent autonomous work groups but work redesign, the changes made in tellers' jobs closely paralleled changes made in the jobs of teams. Griffin used the following measures to assess the impact of work redesign: task perceptions, job satisfaction, organizational commitment, performance, absenteeism, and propensity to quit (turnover). To measure performance, Griffin used supervisory evaluations on a three-item scale: performance quality, performance quantity, and overall performance. No objective measures were used to assess performance. Two key research findings were that attitudes (satisfaction and commitment) increased quickly but then diminished back to initial levels. Also, performance did not increase initially, but did increase significantly by the end of the study period (48 months). This is a very important point regarding work redesign that is commonly part of implementing self-managing teams. This research finding may explain the lack of positive business results associated with self-managing teams: the changes associated with self-managing teams (e.g., cross-training, pay-for-skills compensation system, use of performance feedback) often require years to implement, and therefore results may not be seen for a number of years. Many studies may not collect data over a long enough time period to reflect the potential results.

Because productivity or performance measures were not included as a measurement in other quasi-experiments, they are not discussed in detail, however, they are mentioned briefly here. In comparing four plants with self-managing teams to sixteen plants without teams, Denison (1982) found higher levels of satisfaction and perceptions of greater control on the part of both employees and supervisors in the self-managing team plants. Ondrack and Evans (1987) studied differences in new design plants, redesign plants using self-managing teams, and traditionally-managed plants in the petrochemical industry in

Canada. They found no overall differences in job characteristics, as measured by the Job Diagnostics Survey developed by Hackman and Oldham (1980), however, there were differences on some job characteristics. Also, there were no overall differences in job satisfaction between the plants, which is surprising considering other research studies, however, employees at the new design plants scored higher on some measures of job satisfaction. Lastly, Cordery, Mueller, and Smith (1991) compared two mineral processing plants in Australia, focusing on the impact of autonomous work groups on employee attitudes and behavior. The authors found that employees in autonomous work groups differed significantly on intrinsic job characteristics, job satisfaction, intrinsic satisfaction, and organizational commitment, but not on trust in management. Additionally, it was found that employees in autonomous work groups experienced higher absenteeism and higher turnover. The authors state that this study could not address the issue of productivity within groups directly because of technology differences between the two plants. Nevertheless, the new design plant using autonomous work groups exceeded its overall production target in its first two years of operation and reduced labor costs through a reduction in managerial and support personnel.

Cotton summarizes research findings from a review of individual case studies, case study reviews, and quasi-experiments. Table 2.6 duplicates Cotton's summary. (Note: not all the studies included in Cotton's review in Table 2.6 are included in the references, however, each of those mentioned in this chapter *are* included in the references). In the table, Cotton summarizes whether productivity, satisfaction, and absenteeism increased, decreased, or stayed the same. Cotton states that overall self-managing teams "appear to have been successful" (Cotton, 1993, p. 188) and that "from a total of 156 findings, only 6 were negative (in terms of becoming worse), and only 17 were null findings" (p. 188).

Table 2.6. Summary of Studies Examining Self-Directed Work Teams.
(taken from Cotton, 1993)

Type of Study	Of those studying: Productivity	Of those studying: Satisfaction	Of those studying: Absenteeism
Case studies (6 studies)	3 improved 1 no effect	2 improved	2 improved
Case study reviews (114 studies)			
Cummings & Molloy (1977)	9 improved 1 worsened	5 improved 1 worsened 2 mixed	no data
Pasmore, Francis, Haldeman, & Shani (1982)	40 improved 5 worsened or no change	36 improved	18 improved 3 no change
Beekun (1989)	3 improved 1 worsened	1 improved	5 improved 3 no change
Pearce & Ravlin (1987)	1 no change	2 improved	no data
Quasi-experimental studies (8 studies)	2 improved 3 no effect	6 improved 1 no effect	1 improved 1 no change
Totals	57 improved 7 no change* 5 worsened*	50 improved 3 mixed or no change 1 worsened	26 improved 7 no change

Note: * It is not clear whether non-improvement meant a negative effect or no effect, so three of the five were designated as worsened and two of the five as no effect.
The productivity category includes only studies that directly measured productivity. It does not incorporate studies that measured cost, waste, quality, or other variables that could indirectly influence productivity.

Cotton does mention the problem of studies being published that only reflect positive results, which would create a bias in the reported research findings. From the table, Cotton concludes that the pattern of results varies across the type of study. The case study reviews portray the most positive results in terms of productivity, with less favorable results occurring with the "well-delineated case studies and the better controlled quasi-experimental studies" (p. 188). However, findings across the types of studies were consistently positive for satisfaction.

There are two problems with Cotton's summary table and potentially with his conclusions. His summary does not indicate which improvements in productivity, satisfaction, or absenteeism, were statistically significant. This point does not necessarily mean that the research studies included are not valid, because qualitative case study research is useful, but the reader cannot ascertain which are qualitative data or quantitative data. Also, with Cotton's summary, the reader does not know the relative magnitude of the improvements. For example, all the increases could be significantly large, and the decreases very small, or vice versa.

2.4.3.2.4. Meta-Analyses

This section reviews meta-analyses that have been conducted using statistical techniques to aggregate and analyze data across numerous studies. As part of a review of the effectiveness of self-managing teams, Goodman, Devadas, and Hughson (1988) discuss several meta-analyses conducted on self-managing teams, other forms of participation, and work innovations. The first was conducted by Macy (1986) on 56 innovation projects between 1970 and 1981. This meta-analysis is actually an earlier version of the Macy et. al. (1991) meta-analysis reviewed later in this section. As reported by Goodman, Macy found that self-managing teams have a positive impact on productivity, and this effect is generally larger than for other types of interventions. Also, self-managing teams exhibit a negative association with general satisfaction and job satisfaction, a contrary finding as compared to other research. Guzzo, Jette, and Katzell (1985) studied eleven intervention strategies focused at improving productivity, and the basic research finding was that large-scale sociotechnical systems interventions have a greater-than-average impact on productivity and little impact on withdrawal criteria. Although a large-scale sociotechnical systems intervention is not exactly the same as self-managing teams, the implementation of self-managing teams is based on sociotechnical systems theory. Roitman and Gottschalk (1984) studied effects of sociotechnical design, job enrichment, and quality circles on productivity and QWL indicators. However, the small number of studies in their analysis precluded examining separate effects of these three types of interventions.

Goodman summarizes lessons learned from these meta-analyses in three points. First, there are not many studies of sufficient quality to provide a robust answer to the question of the effect of self-managing teams on organizational outcomes. Second, in the available studies, the focus tends to be more on attitude change than on business outcomes such as productivity, cost, and so on. Third, the more rigorous the research design, the harder it is to identify clear, significant results — a conclusion others have reached.

Considering both individual field studies reviewed and the meta-analyses, Goodman et al. (1988) propose the following lessons learned:

- Meta-analyses indicate productivity increases and that self-managing teams have a stronger impact on productivity than other interventions. However, the real magnitude of productivity effects is much harder to assess. Best judgment is that self-managing teams have a modest impact on productivity.
- Self-managing teams do change attitudes, but the change is specific to the intervention.
- There are no clear trends in the effects of self-managing teams on absenteeism or turnover; there are mixed results here.

- The data indicate self-managing teams improve safety.
- There is very little investigation into the area of whether benefits from self-managing teams exceed investment costs.

In a meta-analysis of sociotechnical interventions in 17 studies during the 1970s, Beekun (1989) divided the studies into three groups: those using autonomous work groups, semi-autonomous work groups, and non-autonomous teams. Beekun found that studies using autonomous work groups rather than semi-autonomous work groups or non-autonomous teams demonstrated larger increases in productivity.

Probably the most comprehensive and rigorous meta-analysis conducted on work innovations in general is by Macy, Bliese, and Norton (1991), performed at the Texas Center for Productivity and Quality of Work Life. In this study, Macy et. al. review past meta-analyses and uncover their weaknesses, such as qualitative studies using reports of a change program's success or failures according to perceptions with very little or no quantitative data; and lack of standardized statistical comparison within or across organizations in the quantitative meta-analyses. Another weakness of past analyses is the method for compiling results across organizations. In sum, Macy et. al. argue that the seemingly overwhelmingly positive evidence from previously published meta-analyses should be treated with caution.

The researchers began with approximately 1800 studies on work innovations in North American from 1961-1990 and progressively narrowed this number down to 131, based on whether the study used empirical, quantitative data, as well as longitudinal or post-intervention contrast data. Furthermore, only empirical field studies were used, and only if: the unit under study was a naturalistic work setting; the number of employees affected by the change intervention was greater than fifteen; effect size information was reported; data was provided for either a pre-test and post-test *or* a post-test contrast was provided between an experimental and control group; and lastly, if the field research study was published and generally available to other researchers. Of the 131 studies used, 88.5% came from refereed journals, the most frequent being the Journal of Applied Psychology, the Academy of Management Journal, and the Journal of Applied Behavioral Sciences.

Thirty-one types of interventions, or action levers, were studied, which fell into three categories: structural (changes occurring in the organization's power and authority, i.e., structure, systems), human resource (changes made within the existing structure, but which change the way people are viewed, the way people view their jobs, or the way people do their job), and technology (changes in the mechanical/electronic and process technology of the organization). In this study, autonomous work groups and semi-autonomous work groups were classified as a structural action lever.

The 31 action levers represented independent variables in this research, falling into the three categories of structural, human resource, and technological. There were four categories of moderator/intervening variables: contextual, organizational, improvement program, and general attitude. The three types of dependent variables were financial outcomes, behavioral outcomes (e.g., turnover, absenteeism), and attitudinal outcomes (e.g., satisfaction, motivation).

Overall research findings were that change programs in general were effective in producing positive results on financial outcomes, strong positive results on behavioral outcomes, and less positive results on attitudinal outcomes. Another research finding was that there appears to be a weak positive correlation between the number of action levers used in a given study and the mean effect size (the impact on financial, behavioral, and/or attitudinal outcomes). The inference to be made from this finding, which the researchers point out, is that change programs such as autonomous work groups and semi-autonomous work groups, which are often implemented in conjunction with human resource action levers such as job enrichment, job rotation, and multi-skilling (cross-training), tend to have higher mean effect sizes. This indicates that to achieve significant positive results, the implementation of self-managing teams must be accompanied by changes in a number of other action levers listed by Macy.

In an earlier presentation of this same research study, Macy reported that autonomous work groups (as opposed to semi-autonomous work groups[2]) were the most effective action lever studied and often results in improvements of 40-70% in a number of measures, including productivity (Macy, Norton, Bliese, & Izumi, 1990).

2.4.3.2.5. Summary of Research on Outcomes of Self-Managing Teams

There are dozens of other individual field studies and other meta-analyses that could be reviewed to try to further explore the issue of whether self-managing teams improve performance. Rather than providing a review of further studies or meta-analyses, those presented were ones which produced typical or interesting results and meta-analyses which are more recent and of higher quality. The Macy et al. (1991) meta-analysis in particular, seems to be the best and most comprehensive review to date of work innovations. The researcher places more confidence in these results than in any other review. To summarize, Macy et al. (1991) found that self-managing teams (both semi-autonomous and autonomous work groups) are often implemented with a number of other human resource action levers, which tends to produce higher mean effect sizes. At the 1990 International Conference on Self-Managed Work Team, where Macy (1990) presented initial research findings from this meta-analysis, he stated that, in fact, one of the distinguishing features of self-managing teams was that they are an intervention consisting of changes to numerous action levers, leading to more significant

[2] Macy, Norton, Bliese, & Izumi (1990) divide self-managing teams into semi-autonomous work groups and autonomous work groups, where semi-autonomous work groups represent further evolution from traditional work groups toward autonomous work groups. Macy states it takes approximately three to five years for a group to evolve to a semi-autonomous work group, and another three to five years to become an autonomous work group.

improvements than other interventions. The assumption in this statement is that the implementation of self-managing teams is always accompanied by these other changes. However, this is not the case; many organizations claim that they are using self-managing teams even though they may have only organized people into teams.

Although much of the research regarding improvements in productivity due to self-managing teams is equivocal and seems to depend on the rigor of the research design, results from Macy's recent meta-analysis are promising in that semi-autonomous and autonomous work groups were found to be the intervention having higher mean effect sizes (higher improvements) in business outcomes. The magnitude of the improvement may be difficult to predict.

2.4.3.3. Problems with Self-Managing Teams

With any opportunity for improvement, there are also potential problems, and self-managing teams are no exception. However, it is a matter of which problems an organization chooses to deal with — problems associated with the old paradigm of organizing work or problems associated with the new paradigm. Common problems experienced are briefly described below, with potential solutions. These problems were identified in previous research (Van Aken, 1991):

- Resistance of first-line supervisors - Supervisors may be reluctant to share, or give up, power. They may feel threatened because they may not know what their role will be in the future, or if they will even have a job. Potential solution: Involve supervisors from the very beginning in the change process and clearly define their needed role as coach and facilitator. Utilize supervisors to work on technical projects needing time and attention.
- People needing individual recognition and praise may not like the team environment and may begin to lose individual identity. Potential solution: Periodically give individual recognition when appropriate and encourage team members to give each other praise and recognition.

- Difficulty in getting everyone trained on all the technical skills and other skills. Training is a long-term investment, which many organizations find too easy to cut back on and it falls by the wayside (Hoerr, 1989). Potential solution: Develop and faithfully execute a training plan for all team members.
- Topping out on the pay-for-skills system. Potential solution: Add elements to the system which encourage and reward depth as well as breadth of knowledge.
- The difficulty in getting people to put to use their training and make decisions without someone else's approval. Potential solution: One-on-one encouragement and counseling to get people to make decisions.
- There can sometimes be higher than expected levels of absenteeism and turnover, due to the increased pressures and stress on employees to learn and perform. Potential solution: Continue to provide employees with necessary information, knowledge, and skills so they feel confident in performing the job. Continue to involve them in how the teams evolve to reduce uncertainty and ambiguity.
- In the short-term, the quality of decisions may suffer. Potential solution: Managers and supervisors need to be aware of this potential problem and not revert to autocratic styles when it begins to happen. Continue to provide teams with information and skills to enhance problem-solving and decision-making activities.
- In the short term, performance measures such as output, productivity, and quality may suffer. Potential solution: Anticipate this potential problem, and provide encouragement and support to teams so they do not feel anxiety or guilt over this predictable outcome.

These problems can be avoided, or the effects of the problems mitigated, if the design, or plan for implementation of teams, considers these potential problems and includes ways to deal with them. Anticipating these problems can lead to a smoother transition process, as opposed to being caught by surprise and having these problems become crises.

2.4.4. Summary and Future Trends

One researcher has expressed a concern that the use of self-managing teams is losing momentum. Because they don't want to risk failure, many managers may avoid implementing self-managing teams (Hoerr, Pollock & Whiteside, 1986). Others, however, believe, as does the CEO of ITT, Jerry Jenkins, that "no matter what your business, these teams are the wave of the future" (Dumaine, 1990). Union leaders in the Corning Blacksburg plant believe this team concept is a way to preserve jobs for the future (Howes, 1989).

Goodman, Devadas, and Hughson (1988) predict a slow but sure growth of their use. They predict *slow* growth because of the complexity and sophistication of self-managing teams as an involvement initiative. They predict *growth* for several reasons. First, self-managing teams are congruent with the cultural trend of participation and democracy in the workplace. Secondly, organizations experimenting with less sophisticated involvement initiatives will gradually move on to more complex ones such as self-managing teams. A third reason is new technology. The spread of computer-integrated manufacturing is changing the nature of work toward more integration, more flexibility and faster reaction time — all consistent with the use of self-managing teams.

With the increase in use of self-managing teams, Goodman et al. predict several changes in their form. Currently, most applications of self-managing teams are in manufacturing organizations, however, their use in non-manufacturing, knowledge work settings is expected to increase (Lawler, 1992). Additionally, satellite organizations which represent linked autonomous units, appear to be conducive to the use of self-managing teams. Telecommuting may have an influence on the form of self-managing teams. Typically, teams are face-to-face groups, however, telecommuting allows employees to work outside traditional boundaries. Goodman et al. predict that as telecommuting increases, self-managing teams linked by computer networks may develop.

Goodman et al. (1988) conclude by observing that "self-managing teams are in place in the United States and other industrialized countries [and] there are strong forces - from cultural values about participation, the evolution of new forms of involvement, and changes in new technology - that will support the growth and redesign of self-managing teams" (p. 325). Self-managing teams are said to be one of the most important work innovations to come along in the past two hundred years (Harper & Harper, 1988). Whether or not this is true, there is no doubt that they are beginning to represent a preferred way of managing work.

2.5. Summary of Body of Knowledge Reviews

This chapter has provided reviews of the literature, and the larger body of knowledge, that are related to this research topic: team effectiveness for cross-functional design teams. First, the key models of group effectiveness were reviewed. Although there is a great deal of research on what leads to group or team effectiveness, there are at least two researchers who specify the need to understand what leads to effectiveness for unique kinds of teams (Goodman, 1986; Mohrman, 1993). Additionally, there is apparently no research that has focused specifically on cross-functional organizational design teams.

The second knowledge area that was reviewed is organizational redesign. Organizational redesign is the primary task or mission of the teams in this research sample. Several redesign processes were reviewed, as well as the concept of key organizational subsystems that must be aligned in organizational redesign.

The third knowledge area which was reviewed was the larger phenomenon of employee involvement and teams. This area was placed later in this chapter because it provided context for this research topic, however, it was not of central focus. The same is true of the fourth knowledge area, self-managing teams. A review of the extensive, and growing, literature on self-managing teams was provided because this configuration of work design is very common outcome of organizational redesign, particularly when the sociotechnical systems approach to work redesign is used.

Chapters 1 and 2 have laid the foundation for this research by specifying the scope and purpose of the research and reviewing the body of knowledge and literature related to cross-functional design teams and organizational redesign.

Chapter 3 Research Methodology

The research scope, described earlier, outlined *what* this research will accomplish, while the research methodology outlines *how* it was accomplished. This dissertation can be described as a correlational research design which blends qualitative and quantitative data analysis. This dissertation falls within the realm of applied research (as compared to basic research or action research, as defined by the National Science Board, 1982 and Patton, 1990). Applied research contributes knowledge and understanding of a phenomenon so that a specific and recognized need may be met, and the purpose of applied research is to understand the nature and sources of problems important to society. Based on the practitioner literature and practitioner input, there is a clear need to understand what leads to effectiveness for cross-functional design teams. These results will provide an important contribution to the scholarly group effectiveness literature and to practitioners involved in installing and managing design teams.

The purpose of the quantitative component of this research is to identify which design features have the most important relationship with design team effectiveness. The purpose of the qualitative component of this research is to supplement the quantitative learnings by collecting rich data describing team members' experiences and lessons learned in their own words. Other organizations can use these qualitative learnings to benchmark and serve as a point of comparison. This study included three research sites. Across two of the sites, fifteen cross-functional design teams were studied using survey questionnaires and interviews, while the third site involved field research to identify key learnings from the overall organizational strategy on design teams.

This chapter describes the research sites and teams in the research sample, operational measures and data collection, and data analysis methods.

3.1. Description of Research Sites and Teams Studied

As mentioned, this research was conducted at three research sites. Fifteen teams were studied across two of the sites, while at the third site, the focus was on identifying key learnings at an organizational level related to design teams. This section describes the three research sites, as well as the teams included in the research sample.

Individual teams are briefly described later in this section, however, a general description of the design task of these teams is provided here. Although differing frameworks for redesign were used by teams, the commonality between teams studied was the organizational redesign of a work system which can viewed as a sociotechnical system. The sociotechnical systems perspective (see Pasmore, 1988) suggests that any work system can be viewed as having both a technical system (defined by the tasks and objectives within the work system and the technologies used to convert inputs to outputs) and the social system (including the people in the system, their attitudes, beliefs, behaviors, etc.). In redesigning the target system, design teams had to address both the technical and the social system, which encompassed multiple organizational sub-systems: the technology, the reward system, the information and communication system, the education and training system, and so on. For example, the design tasks of teams included the redesign of information technology, financial performance measurement, distribution pipeline of grocery product, computer information systems, warehouse layout, and property/store acquisition and location process.

3.1.1. National Grocers

The first research site was National Grocers, the Eastern Canada Division of Loblaw Companies Limited, with annual sales in excess of $5 billion Cdn. Employing over 30,000 people, National Grocers operates twelve warehouses in five provinces, supplying over 200 corporate store locations, approximately 600 franchised outlets, and thousands of independent retail outlets throughout Eastern Canada. The corporation is divided into a Retail side (corporate-owned and franchised stores) and Wholesale Services (which includes Distribution, Finance, Information Services, Corporate Development, and Property Management). Although National Grocers is a very successful enterprise, particularly in the last five years, throughout the early 1990s, the company has faced potentially severe competition from Wal-Mart which has penetrated the Canadian market.

National Grocers embarked on a large-scale organizational transformation, which began in 1992 with a pilot effort in one distribution centre, and was launched throughout the rest of the organization in 1993. More effort has been concentrated in the Wholesale Services side of the organization, largely due to an executive vice president who has sponsored this change effort. However, several initiatives were started in the Retail side of the organization, one at a "banner" level (a banner refers to a series of stores all with the same name) and one within a specific store.

To support its organizational transformation effort, National Grocers instituted a number of design teams as the vehicle for organizational change. Although various terms are used for teams across the organization, all of these teams were accountable for planning organizational redesign within a target system (whether a store, a distribution centre, or a division). Nine National Grocers design teams were selected for study in this dissertation. In addition to these nine teams, there were four other National Grocers design teams considered for inclusion in this research. Two teams were not approached to participate because they were considered to be too "young" (less than three months old in each case with only several team interactions). Another team was approached but was found upon closer examination to be more of an information-sharing group of project managers for an organization-wide supply chain reengineering effort. All of the design work was being done at the project team level. A fourth team that represented the "architect and engineering" design team for the entire corporation was considered but was not approached because of the timing and business issues the team faced at that point in time. All the remaining nine National Grocers teams that were approached to participate in this effort agreed. The research was sponsored by the executive vice president mentioned earlier, and team members who served as the point of contact were aware of the vice president's support prior to being contacted.

The two variations of the nine National Grocers design teams included in the research sample were "design and development teams" (DDTs) and "leadership teams," which were primarily used in distribution centres[1]. Out of the nine teams studied, eight were active teams at the time of data collection and one had been disbanded for approximately five months. This last team was included because it was believed an important experience to capture[2]. The National Grocers teams are described below.

- Finance Senior Management Team: This team was the top management/leadership team for the Finance Division. The sociotechnical redesign task for this team involved how to redesign the core Division processes of collecting, analyzing, and portraying data to internal customers about financial performance of the company to support decision-making. The team had, within the last six months, absorbed ownership and responsibility for driving and integrating change initiatives within the Finance Division, and devoted one meeting a month to redesign initiatives for the Finance Division.
- Information Services Division (ISD) DDT - This team had ownership for change/redesign in the Information Services Division. The team's redesign task involved reengineering the information technology to support internal customers. This team was the second formulation of the team (the first team was disbanded because the composition of the team was found to be lacking in sufficient leadership/management perspective). The ISD DDT was on hiatus at the time of data

[1] The terms warehouse and branch are used as synonyms for distribution centre.

[2] Although teams are described in the past tense, many of them are still active at the time of this writing.

collection and was disbanded by the vice-president of ISD shortly after data collection because it had fulfilled its purpose.

- IPCF DDT - This is the design and development team for the Property Management Division within NG. The redesign task involved redesigning the core Division processes of acquiring and managing properties (stores) within the company, including store location. This team emerged from a larger group of "front owners" (individuals having ownership and accountability for monitoring change within fronts, or organizational sub-systems, of IPCF). The team was active at the time of data collection.
- Distribution System of the Future (DSOTF) DDT - The target system for redesign which this team focused on was the entire Distribution System, which encompassed all the distribution centres. The task of this team was how to redesign the entire distribution system which spanned the acquisition of grocery product from suppliers, like Procter & Gamble, to distribution of product to store shelves. Reengineering the distribution supply chain had been targeted as a company-wide initiative. At the time of data collection, this team had been disbanded for approximately five months and was reformed twice after the initial team was disbanded. After the initial team was disbanded, a second team was formed to include more representation from higher-level managers. The second team met only twice, after which the team's convener (similar to a team leader role) decided, with an external facilitator, that the composition was still not appropriate. A third team was formed (the Distribution Senior Leadership Team). This team was one considered for the research sample, but had only met twice at the time of data collection and was considered to be too young as a team.
- Slow Moving Warehouse Steering Team - This team was responsible for the design and start-up of a new distribution centre (called the slow-moving warehouse), which was instrumental to the supply chain reengineering effort within the Distribution System. This warehouse was built to centralize all product characterized as "slow-moving" for more a cost-effective distribution pipeline of this type of product to stores. The team consisted of team leaders of more focused project teams which performed more detailed design work for the warehouse, and this steering team was responsible for integrating and coordinating the design, construction, and start-up of the warehouse. The team was active at the time of data collection. The transition

plan for this team was to hand off ownership for warehouse coordination and management to an on-site leadership team once the warehouse reached full capacity.

- Peterborough Leadership Team (PLT) - This team was the leadership team for the Peterborough warehouse (distribution centre). The redesign task for this team involved redesigning core warehouse processes such as loading and assembly of customer orders, warehouse layout, education and training of employees, and work standards and measurement to name a few examples. This team was one of the "oldest" teams in the research sample, having been part of the pilot effort in National Grocers. The team was formed when ownership for redesign at the warehouse was transferred from a design and development team. At the time of data collection, the PLT had been reformed (downsized significantly) and so had been inactive as the large team for almost two months prior to data collection. The PLT (the larger, former team that was surveyed for this research) was a cross-functional and multi-level team with ownership for driving change and redesign in the warehouse. Over the two-and-half year life of the team, there was significant turnover in team membership.
- Surveyor Road Leadership Team - This team was similar in composition and in mission as compared to the PLT. This team was also a cross-functional and multi-level team focused on redesigning core processes for the Surveyor Road Distribution Centre. Team membership included representation from management (the Distribution Manager), supervision, and employees from various functional areas and work shifts. At the time of data collection, the SRLT was an active team.
- Ottawa Leadership Team - This team was similar in composition and mission to the previous two teams. It was also a cross-functional, multi-level team having ownership for redesign of core processes in the distribution centre. One difference between the OLT and the other distribution centre leadership teams was that the OLT used a different methodology for change (called "IMPROVE"), a structured framework to identify and redesign core work processes in the distribution centre. Immediately after data collection, the OLT as a full team went on hiatus due to labor negotiations. Team members who were not union employees continued to perform some work as a team.
- City Farms Leadership Team - This team was analogous to the distribution centre leadership teams and had a similar mission and composition, however, the target system was a store (City Farms Store). The CFLT used the IMPROVE method to

drive change and redesign in the store, and had targeted specific work processes for redesign, including the pricing process (to price products in the store) and the stocking process (to stock store shelves). At the time of data collection, the team was active. Immediately after data collection, the team had significant turnover.

The teams described above, while somewhat different, have common characteristics such that they were included in this research. First, all teams had organizational redesign of an entire target system as their essential mission. Some of the teams were outside the formal organizational structure (such as the DDTs) and were part of the parallel structure (as described by Stein and Kanter, 1980). Other teams were permanent teams (e.g., the leadership teams in the distribution centres), while one also had responsibilities to manage the business in addition to redesign (i.e., the Finance SMT). Second, the composition of all but one of these teams (the Finance SMT) represented a "diagonal slice" of the target system[3].

3.1.2. Virginia Tech

The second research site was Virginia Polytechnic Institute and State University (Virginia Tech). In the early 1990s, Virginia Tech embarked on a university-wide effort called Project Enable to redesign core administrative processes falling within the following "core systems": human resources, student systems, alumni systems, and financial systems. Project Enable began as a fast-track implementation effort to install a new human resource information system, called the Banner system, which had been procured. Because of the configuration of the system, many of Virginia Tech's administrative processes needed to be redesigned. In 1994, in order to be more proactive

[3] Although the Finance SMT did not have as much representation from lower-level employees as other design teams in the research sample, it was a cross-functional team in that all key functional areas within Finance were represented on the team.

in process redesign (vs. reactive to align with the Banner system constraints), Project Enable achieved much more of a business process redesign focus versus a fast track implementation focus for the Banner system.

The infrastructure supporting the project included high level cross-functional teams for each core system (HR, student, financial, alumni), and within these core systems were focused design teams to redesign specific administrative processes. Because Project Enable had only relatively recently gained a business process redesign focus at the time of this research, there were a limited number of design teams available for study. Six teams were selected for inclusion in this research. Four teams were focused process redesign teams, one was a higher-level design and steering team, and one was a resource and support team to all of the teams in Project Enable. Additional teams were considered but were not included because either the team was too young or the full team was on a hiatus. The Virginia Tech teams are described below.

- Staff Support Team - This team was an internal support and resource team, dedicated full-time to Project Enable to establish processes and systems to support other redesign teams in the Project. For this team, the target system was Project Enable itself and customers of the team's work were members of other teams and the larger university system. The team was responsible for creating processes to communicate goals, activities, and results to customers. The team provided technical training to university employees on the new Banner system, created a home page on the World Wide Web for users to keep informed of results and progress, and created a university newsletter to share information about Project Enable.
- Direct Entry Team - This team was the first design team chartered as part of Project Enable. The team's task was to design a new concept, or process, to directly enter transactions into the university system. This team's work was used in subsequent Project Enable design teams. As part of its redesign task, this team, for example, addressed technology design issues (e.g., computer screens for data entry) and a risk assessment of the direct entry process. This team had been disbanded for approximately one month at the time of data collection.

- Time Entry/Leave Team - This team's mission was to redesign the wage time entry and leave process. As with the Direct Entry Team, the TELT addressed how to redesign technology supporting the wage time entry process (computer screens) and the social system (training of university employees who worked within the wage time entry process). The team was active at the time of data collection, but soon after, the team leader divided the members into sub-groups to work on smaller design pieces, to be integrated in the full team at a later time.
- Business Process Redesign Planning Team - This team served as a steering and support team which performed initial data collection and design work to target and scope out human resource processes within the university requiring redesign. This team was active at the time of data collection, but soon after completed its initial charter and had entered a phase of coordination of all design teams focused on human resource processes. In this new phase, the team would charter other teams and provide ongoing resources and support.
- Resource Allocation Team - This team was chartered to redesign the position and salary budgeting process. As with the previous Project Enable teams, this team's redesign task encompassed redesign of technology as well as the social component of the process. At the time of data collection, the team had been disbanded for approximately one month, but the team leader was considering reconvening the team, or some members, to do further design and begin pilot testing for implementation.
- Direct Lending Team - This was the only team in the research sample that was redesigning a process outside of the human resource core system. The team, as part of student systems, was charged with designing a new process, called the direct lending process, and redesigning aspects of related Financial Aid and Student Account processes. The team's redesign task included hardware (new computer), software (from the U.S. Department of Education for direct lending), as well as training of employees who would work in the direct lending process. The team was active at the time of data collection.

Of the six teams described above, four of them were still active at the time of this writing, and two were disbanded because they had fulfilled their team mission. Although the mission of some teams differed in that the team also had coordinating and support responsibilities, all teams were responsible for design/redesign for a target process as part of Project Enable.

3.1.3. Eastman Chemical Company

A third research site was Eastman Chemical Company (Eastman), formerly a subsidiary of Eastman Kodak. Eastman, headquartered in Kingsport, Tennessee, has additional manufacturing facilities in Longview, Texas; Batesville, Arkansas; Columbia, South Carolina; Toronto, Ontario; Workington, England; and Rochester, New York. Eastman products do not go directly to the consumer but instead are used by manufacturers who produce end-use items.

In support of overall quality management efforts, Eastman has implemented work redesign in many of its manufacturing and support (knowledge work) divisions and departments. Some work systems have adopted an evolutionary approach to change, while others have chosen a more revolutionary approach using the sociotechnical systems approach to transition to a high performance work system using self-managing teams. The label used by Eastman for this different design is the New Work System (NWS). Efforts to implement the NWS began in late 1987, with investigating and exploring concepts in how to evolve Eastman's current natural unit teams to more empowered teams. Work redesign and empowerment at Eastman evolved over the years and were integrated with quality management efforts, the umbrella for all improvement efforts.

Individual teams from Eastman were not included for study in this research. Instead, the focus was to capture key learnings accumulated by people in Eastman throughout the eight-year journey of work redesign. The change structure for work redesign at Eastman included three types of design-oriented teams. In departments targeted for transition to the NWS, a cross-functional, multiple-level *design team* is formed to develop and implement a new design for the department as a target system. After the design is implemented and functioning for some period of time, a *renewal team* is formed to evaluate the design and make any necessary adjustments. Renewal teams are similar in composition to design teams, but with proportionately more members from the target system (i.e., technicians) than design teams. Eastman has begun to experiment with *work system effectiveness teams* (WSET) also called business effectiveness teams in some departments, which replace the need for renewal teams. As a permanent team, a WSET "owns" the process of monitoring the design to ensure it meets the needs of the work system and making any necessary adjustments over time. Unlike renewal teams, which are temporary and therefore disbanded once a design has been evaluated, membership of the WSET is permanent and is rotated so that all members of the work system eventually have an opportunity to participate on the team.

One way to consider the three research sites is that National Grocers and Virginia Tech represented organizations in fairly early development of design team use and redesign, while Eastman represented the next evolution.

3.2. Data Collection and Operational Measures

This section describes how data were collected for this research and how variables (design features)[4] identified in the operational research model from Chapter 1 (repeated in Figure 3.1) were operationalized. First, the pilot study to test data collection instruments is described. Second, the data collection methods used in this research are described. And lastly, this section includes a discussion of the psychometric properties of the survey instruments. Data collection instruments described in this section are shown in Appendix B.

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[4] Throughout the remainder of this chapter, design features from the operational research model are referred to as variables, or more specifically, as independent variables.

3.2.1. Data Collection Instruments Used in this Research

Quantitative data were collected from design teams using two survey questionnaires. The Campbell-Hallam Team Development Survey (TDS), a commercial instrument, was chosen because it measures many of the variables of interest in the operational research model. Additionally, psychometric properties of the dimensions, or scales, in the TDS are described in the technical manual (Hallam & Campbell, 1994). Another reason for selecting the TDS was because the purchase of the TDS included a summary report for each team member completing the survey which summarized individuals' responses to the TDS as compared to the entire team. National Computer Assessments, the vendor for the TDS, also provides a facilitator's guide for team feedback sessions to review the results. Although these team feedback sessions were not part of the dissertation research and were voluntary for participating teams, they were viewed as a beneficial outcome for teams and were used as a "selling point" when initially approaching team leaders.

A second survey questionnaire, called the Design and Leadership Team Survey (DLTS), was developed by the researcher to measure variables not included in the TDS or in any other instrument reviewed. Dillman (1978) was used as a resource in designing the DLTS. The questions pertaining to team performance dimensions in the DLTS (questions 57-64) were also used to survey at least one stakeholder of a team on their external viewpoint of the team's performance.

The DLTS was also used to collect qualitative data from design teams using open-ended questions (e.g., "what results has your team accomplished so far?"). Qualitative data were also collected using interview guides and a focus group guide, shown in Appendix B. The interview guide was used to interview one team member from each of the fifteen design teams. A second interview guide was used to interview team leaders and internal team consultants at Eastman. A different interview guide was developed for interviewees at Eastman because questions to National Grocers and Virginia Tech teams were focused on their experience with one team, while interviewees at Eastman were asked about their experiences and learnings from the many teams each individual had experience with. A third interview guide was used to interview an individual who can best be described as a "strategy designer" of design teams within Eastman. Lastly, a focus group guide was developed, using Krueger (1994) as a resource. Face-to-face interviews were conducted with members of Virginia Tech teams, and telephone interviews were conducted with members of National Grocers teams.

3.2.2. Data Collection at Eastman

Qualitative data were collected at Eastman using individual and focus group interviews prior to any data collection at the other two research sites. In addition to gaining an overall perspective of organizational learnings, Eastman provided some important insights into the design team process which were used to revise and improve how variables were operationalized before data collection at National Grocers and Virginia Tech. Two full-day trips were made to Eastman in the Spring of 1995. One full day was spent interviewing the strategy designer mentioned earlier, as well as five individuals who had served as team leaders or internal team consultants to various design teams. Altogether, these five individuals had experience with several dozen different design or renewal teams. The second trip to Eastman was spent conducting a focus group of nine individuals who had also served as either team leaders or internal team consultants to design/renewal teams. During the second trip, an additional interview was conducted with the strategy designer.

Audio tapes of individual interviews were transcribed and detailed notes were taken at the focus group interview. These transcripts and notes became the raw data which were analyzed to extract key learnings about creating and managing design teams. The data analysis process is described later in this chapter.

3.2.3. Data Collection at Two Primary Research Sites

This section describes the pilot study to test survey instruments, and data collection and survey administration at the two primary research sites, National Grocers and Virginia Tech.

3.2.3.1. Pilot Study

Each of the three instruments used to collect data from members of design teams (the Campbell-Hallam Team Development Survey, the Design and Leadership Team Survey, and the interview guide for design team members) were pilot tested in the Spring of 1995. The purpose of the pilot study was to assess the psychometric properties of survey questionnaires and to solicit feedback on the content and wording of question items in both the survey and interview guide.

Two teams were used to pilot test the two survey questionnaires (the TDS and DLTS). The first pilot team was the Research and Development Team for the Center for Organizational Performance Improvement at Virginia Tech. Although this team was not a design team but instead a team of graduate research associates, the team was used because of members' content knowledge about teams and organizational redesign. Team members provided feedback on any items which were unclear or difficult to read. Additionally, one team member with extensive previous experience leading design teams provided substantive feedback on the DLTS. Because the TDS is copyrighted, the researcher was unable to make revisions to the instrument but still measured psychometric properties (described later in this chapter).

The second pilot team was the On-Campus Interviewing Team at Virginia Tech which was a process redesign team in Career Services. The researcher solicited feedback from the team and met with the team leader individually to obtain feedback on the surveys. Because the pilot sample was small (fifteen people from two teams), the data could not be subjected to factor analysis. However, the reliability of each scale (a set of question items used to operationalize and measure a design feature) was measured using Cronbach's coefficient alpha as a measure of internal consistency (Cronbach & Meehl, 1955). Reliabilities and changes made to the DLTS from the pilot study are summarized in Appendix C.

The interview guide was piloted with a member of a former design and development team at National Grocers which had been disbanded within the last year. Questions were asked as if the team were still active, and minor revisions were made to the interview questions.

Based on the pilot study, it was observed that completing the two survey questions (including reading survey instructions and signing the informed consent form) required about one hour. The team member interview was timed at about 45 minutes.

3.2.3.2. Survey Administration and Interview Data Collection

The fifteen design teams from National Grocers and Virginia Tech completed survey questionnaires and team members were interviewed throughout the Summer of 1995. The survey questionnaires and survey instructions were designed to be clear and simple so that they could be self-administered. Because the teams in this research met only one or a few times a month, their time together as a team was scarce. Because of this constraint, the researcher designed the survey process such that individual team members would be able to complete the surveys on their own time, rather than in a team setting.

For some teams, the survey packages were distributed in a team meeting. For inactive teams and/or for teams whose members were geographically dispersed, each team member was sent a survey package. The survey package contained a cover letter explaining the purpose of the research project and what was being asked of team members, an informed consent form, the two survey questionnaires (the TDS and the DLTS), a return envelope, and a pencil (required for the TDS). The researcher's phone number was included in several places in the survey package and team members were encouraged to call if they had any questions. Only one person out of 130 had a clarification question[5]. Team members were asked in most cases to complete the surveys within one week, and for the most part, did. Follow-up calls were necessary with some team members due to vacations and business travel, however, a total of 130 people completed the surveys, a 96% response rate (135 surveys were distributed).

For each team, the researcher identified and coordinated the distribution of surveys with a contact person, often the team leader or convener (a role used within National Grocers teams which is similar to team leader). For active National Grocers teams, all survey packages were sent to the contact person who distributed them either at a team meeting or individually to team members. In these cases, the contact person was sent a "script" to verbally describe the purpose and expectations for the survey. For Virginia Tech teams, the researcher attended a team meeting to distribute the survey packages.

Surveys were returned to the researcher in one of two ways. The survey instructions specified that surveys could be returned (sealed in the return envelope provided) to the team contact person who would return all of them together to the researcher. Or, if members felt uncomfortable with this arrangement and wanted to ensure confidentiality of their survey responses, they could return the envelop containing both surveys directly

[5] This individual was the team leader for one of the teams and wanted to confirm that he was expected to answer survey questions in the TDS related to the team leader (which he was).

to the researcher, either through university campus mail for Virginia Tech teams, or using postal mail for National Grocers teams. The majority of individuals opted to return the surveys through a team contact person.

After data were collected from teams using the survey questionnaires, the researcher interviewed one team member from each team. Because the researcher was interested in gaining accurate historical and background information on each team in addition to perceptions about the team's functioning and performance, the team leader or convener was selected for most teams. The team leader/convener was believed to be more likely to not only have accurate background information, but also to be an active team member and aware of current issues within the team. Members of National Grocers teams were interviewed over the telephone (because of geographical distance), while members of Virginia Tech teams, being in close proximity, were interviewed face-to-face. In both cases, detailed notes were taken on a portable computer as the interviews were conducted. Because of typing speed, the researcher was able to capture responses almost word for word. Each interviewee was asked if he or she objected to this type of note-taking, and none did. In face-to-face interviews, the researcher purposefully maintained eye contact with the interviewee and infrequently had to break eye contact. Immediately following each interview, the notes were reviewed in detail, and any information not captured was added. This method of capturing interview data was viewed to be much more efficient with almost the same quality (in terms of information captured) as compared to transcribing audio tapes of interviews.

In the interviews with team members, a stakeholder was identified for each team who had knowledge about the team's results and progress. In most cases, the stakeholder was also the team's sponsor. Stakeholders were then contacted for their viewpoint on the team's performance, using the same team performance-2 measure that team members completed. Because there were few questions, a formal survey package was not used for all stakeholders; in some cases, telephone or electronic mail was used.

3.2.4. Assessing Psychometric Properties of Survey Instruments

This section describes what was done to examine the psychometric properties of the survey instruments. Based on the results of reliability analysis and factor analysis, the set of variables in the operational research model and how they were operationalized using scales, were revised as compared to the research model and variables in the dissertation proposal. Readers who wish to see only the final set of variables in this research, how they are operationalized, and the scale reliabilities should refer to Table 3.1. The specific survey items for a given scale shown in Table 3.1 can be found in Appendix D. For readers who wish to see further detail, results from exploratory data analysis, reliability analysis, and factor analysis are provided in this section, where specific changes to operational measures of variables are described.

3.2.4.1. Exploratory Data Analysis

Once collected, quantitative data were entered into an SPSS data file in sequential order of the survey questions. A "codebook" was maintained that showed which scales contained which survey items. For each survey item, the following were examined in order to uncover any data entry errors or unusual distributions: mean, standard deviation, minimum, maximum, and histogram. In addition, two surveys from each team were randomly selected and all survey items were re-checked to assess accuracy of data entry. A total of 17 errors were discovered, which represents less than 0.05% of total pieces of data entered[6], which was viewed to be acceptable.

[6] There were a total of 245 pieces of data to enter from the two survey questionnaires together, and there were a total of 130 surveys returned, for a total of 31,850 pieces of data entered.

Table 3.1. Construct Measurement and Data Collection for Variables in the Operational Research Model.

Construct and Variable Name	Operationalization of Variable	Level of Measurement	Data Collection	Item Number	Reliability
Organization Number (ORG_NO)	1=Virginia Tech 2=National Grocers	Nominal	TDS[7]	k=1 CBQ01	n/a
Team Number (TM_NO)	Teams 1 through 15	Nominal	TDS	k=1 CBQ02	n/a
Demographics[8]	Gender (DMGNDR): 1=Male 2=Female	Nominal	TDS	k=1 CBQ03	n/a
	Age in years (DMAGE)	Ratio	TDS	k=1 CBQ04	n/a
	Education level (DMEDL)[9]	Ordinal	DLTS	k=1 DT04	n/a
	Organization tenure (DMORGTEN): Number years with organization	Ratio	DLTS	k=1 DT01	n/a
	Job tenure (DMJOBTEN): Number years in present job	Ratio	DLTS	k=1 DT02	n/a
Team Skills (TMSKLS)	Team members' perception of the team's skill and knowledge. (Example: Our team members are skilled and competent.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=5 CQ05 CQ39r* CQ53 CQ56 CQ64	IC .71[10] T-R .88 .77/.78[11]
Cross-Functional Representation (XFCNS)	Number of functional areas or units within the target system represented on the team.	Ratio	Interview	k=1 IQ06	n/a

7 TDS=Campbell-Hallam Team Development Survey and DLTS=Design and Leadership Team Survey.

8 For age, education level, organization tenure, and job tenure, the coefficient of variation was used to test the research hypotheses about these variables. For gender, the standard of deviation was used to test the research hypothesis, because it is maximized when a team was most diverse on gender.

9 1=Some elementary school; 2=Completed elementary school; 3=Some high school; 4=Graduated from high school; 5=Some technical training, or vocational school beyond high school; 6=Graduated from vocational school; 7=Some college/university education; 8=Graduated from college/university; 9=Some graduate school; 10=Completed graduate degree

10 The reliability of each scale from the Campbell-Hallam Team Development Survey is reported (from Hallam & Campbell, 1994). Two measures of reliability are reported: internal consistency using Cronbach's alpha (IC) and test-retest reliability (T-R).

11 The first number reported represents the alpha value from SPSS corresponding to Cronbach's alpha, and the second number represents the standardized alpha. The same format is repeated for all scales.

Table 3.1 (cont'd).

Variable and Variable Name	Operationalization of Variable	Level of Measurement	Data Collec-tion	Item Number	Reliability
Multi-Level Representation (MLVLS)	Number of distinct organizational levels in the target system represented on team.	Ratio	Interview	k=1 IQ07	n/a
Individual Goals (INDGLS)	Whether team members have clear goals or expectations for what they are doing as part of the team. (Example: I know what I want to achieve on this team.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=2 CQ08 CQ24 CQ15r	IC .61 T-R .81 .72/.74
Turnover (TRNVR)	The amount of turnover the team has experienced: 1= A lot of turnover 2=Some turnover 3=No turnover	Ordinal	Interview	1 IQ04	n/a
Size (TMSIZE)	Number of active participating team members.	Ratio	Interview (sup-ported by other sources)	1 IQ05	n/a
Co-location (LCNS_SZ)	The number of distinct locations (buildings or geographic locations) over which the team is dispersed, with respect to team size (no. lcns/size).	Ratio	Interview	k=1 IQ08	n/a
Team Age (TMAGE)	Amount of time in months team has been an active team.	Ratio	Interview	k=1 IQ01	n/a
Defined Design Process (DEFPRC)	The extent to which the team uses a defined process for redesign/change. (The process we use to redesign/change the target system has well-defined steps planned in advance.)	Ordinal 6 point scale from SA (6) to SD (1)	DLTS	k=1 DT39	n/a
Systemic Perspective (SYSPERS)	Whether the team considers how proposed changes impact key organizational components. (Example: We consider how what we're doing impacts the technology of the *target system*)	Ordinal 6 point scale from SA (6) to SD (1)	DLTS	k=8 DT49-DT56	.87/.88
Comprehensive Design Process (CMPDES)	Percent of team's time spent in stages of design process. Note: Coefficient of variation for time spent across the stages of design process was used to test hypothesis.	Ratio	DLTS	k=1 DT19	n/a

Table 3.1 (cont'd).

Variable and Variable Name	Operationalization of Variable	Level of Measurement	Data Collec-tion	Item Number	Reliability
Electronic Mail Capability (EMAIL)	The proportion of fellow team members each person can communicate with using e-mail: 1=None 2=Some 3=Most 4=All	Ordinal 4 point scale from none (1) to all (4)	DLTS	k=1 DT07	n/a
Team Charter (TMCHRT)	Status of team charter: 1=No charter 2=Team-developed charter 3=Team reviewed a charter developed outside the team	Ordinal	Interview	k=1 IQ02	n/a
Team Commitment (TMCMT)	The extent to which team members focus their personal energy on their work and their team goals. (Example: Our team works hard.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=4 CQ01 CQ12 CQ21 CQ46	IC .66 T-R .78 .80/.81
Team Unity (TMUNTY)	Overall quality of the relationships between team members. (Example: When we disagree, we usually work out our differences in an honest, healthy way.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=4 CQ14 CQ28 CQ65r CQ68r	IC. .77 T-R.86 .82/.82
Team Self-Assessment (TMASSMNT)	The extent to which the team takes time to assess its performance in order to find ways to improve. (Example: We rarely stop to consider how we can work better as a team.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=6 CQ04 CQ33r CQ43 CQ58	.72/.72
Team Decision Processes (TMDEC)	How well team members coordinate internal team activities and make decisions. (Example: We have a difficult time making decisions.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS and DLTS	k=7 CQ09r DT25 DT27 DT32 DT35 DT45 DT41	.85/.86
Team Roles (TMROLES)	The extent to which the team uses roles within the team. (Example: My team has clearly defined roles)	Ordinal 6 point scale from SA (6) to SD (1)	DLTS	k=3 DT20 DT24 DT43	.78/.78
Team Leadership (TMLDR)	The contribution and ability of the team leader to the team. (Example: The team leader is skilled and experienced)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=6 CQ25 CQ31 CQ35 CQ47 CQ59 CQ67	IC .85 T-R .75 .86/.86

Table 3.1 (cont'd).

Variable and Variable Name	Operationalization of Variable	Level of Measurement	Data Collec-tion	Item Number	Reliability
Meeting Frequency (MTGFRQ)	Number of regular team meeting per month.	Ratio	Interview	k=1 IQ03	n/a
Communication Between Meetings (CMFRQ)	Number of times members communicate with other members per week outside of team meetings. Note: Assume 5 days in a week and 4 weeks in a month.	Ratio	DLTS	k=1 DT05	n/a
Meeting Attendance (MTGATN)	Percent of meetings attended.	Ratio	DLTS	k=1 DT06	n/a
Clarity in Sponsor Expectations (CLRSPNEX)	Whether team members are clear about what sponsor(s) expect the team to achieve. (Example: We know what our sponsors expect us to accomplish.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS and DLTS	k=5 CQ22 CQ38r DT26 DT33 DT37	.87/.88
Keeping Stakeholders Informed (STKINF)	Whether the team regularly shares information with customers and stakeholders. (Example: We communicate regularly to keep customers informed of our plans and progress.)	Ordinal 6 point scale from SA (6) to SD (1)	DLTS	k=2 DT30 DT31	.83/.83
Building Commitment (CMTBLD)	Whether the team is effective at building commitment from key stakeholders. (Example: We are effective at building sponsor commitment to what we are doing.)	Ordinal 6 point scale from SA (6) to SD (1)	DLTS	k=3 DT21 DT22 DT23	.83/.83
Inter-organizational Perspective (INTRORG)	Whether the team coordinates with and is informed about other related improvement initiatives. (Example: We are well-informed about other improvement teams that might impact what we're doing.)	Ordinal 6 point scale from SA (6) to SD (1)	DLTS	k=3 DT44 DT48 DT34	.79/.80
Release Time (RELTIME)	The extent to which team members feel they have enough "release time" from other responsibilities for their work on the team. (I am burdened by other responsibilities that reduce my ability to contribute to this team.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=1 CQ10r	n/a

Table 3.1 (cont'd).

Variable and Variable Name	Operationalization of Variable	Level of Measurement	Data Collection	Item Number	Reliability
Education Time (ETDTIME)	Number of days each team member has spent in education and training in the last 12 months.	Ratio	DLTS	k=1 DT16	n/a
Organization Support to Team (ORGSPTTM)	Whether team members feel the organization supports the team by providing information, time, and general support. (Example: We usually have access to the information we need.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=5 CQ13 CQ19 CQ26 CQ44 DT40	.74/.75
Organization Support to Individuals (ORGSPTIN)	Whether team members feel the organization supports them as individuals team. (Example: I receive few rewards for performing well on this team.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=4 CQ11 CQ18 CQ55r CQ62	.73/.74
Team Performance-1 (TMPERF1)	Whether the team members believe that they are doing well as a team. (Example: Our work is high quality)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=5 CQ02 CQ17 CQ40 CQ60 CQ72	IC .85 T-R.84 .92/.92
Team Performance-2 (TMPERF2)	Team members' rating of percent effectiveness, from 0 to 100%, in 6 performance areas[12]: Quality of team decisions and solutions Quality of team deliverables Timeliness of team deliverables Customer/ stakeholder satisfaction Improving business results in target system Overall performance	Ratio	DLTS	k=6 DT57 DT58 DT59 DT62 DT63 DT64	.93/.93
	Stakeholder rating of percent effectiveness in 6 performance areas (see previous) for at least one stakeholder per team. (STKPERF)	Ratio	Stake-holder Interview	k=6 IQ13	n/a
Team Member Satisfaction (TMSATF)	How happy or satisfied team members feel to be part of the team. (Example: I like being part of this team.)	Ordinal 6 point scale from SA (6) to SD (1)	TDS	k=3 CQ06 CQ32 CQ52r	IC .85 T-R .81 .88/.89

[12] The approach to measuring team performance-2 was adapted from one presented by Cohen, Mohrman, & Mohrman (1993) who identified a different set of performance dimensions but used the same approach.

Table 3.1 (cont'd).

Variable and Variable Name	Operationalization of Variable	Level of Measurement	Data Collection	Item Number	Reliability
Additional Data Collected					
Team Methodology (TMMETH)	The macro methodology the team uses to drive change/redesign: 1=IMPROVE 2=GSS 3=BPR/CPI 4= Spt/Str (Support/Steering Team)	Nominal	Interview	k=1	n/a
Number of Team Roles Used (NOROLES)	Number of formal team roles used within the team.	Ratio	DLTS	k=1 DT11tr	n/a
Percent Time on Team (PRCTM)	Percent of working time spent on average on team activities.	Ratio	DLTS	k=1 DT18	n/a
Team Education Content Areas (ETDCON)	Number of ETD content areas each team member received in last 12 months.	Ratio	DLTS	k=1 DT14_2	n/a
Decision-Making Domain	The amount of decision-making influence the team has over decisions about what the team does (DMDOMWHT). (Example: Defining the team's mission or purpose)	Ordinal 4 pt scale from none (1) to complete (4)	Interview	IQ09a,b,c	n/a
	The amount of decision-making influence the team has over decisions about how the team functions (DMDOMHOW) (Examples: How to run meetings, changing membership of team)	Ordinal 4 pt scale from none (1) to complete (4)	Interview	IQ09d - l	n/a
Communication Mechanisms	Ranking of importance for each of 6 types of communication mechanisms to get information from other team members: Regular team meetings Telephone Electronic mail Informal face-to-face communication Written memo or report	Ordinal	DLTS	k=1 DT08	n/a
	Ranking of importance for each of same 6 communication mechanisms to get information from outside the team.	Ordinal	DLTS	1 DT09	n/a

3.2.4.2. Reliability Analysis

All of the scales measuring variables in the operational research model using the TDS and the DLTS were subjected to reliability analysis. Reliability is the accuracy or precision of a measuring instrument (Kerlinger, 1986). There are a number of ways to measure various aspects of reliability. One of the most common, particularly in survey research, is the internal consistency method. The measure of internal consistency used for this research is Cronbach's alpha (Cronbach and Meehl, 1955). As defined in Tamimi, Gershon, and Currall (1995), alpha is the average of the correlation coefficient of each item with each other item constituting a given "scale."

SPSS was used to calculate Cronbach's coefficient alpha and scale statistics. In addition, the scale was examined for the impact on alpha of deleting any one item. Generally, a minimally acceptable alpha value is 0.70, although Nunnally (1978) suggests that it may be acceptable to use scales having lower alpha values when newly-developed scales are being explored as in Tamimi, Gershon, and Currall (1995).

If a scale could not be improved by deleting any one item and the coefficient alpha was still less than 0.70, the scale was not used but instead a single item was selected from the scale to use in data analysis. Table 3.2 summarizes the scales, the number of items used to operationalize variables, and the reliability using Cronbach's alpha. The changes indicated after this initial reliability analysis are summarized below.

- The scale for defined design process could not be used because of low reliability; instead item DT39 was selected for potential use.
- The scale for feedback could not be used because of low reliability, instead two of the single items were identified for potential use.
- The scale for rewards could not be used because of low reliability, instead two of the single items were identified for potential use.
- One item from the team roles scale was deleted to improve reliability.

Before making a decision to use only the single survey items for the scales with low reliability, factor analysis was used to determine whether the items from the feedback and rewards scales clustered as defined by Hallam and Campbell (1994). Table 3.2, which summarizes scale reliabilities, reflects the status of operational measures of variables *before* factor analysis, which is described in the next section.

3.2.4.3. Factor Analysis

Factor analysis was used to determine whether scales (variables) in the research model were in fact measuring the same underlying factor and therefore could be combined to reduce the overall number of variables (Bryman & Cramer, 1994; Kerlinger, 1986). Additionally, because the researcher had not used the Campbell-Hallam Team Development Survey previously, factor analysis was used to determine whether surveys items clustered into factors according to the scales as specified by the authors of the TDS.

In SPSS, principal-axis factoring was used as the extraction method and direct oblimin was used as an oblique rotation method, with delta equal to zero. Any factors that emerged which were different than the original scales were then subjected again to reliability analysis to ensure that scales suggested by factor analysis were reliable.

Kerlinger (1986) recommends ten subjects, or team members, for each variable (survey item in this case) entered into a factor analysis, while Gorsuch (1983) as cited in Bryman and Cramer (1994) proposes an absolute minimum of five subjects per variable. The sample size in this research was a total of 130 subjects. Using Gorsuch's criteria, no more than 26 items should be loaded into a factor analysis. Therefore, all survey items could not be entered into a factor analysis.

Table 3.2. Coefficient Alphas for Scales Before Factor Analysis.

Variables and Associated Measures	Alpha	k= no. items
Team Composition		
Demographics (age, gender, ed. level, organization tenure, job tenure)	--	1 each
Skills	0.77	5
Cross-Functional Representation	--	1
Multi-Level Representation	--	1
Individual Goals	0.72	3
Team Turnover	--	1
Team Size	--	1
Co-location	--	1
Team Age	--	1
Team Technology/Task		
Defined Design Process	0.63	3
Systemic Perspective	0.87	8
Comprehensive Design Process	--	1
Team Methodology	--	1
Mission Clarity	0.81	4
E-mail Capability	--	1
Team Charter	--	1
Team Processes: Intrateam Processes		
Team Commitment	0.80	4
Team Unity	0.82	4
Team Self-Assessment	0.72	4
Team Coordination	0.70	4
Team Decision Processes	0.84	5
Team Roles	0.78	3
Team Leadership	0.84	5
Meeting Frequency	--	1
Communication Frequency Between Meetings	--	1
Meeting Attendance	--	1
Team Processes: Boundary Management Processes		
Sponsor Management	0.86	5
Customer Management	0.70	3
Stakeholder Management	0.71	3
Improvement Team Coordination	0.74	3
Inter-organizational Impact	--	1
Organizational Resources Available		
Time	0.67	4
Education (days spent in ETD)	--	1
Information	0.64	4
Feedback	0.42	3
Rewards	0.47	2
Organization Support	0.71	3
Dependent Variables		
Team Performance-1 (Campbell-Hallam Team Development Survey)	0.92	6
Team Performance-2 (Design and Leadership Team Survey)	0.93	8
Team Satisfaction	0.88	3

A strategy using the categories of variables from the operational research model (e.g., team processes, organizational resources) was used to identify sets of items believed to be potentially related. For example, all survey items from scales measuring intrateam processes were loaded into a factor analysis, and all scales measuring boundary management processes were loaded into a factor analysis.

Many factor analyses were run using SPSS, however, results reported here are only those which led to changes in how survey items clustered into scales.

Team unity and team commitment were entered into a factor analysis. Principal-axis factoring required 10 iterations to extract two factors, accounting for 60.6% of the common variance in these items. Direct oblimin converged in 7 iterations. The factor pattern matrix is shown in Table 3.3 (factor loadings are rounded to two digits).

Table 3.3. Factor Pattern Matrix for Team Commitment and Team Unity.

	Factor 1	Factor 2
CQ01-C		.72*
CQ12-C		.85*
CQ21-C		.62*
CQ57-C		
CQ14-U	.58*	
CQ28-U	.92*	
CQ46-U		.53*
CQ65-U	.64*	
CQ68-U	.78*	

A "C" designates items part of team commitment scale, and "U" designates items part of team unity scale.
*Loaded onto this factor.
Factor loadings less than .40 suppressed.

With two exceptions, items loaded as expected onto factors representing team unity and commitment (factors 1 and 2, respectively). First, item CQ57 did not load strongly onto either factor, and was excluded from further analysis. Second, item CQ46 (originally part of the team unity scale) loaded more strongly onto team commitment, and was therefore switched to this scale. Alpha values for team commitment with these two revisions was improved from the original TDS scales (0.80 compared to 0.73 for team commitment) and was the same for team unity (0.82).

The second factor analysis included survey items part of boundary management scales: sponsor management (k=5 items), customer management (k=3), stakeholder management (k=3), improvement team coordination (k=3), inter-organizational impact (k=1). In addition, items from the mission clarity (k=3) scale were included, because the scales for mission clarity and sponsor management were strongly correlated ($r=.74$, $p<.005$). Principal-axis factoring required 16 iterations to extract four factors, accounting for 65.2% of the common variance in these items. Direct oblimin converged in 12 iterations. As shown in the factor pattern matrix in Table 3.4, items did not load onto factors as expected based on the original scales.

Table 3.4. Factor Pattern Matrix for Boundary Management Scales.

	Factor 1	Factor 2	Factor 3	Factor 4
CQ22-M	.77*			
CQ38-M	.69*			
CQ51-M	.57			
DT23-Sp	.59		.36*	
DT26-Sp	.68*			
DT29-Sp	.55			
DT33-Sp	.79*			
DT37-Sp	.80*			
DT21-C			.53*	
DT30-C				-.81*
DT36-C		.42		-.42
DT22-Sk			.86*	
DT31-Sk				-.86*
DT47-Sk				
DT42-I		.56		
DT44-I		.84*		
DT48-I		.64*		
DT34-P		.54*		

M=Mission clarity scale, Sp=Sponsor management, C=Customer management, Sk=Stakeholder management, I=Improvement team coordination, and P=Inter-organization impact.
*Loaded onto this factor.
Factor loadings less than .40 suppressed, with the exception of DT23.

All items from the original sponsor management and mission clarity loaded onto the first factor, which was called "clarity in sponsor expectations." Reliability of the 8-item scale is 0.89, however, as the 8 items were examined more closely, three were excluded (CQ51, DT23, and DT29) so that items in the new scale were conceptually very aligned. The alpha value for the 5-item scale is 0.87.

Items from the scales for improvement team coordination and inter-organizational impact loaded onto the second factor, which was called "inter-organizational perspective." Reliability for this 4-item scale is 0.78, and reliability analysis indicates the scale reliability can be improved to 0.79 by deleting DT42; therefore, this item was not loaded onto factor 2.

The items having to do with building commitment (one item from each of the following scale: sponsor management, customer management, and stakeholder management) loaded onto the third factor, which was called "commitment-building." Although item DT23 loaded more strongly onto the first factor, it was not retained in clarity in sponsor expectations because of conceptual misalignment. Item DT23 was included instead in the scale for commitment-building (factor 3) in spite of a lower factor loading because it improved reliability for this scale (alpha=0.83).

The fourth factor in this analysis of boundary management processes, which was called "keeping stakeholders informed," had two items: one from the customer management scale and one from the stakeholder management scale. Reliability for the 2-item scale is 0.83.

Because item DT36 did not load clearly onto any one factor, it was excluded from further analysis.

Gladstein (1984) called for further research on boundary management processes used by teams. This factor analysis identified those distinct boundary management processes that teams perceived as defining how they interact with their external environment and surroundings.

The third factor analysis included survey items from intrateam process scales: team coordination (k=4), team decision processes (k=6), team roles (k=4), team leadership (k=6), and team self-assessment (k=4)[13]. Principal-axis factoring required 11 iterations to extract four factors, accounting for 59.7% of common variance in those items. Direct oblimin converged in 12 iterations. The factor pattern matrix is shown in Table 3.5.

Table 3.5. Factor Pattern Matrix for Intrateam Process Variables.

	Factor 1	Factor 2	Factor 3	Factor 4
CQ03-C				
CQ09-C	.75*			
CQ29-C				
CQ45-C				
DT25-D	.46*		.47	
DT27-D	.55*			
DT32-D	.50*			
DT35-D	.47*			
DT45-D	.61*			
DT20-R			.79*	
DT24-R			.70*	
DT41-R	.53*			
DT43-R			.60*	
CQ25-L		-.86*		
CQ31-L		-.66*		
CQ47-L		-.67*		
CQ59-L		-.54*		
CQ67-L		-.72*		
CQ04-A				
CQ33-A				.60*
CQ43-A				.44*
CQ58-A				.72*

C=Coordination, D=Decision processes, R=Team roles, L=Team leadership, A=Team self-assessment
*Loaded onto this factor.
Factor loadings less than .40 suppressed.

[13] Team commitment and team unity were not included in this factor analysis even though they were also intrateam processes because they were considered together in an earlier factor analysis, and even when loaded into a factor analysis with other internal team process scales, no other changes are indicated.

Items from team decision processes (DT25, DT27, DT32, DT35, and DT45), from team coordination (CQ09), and from team roles (DT41) loaded onto the first factor, which was called team decision processes (the same name as the original DLTS scale). Reliability of this 7-item scale is 0.85. Although item DT25 loaded more strongly onto the third factor, it was retained in factor 1, because it improved scale reliability and was more conceptually aligned with this factor ("we follow well-defined and systematic decision processes").

All items loaded as expected onto the second factor, team leadership, which has a reliability of 0.86.

Items loaded as expected onto the third factor (team roles), except that one item (DT41), mentioned earlier, loaded onto factor 1. Reliability of the 3-item scale is 0.78.

Items from the original scale "team self-assessment" loaded onto the fourth factor, except that CQ04 did not load onto this factor. However, this item is retained in the team self-assessment scale because it improved reliability from 0.70 to 0.72.

Items CQ03, CQ29, and CQ45 were excluded from further analysis because they did not load clearly onto any one factor.

The fourth factor analysis included survey items from the organizational resource scales: time (k=4 items), information (k=4), feedback (k=3), rewards (k=2), and organizational support (k=3). As mentioned earlier, the reliability for feedback and rewards were quite low prior to factor analysis. However, before excluding the scales and selecting single items to represent each scale, the items were included in a factor analysis to examine how they would cluster with other organizational resource scales. Principal-axis factoring required 49 iterations to extract 4 factors accounting for 60.3% of the common variance in these items. Direct oblimin converged in 14 iterations. The factor pattern matrix is shown in Table 3.6.

Table 3.6. Factor Pattern Matrix for Organizational Resource Variables.

	Factor 1	Factor 2	Factor 3	Factor 4
CQ13-O				.52*
CQ44-O				.60*
DT40-O	.44			.57*
CQ10-T			.87*	
CQ26-T		.53		.38*
CQ41-T		.73		
CQ63-T		.44		
CQ18-R	.68*			
CQ55-R	.40*			
CQ11-F	.60*			
CQ30-F				.42
CQ19-I				.40*
CQ37-I		.51		
CQ50-I	.63			
CQ62-I	.72*			

O=Organization support, T=Time, R=Rewards, F=Feedback, I=Information.
*Loaded onto this factor.
Factor loadings less than .40 suppressed, with the exception of CQ26.

It was found that items relating to individual team members loaded onto the first factor, which was called "organizational support to individuals" (for example, "I receive few rewards for performing well on this team" and "I often find it difficult to get answers to important questions about my work"). Two items (DT40 and CQ50) that had factor loadings for the first factor were not included in "organizational support to individuals," because they were conceptually not aligned. The reliability of this new 4-item scale is 0.73.

Three of the four items from the original "time and staffing" scale from the TDS loaded onto the second factor, which was called "time available." Another item, CQ37, was not loaded onto this factor because it was conceptually misaligned. The reliability of the scale time available is 0.61, which is below the 0.70 criteria. Therefore, this scale is not used in data analysis.

A single item loaded strongly onto the third factor, which is called "release time" (the item is "I am burdened by other responsibilities that reduce my ability to contribute to this team"). This was used as a single-item operational measure in data analysis.

Items relating organizational support and resources to the team loaded onto the fourth factor, which as called "organizational support to team" (for example, "our organization fully supports this team and its mission", "we have enough money and other material resources to do our work"). Item CQ30 was not loaded onto factor 4 because it was not conceptually aligned with the other items. Item CQ26 *was* loaded onto factor 4, even though it had a stronger loading on the second factor, because it was more aligned with other items in factor 4 ("we have enough time and people to perform well"). And, item CQ26 improved reliability of the scale "organizational support to team." The reliability of the 5-item scale is 0.74.

Lastly, the items part of the three dependent variables scales were loaded into a factor analysis: team performance-1 (k=5), team performance-2 (k=8), and team satisfaction (k=3). Principal-axis factoring required 18 iterations to extract 4 factors, accounting for 77.5% of the common variance in these items. Direct oblimin converged in 7 iterations. The factor pattern matrix is shown in Table 3.7.

The first factor represents one of the operational measures of team performance (called team performance-2), and items loaded onto this factor as expected, with two exceptions. Items DT60 and DT61 did not load clearly onto the first factor and so were removed from the scale for team performance-2. The reliability for the 6-item scale is 0.93.

Table 3.7. Factor Pattern Matrix for Dependent Variables.

	Factor 1	Factor 2	Factor 3	Factor 4
CQ02-P1			-.72*	
CQ17-P1			-.80*	
CQ40-P1			-.61*	
CQ60-P1			-.85*	
CQ72-P1			-.78*	
CQ06-S		.86*		
CQ32-S		.86*		
CQ52-S		.81*		
DT57-P2	.68*			
DT58-P2	.81*			
DT59-P2	.80*			
DT60-P2				.58
DT61-P2	.47			.40
DT62-P2	.77*			
DT63-P2	.78*			
DT64-P2	.72*			

P1=Team performance-1 (from the Campbell-Hallam Team Development Survey), S=Team satisfaction, P2=Team performance-2 (from the Design and Leadership Team Survey).
*Loaded onto this factor.
Factor loadings less than .40 suppressed.

Items loaded as expected onto the second factor which represents the team satisfaction scale. Items also loaded as expected onto the third factor which represents the other operational measure of team performance (called team performance-1 from the TDS). No changes were made in these scales, and reliabilities are 0.88 for the 3-item team satisfaction scale and 0.92 for the 6-item team performance-1 scale.

As a summary of the revisions made to scales after factor analysis, Table 3.8 contains the scales used in this research after factor analysis. In addition, the number of items in each scale and the coefficient alpha (reliability) for each scale are included. Those scales which were revised in reliability analysis (items deleted) or represent a new scale as a result of factor analysis (items clustered into different scales than originally specified) are indicated with an asterisk in the table. The variables represented in Table 3.8 are also shown in the operational research model in Figure 3.1 (repeated from Chapter 1).

3.3. Data Analysis Methods

Data analysis techniques to test the research hypotheses and questions specified in Chapter 1 are described in this section. Table 3.9 provides a summary of data analysis methods used to address the overall research questions described in Chapter 1. These analytic methods are described in further detail this section, with the exception of Research Question 1. Because the purpose of Research Question 1 was to describe design teams in this research sample, there are no hypotheses tested and no analytic methods to describe.

<u>3.3.1. Analysis Method for Research Question 2</u>

This research question asks: Are there differences in team effectiveness for teams using different methodologies for redesign? The research sample included teams using four different methodologies as the guiding framework for redesign in the target system (variable name is "TMMETH").

Two teams at National Grocers used "IMPROVE" as a methodology, which is a process using economic data to identify and improve in a structured way those key processes within a target system that have the most impact on system performance. Six teams at National Grocers used Grand Strategy Systems (GSS), a methodology for large-scale change within a target system which focuses on documenting the past and present, and planning for the future along key organizational fronts. Four teams at Virginia Tech used Business Process Redesign/Continuous Process Improvement (BPR/CPI) as the umbrella for their redesign effort and were focused on redesigning key administrative processes within a larger organization. And lastly, three teams which were involved with organizational redesign efforts at both organizations also provided direction, sponsorship, and/or resources to other teams, functioning as steering and support teams (SPT/STR).

Table 3.8. Coefficient Alphas for Scales After Factor Analysis.

Category of Variables and Associated Measures	Alpha	k= no. items
Team Composition		
Demographics (age, gender, education level, organization tenure, job tenure)	--	1 each
Skills	0.77	5
Cross-Functional Representation	--	1
Multi-Level Representation	--	1
Individual Goals	0.72	3
Team Turnover	--	1
Team Size	--	1
Co-location	--	1
Team Age	--	1
Team Technology/Task		
Defined Design Process* (use single item)	--	1
Systemic Perspective	0.87	8
Comprehensive Design Process	--	1
Team Methodology	--	1
E-mail Capability	--	1
Team Charter	--	1
Team Processes: Intrateam Processes		
Team Commitment* (1 item deleted, 1 added)	0.80	4
Team Unity* (1 item deleted)	0.82	4
Team Self-Assessment	0.72	4
Team Decision Processes (1 item added from other scale)	0.85	7
Team Roles* (1 item deleted)	0.78	3
Team Leadership	0.86	6
Meeting Frequency	--	1
Communication Frequency Between Meetings	--	1
Meeting Attendance	--	1
Team Processes: Boundary Management Processes		
Clarity in Sponsor Expectations* (combined two scales)	0.87	5
Keeping Stakeholders Informed* (new scale)	0.83	2
Commitment-Building with Stakeholders* (new scale)	0.83	3
Inter-organizational Perspective* (new scale)	0.79	3
Organizational Resources Available		
Release Time* (new single-item measure)	--	1
Education (days spent in ETD)	--	1
Organization Support to Teams* (new scale)	0.74	5
Organization Support to Individuals* (new scale)	0.73	4
Dependent Variables		
Team Performance-1 (from TDS)	0.92	6
Team Performance-2* (from DLTS; 2 items deleted)	0.93	6
Team Satisfaction	0.88	3

* Indicates the scale was revised or is a new scale as a result of reliability analysis or factor analysis.

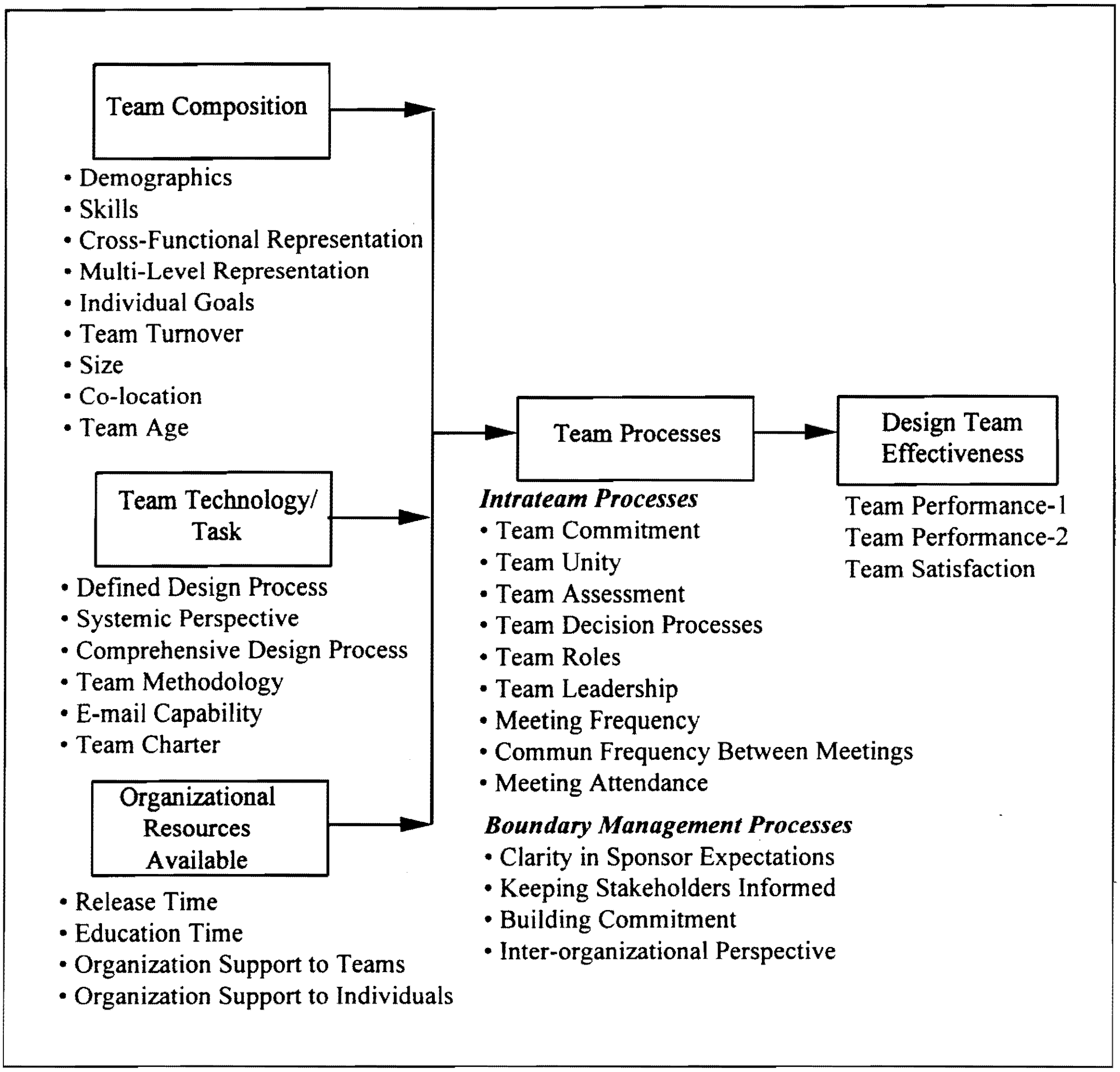

Figure 3.1. Operational Research Model After Factor Analysis.

Table 3.9. Summary of Overall Research Questions and Data Analysis Methods.

Research Question	Data Analysis Method
Research Question 1: What are the team characteristics and attributes for design teams in this research?	Descriptive statistics on independent variables to describe design teams in the research sample.
Research Question 2: Are there differences in team effectiveness for teams using different methodologies for redesign?	Multivariate analysis of variance with three dependent variables (TMPERF1, TMPERF2, and TMSATF) and team methodology (TMMETH) as a factor having four levels.
Research Question 3: Which design features have the greatest variation between design teams?	One-way analysis of variance using team number as a factor with 15 levels (corresponding to 15 teams), treating the design features as dependent variables. The *eta*-between and *eta*-within were calculated for each independent variable (design feature) and F-test reported.
Research Question 4: Which design features have a significant relationship with design team effectiveness?	1. Bivariate Pearson's correlation coefficients were calculated using weighted group means for each independent variable with the three dependent variables. 2. Within and Between Analysis (WABA) was used to identify those relationships between independent variables and dependent variables that were operating at the team level. 3. Partial bivariate Pearson's correlations were calculated for the remaining variables to identify variables uniquely explaining variance in the dependent variables. 4. Remaining variables were entered into a multiple regression for each dependent variable.
Research Question 5: What are the key learnings from organizations using design teams?	Content analysis was used to extract key learnings from survey questionnaires and interview notes.

Research Question 2 was addressed using multivariate analysis of variance (MANOVA) to detect overall differences between teams on the three dependent variables: team performance-1, team performance-2, and team satisfaction (TMPERF1, TMPERF2, and TMSATF). Team methodology (TMMETH) was treated as the independent variable having four levels: IMPROVE, GSS, BPR/CPI, and SPT/STR. To detect whether the four groups of teams were significantly different from each other, a one-way ANOVA with Bonferroni's post-hoc multiple range test was used[14].

3.3.2. Analysis Method for Research Question 3

This research question asks on which design features are teams in the research sample most different from each other. For each independent variable (i.e., design feature) in the operational research model and for the three dependent variables, the *eta*-between was calculated, which measures the proportion of variation for a single variable that is accounted for between teams. Conversely, the *eta*-within measures the proportion of variation that is accounted for within teams for a single variable. These etas were calculated using output from one-way analysis of variance (ANOVA), treating each design feature as a dependent variable and team number (TM_NO) as a factor with 15 levels (corresponding to 15 teams). Formulas for the *eta*-between and *eta*-within are shown, which are based on the R^2 from the one-way ANOVAs. The F-test, which is a significance test for the *eta*-between, was also reported in the results for this research question.

$$R\text{ - }square = \frac{\textit{Between groups sums of squares}}{\textit{Total sums of squares}}$$

[14] The Statistical Consulting Center at Virginia Tech suggested the use of Bonferroni's test as a post-hoc multiple range test rather than Duncan's test which was viewed to be too liberal or Scheffe's test which was viewed to be too conservative.

$$Eta - between = \sqrt{R - square}$$

$$Eta - within = \sqrt{1 - (R - square)}$$

3.3.3. Analysis Method for Research Question 4

The strategy to address this research question was one that relies on multiple data analysis techniques in order to narrow the candidate list of independent variables, given the number of variables in the operational research model. As shown in Figure 3.2, variables were identified:

1. which had a significant relationship with team effectiveness (team performance and team satisfaction);
2. which had a relationship with team effectiveness at the team level (there was a "team effect" operating); and
3. which contributed uniquely to explaining the variance in team effectiveness.

Bivariate correlations were used to identify variables having a strong relationship with each of the three dependent variables (two team performance measures and team satisfaction) in step 1. Within and Between Analysis was used in step 2 to identify those variables which had a significant relationship with team effectiveness at the team level, which was accomplished by partitioning the variation and covariation between variables. Only variables for which there was a clear team effect (described later) were retained after step 2. Lastly, partial correlations and multiple regression were used to identify those variables which significantly and uniquely contributed to explaining variance in each of the three dependent variables. Because correlations and multiple regression are common data analysis methods, they are not described in any more detail here. However, Within and Between Analysis, a less common data analysis technique, is described next.

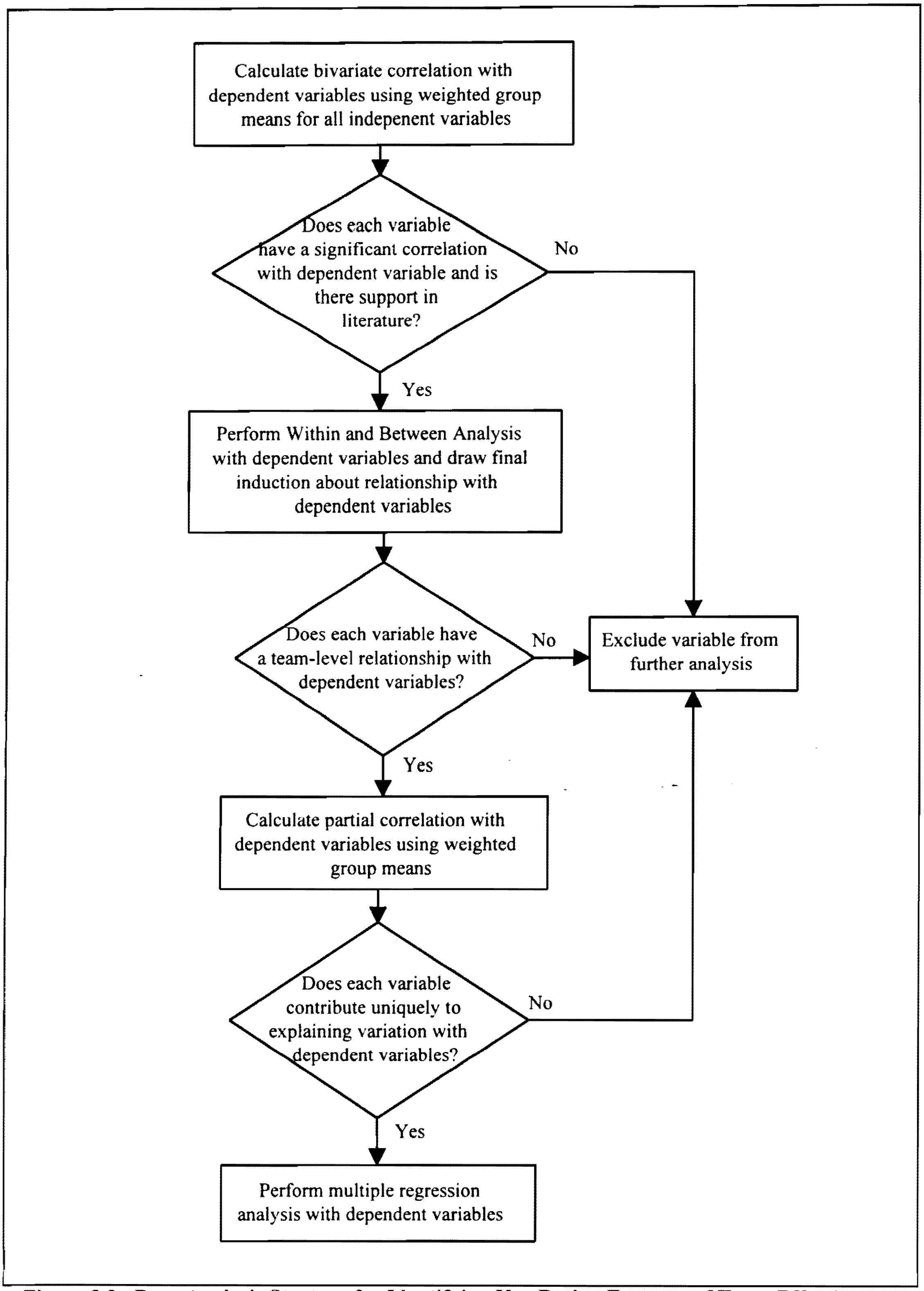

Figure 3.2. Data Analysis Strategy for Identifying Key Design Features of Team Effectiveness (Research Question 4).

Within and Between Analysis (WABA), which makes use of the Covariance Theorem, was used to provide a more complete understanding of the relationship between variables than can be obtained by bivariate correlations alone (Dansereau, Alutto, & Yammarino, 1984). The goal of WABA is to enable a researcher to make an induction about the appropriate focus of the relationship between two variables, and determine what level of analysis (e.g., individual or team) is the most appropriate. In this study, the researcher used theory to develop hypotheses about teams and was interested in developing inferences about teams, however, data is collected from individuals. Some researchers aggregate individual data to the team level for statistical analysis without examining whether this is valid based on the nature of the relationship (Klein, Dansereau, & Hall, 1994). As stated in Klein et al. (1994, p. 199):

> "When levels of theory, measurement, and statistical analysis are not identical, the obtained results may reflect the level of measurement or statistical analysis rather than the level of theory. Moreover, the obtained results may seriously misrepresent the relationships a researcher would have found if he or she had analyzed the data at the same level as the theory. In attributing the results to the level of the theory, a researcher may draw an erroneous conclusion or, in the language of levels, commit a fallacy of the wrong level."

WABA, as a set of statistical and inferential techniques, is designed to address these levels of analysis issues. For this research, WABA was used to provide the researcher with more information in order to draw the appropriate inference about whether two variables are related at the individual or team (group) level.

WABA is based on the Covariance Theorem, shown below along with definitions of each component and degrees of freedom for each component. The first three components in the covariance equation are referred to as the "between component," while the last three components are referred to as the "within component."

Covariance Equation

$r_{xy,T} = (\eta_{bx})(\eta_{by})(r_{xy,b}) + (\eta_{Wx})(\eta_{Wy})(r_{xy,w})$

where

$r_{xy,T} =$ total correlation between X and Y, $df=N-2$

η_{Bx} = between-eta correlation for variable X, *df=(J-1,N-J)*
η_{By} = between-eta correlation for variable Y, *df=(J-1,N-J)*
$r_{xy,b}$ = between-group correlation between X and Y using group means, *df=J-2*
η_{Wx} = within-eta correlation for variable X, *df=(N-J,J-1)*
η_{Wy} = within-eta correlation for variable Y, *df=(N-J,J-1)*
$r_{xy,w}$ = correlation between X and Y using within-group deviation scores (within-group correlation), *df=N-J-1*

There are essentially three steps to WABA as described in Yammarino and Markham (1992). In the first step (WABA I), each single variable in a study is assessed to determine whether it varies primarily between groups, within groups, or both. *Eta*-between and *eta*-within, which were obtained to address Research Question 3, were examined in this step. An inference is drawn from the WABA I statistical tests using the F-test from one-way analysis of variance. The second step (WABA II) looks at relationships between two variables to determine whether the correlation between two variables is a function of between-group covariance, within-group covariance, or both. An inference is drawn from the WABA II statistical tests, which examined the magnitude of the between-group correlation (using a t-test of statistical significance) and the difference between the between-group and within-group correlation (using a modified Z-test as described in Markham, Dansereau, Alutto, and Dumas (1983). The formula for the Z-test is shown below[15].

$$Z_{BW} = \frac{Z'_B - Z'_W}{\sqrt{1/(N-J-2) + 1/(J-3)}}$$

In the third step of WABA, the results from WABA I and WABA II are compared for consistency, and a final induction is drawn. Dansereau et al. (1984) provide guidelines for combining inductions from WABA I and WABA II for a final induction (see Table 3.10). A Category I induction is stronger than a Category II induction because there is

[15] The transformation of $r_{xy,B}$ and $r_{xy,W}$ to Z'_B and Z'_W is done using Table A.2 in Dansereau et al. (1984), which uses the hyperbolic tangent function.

more evidence for the final induction in that WABA I and WABA II provide consistent results and inductions.

Table 3.10. Illustration of Inductions from WABA I and II.
(taken from Dansereau et al., 1984)

	WABA I Induction	WABA II Induction	Final Induction
Category I (stronger)	Wholes	Wholes	Wholes
	Parts	Parts	Parts
	Equivocal	Equivocal	Equivocal
	Null	Null	Null
Category II (weaker)	Equivocal	Wholes	Wholes (weaker)
	Wholes	Null	Wholes (weaker)
	Equivocal	Parts	Parts (weaker)
	Parts	Null	Parts (weaker)
Category III	Wholes	Parts	None
	Parts	Wholes	None
	Wholes	Equivocal	None
	Parts	Equivocal	None

There are four inductions possible when combining the results of WABA I and II tests (Markham, 1988; Yammarino & Markham, 1992). First, if results indicate that variation and covariation are more likely to occur between rather than within groups, then there is a relationship at the team level between two variables; in other words, there is "team effect"[16] and this is called a "wholes" condition. In this condition, any variation within groups is viewed as error. Second, when WABA I and II results indicate that differences are more likely to occur within groups rather than between groups, "the relationship is also relevant for the groups but is applicable in terms of the interdependent parts of the groups" (Yammarino & Markham, 1992, p. 170). In this condition, called a "parts" condition, variation between groups is viewed as error. The third induction is equivocal, where variation both between and within groups is found which makes an induction of

[16] The terms "group" and "team" in this chapter are used synonymously.

wholes or parts erroneous, therefore, no inference is made. In the last condition, a null condition[17], variation is found neither between nor within entities.

For this research, the interest and focus was on variables for which a wholes induction could be drawn. The research focus was on teams, and the researcher wished to draw conclusions about relationships between variables *at the team level.* WABA, through its use of the covariance equation to partition the variance and covariance between two variables, allowed the researcher to determine whether or not the relationship between two variables is actually a team-level phenomenon (a wholes condition).

In order for a final wholes inference to be drawn for any relationship between two variables, there are several criteria in WABA that must be met. The first criteria is that teams are significantly different from each other for both variables, which is assessed by the WABA I F-tests (a test of *statistical* significance for each variable individually). The second criteria is that teams which report higher on one variable also on average report higher on the second variable, which is assessed by the WABA II test for the between-team correlation, r_b (a *magnitude* test of *statistical* significance). Third, the between-team correlation, r_b, is significantly higher than the within-team correlation, r_w, as assessed by the WABA II Z-test (a *difference* test of *statistical* significance). An additional test, of *practical significance*, is a comparison of the "between component" of the covariance equation (the first half of the right-hand side of the covariance equation) to the "within component" (the second half of the right-hand side of the covariance equation). This practical significance test is aligned with a wholes condition if the between component is greater than the within component, although this is not required for a final wholes inference.

The degrees of freedom for WABA tests in this research are N=130 individuals and J=15 teams, which makes degrees of freedom for r_T=N-2=128, the degrees of freedom for r_b=J-2=13, and the degrees of freedom for r_w =N-J-1=114.

[17] This condition is called "inexplicable" by Dansereau et al. (1984).

3.3.4. Analysis Method for Research Question 5

As mentioned earlier in this chapter, qualitative data were collected from members of National Grocers and Virginia Tech teams in two ways: in open-ended questions in the Design and Leadership Team Survey and in interviews with one member of each team. The qualitative data of particular interest from the survey questionnaire were responses to the following two questions:

- What are the biggest things contributing to the team's effectiveness?
- What are the biggest obstacles to the team's effectiveness?

Responses from all 130 participants were entered into the computer and were clustered into "themes" which corresponded to variables in the operational research model. The same themes were used to cluster responses to both questions above ("contributors" and "obstacles"). Within a theme, the number of comments from the survey was counted (a frequency measure), and the number of teams over which comments were dispersed was also counted (a dispersion measure). For each theme, these two numbers were multiplied to obtain a number which accounts for both frequency and dispersion over teams in the research sample. Themes were then ranked using this product, in descending order. This ranking procedure was used for both contributors to and obstacles to team effectiveness.

Qualitative data from interviews with members of National Grocers and Virginia Tech teams were coded using the variables in the operational research model as the code list. In this way, theory (which was used to develop the operational research model) guided the qualitative data analysis. Specific quotes from interviews with team members were used to illuminate quantitative results.

Additionally, qualitative data was collected in interviews and a focus group at Eastman, the third research site. Individual interviews were recorded and were transcribed. Key learnings were extracted from interview transcripts and were clustered into major categories.

3.4. Summary

This chapter outlined how data were collected, how variables in this research were operationalized, and how data were analyzed using a variety of quantitative statistical techniques supplemented by qualitative techniques. The primary focus of the research was Research Question 4 (to develop a deeper understanding of what leads to team effectiveness for cross-functional design teams). The strategy used to analyze data was one of successively narrowing the number of independent variables (design features) to be considered in analysis, by eliminating those variables which did not have a significant relationship with team effectiveness, which did not have a team-level relationship with team effectiveness, and which did not uniquely contribute to explaining variance in team effectiveness. This strategy fulfills a need identified by McGrath (1986) to use multiple data analysis methods in group effectiveness research.

Chapter 4 Results

The purpose of this chapter is to present the results from quantitative and qualitative data analysis performed to address the research questions and hypotheses described in Chapter 1. Conclusions and inferences from these results are presented in the Chapter 5, while Chapter 6 focuses on practical implications of these research conclusions and provides recommendations for practitioners.

The overall research questions in this dissertation are shown in Table 4.1, which were described in earlier chapters. Following each overall research question is a brief description of the data analysis method, as well as a brief summary of the results obtained. For Research Question 1 (a descriptive question), research hypotheses were not tested, and summary of results is not applicable.

As mentioned earlier in this dissertation, Research Question 4 represented the primary focus of this research: which design features have the most significant relationship with team effectiveness? Multiple data analysis techniques were used to address this question in order to successively narrow the number of independent variables, to arrive at a set of independent variables (design features) for which there was a significant relationship with team effectiveness and for which there was a relationship at the team level (i.e., there was a clear "team effect" between independent variables and team effectiveness). The intention was to be able to identify a smaller set of variables to be entered into a multiple regression model (for which there were limited degrees of freedom with a sample size of 15 teams). The data analysis techniques for Research Question 4 included: bivariate correlations to examine the relationship between an independent variable and dependent variables, Within and Between Analysis (WABA) to identify relationships between independent and dependent variables operating at the team level, partial correlations to identify those variables uniquely contributing to explaining variance in the dependent variables, and multiple regression analysis to examine the strength of relationship between variables in predicting team effectiveness in the context of other variables.

Before any of the hypotheses were tested, the data were examined for missing values. The following variables had missing values (out of 130 people): age (DMAGE; 11; 8.5%), job tenure (DMJOBTEN; 5; 3.8%), team member tenure (MBRTEN; 10; 7.7%), comprehensive design process (CMPDES; 8; 6.2%), defined design process (DEFPRC; 3; 2.3%), keeping stakeholders informed (STKINF; 1; 0.8%), percent of time on team (PRCTIME; 2; 1.5%), time spent in education/training/development (ETDTIME; 3; 2.3%), and team performance (TMPERF2; 3; 2.3%). Because the proportion of missing values compared to total possible values was not extreme, missing values were replaced by the overall mean of each variable before hypotheses were tested. The exception to this is PRCTIME, for which the two missing values were replaced by the mean for the team rather than the overall mean because of the differences between teams in this variable.

Throughout this chapter, results that are significant at the .01, .05, and .005 level (i.e., less than .01, .05, and .005) are indicated with a single, double, and triple asterisk, respectively.

Table 4.1. Summary of Overall Research Questions, Data Analysis Method, and Research Results.

Research Question	Data Analysis Method	Summary of Research Results
Research Question 1: What are the team characteristics and attributes for design teams in this research?	Descriptive statistics on independent variables to describe design teams in the research sample.	Not applicable
Research Question 2: Are there differences in team effectiveness for teams using different redesign methodologies?	Multivariate analysis of variance with three dependent variables and team methodology (TMMETH) as a factor having four levels.	There were significant differences between teams using different methodologies for redesign ($p < 0.001$ for all three dependent variables).
Research Question 3: Which design features have the greatest variation between design teams?	One-way analysis of variance using team number as a factor with 15 levels (corresponding to 15 teams), treating the design features as dependent variables. The *eta*-between and *eta*-within were calculated for independent variable (design feature).	All independent variables had significantly more variation between teams than within teams ($p<.05$),with the exception of job tenure ($p=.09$), meeting attendance ($p=.64$), and release time ($p=.21$).
Research Question 4: Which design features have a significant relationship with design team effectiveness?	1. Bivariate Pearson's correlation coefficients were calculated using weighted group means for each independent variable with the three dependent variables. 2. Within and Between Analysis (WABA) was used to identify only those relationships at the team level. 3. Partial bivariate Pearson's correlations were calculated for the remaining variables. 4. Remaining variables were analyzed using multiple regression.	Team skills and clarity in team sponsor expectations were significantly related to team performance at the team level ($r=.83$, $p< 0.005$, and $r=.89$, $p<.005$, respectively). These design features were the two most significant predictors of team performance ($p< 0.0005$ for both). Similar results were obtained for the second team performance measure. Team self-assessment was significantly related to team satisfaction at the team level ($r=.84$, $p< 0.005$) and was the most significant predictor of team satisfaction ($p= 0.0001$).
Research Question 5: What are the key learnings from organizations using design teams?	Content analysis was used to extract key learnings from survey questionnaire and interview data.	Teams attributed factors internal to the team as contributing to team effectiveness, but attributed factors external to the team as obstacles to team effectiveness. Key learnings from Eastman Chemical Company were categorized into team start-up, team functioning and development, team transition and hand-off, and overall strategy.

4.1. Research Question 1

This question asks: What are the typical team characteristics for intact design teams? In other words, what does a typical team look like in terms of the design features included in this study? To address this question, descriptive statistics were summarized for each team and for teams overall. Table 4.2 summarizes information about each team: the full name of each team, the abbreviation for the team's name, which organization each team was from, the type of team, the "target system" each team focused on for redesign, and the current status of each team as of this writing.

In Table 4.3, teams are described according to many of the design features included in this research, for example, team size, team composition, and so forth. Variables in the operational research model which were measured using scales of team members' perceptions are not described in Table 4.3 (for example, team unity, team commitment). Instead, these data were analyzed to address Research Question 4. The design features from the operational research model which are summarized in Table 4.3 are: demographics (gender, race, age, organization tenure, job tenure), cross-functional representation on team, multi-level representation on team, team turnover, team size, co-location, team age, team charter status, meeting frequency, percent of time devoted to team, and time members spent in education/training. In Table 4.3, team names have been abbreviated.

Table 4.2. Summary of Teams in the Research Sample.

Team Abbreviation	Full Team Name	Organization	Type of Team and Target System	Status of Team (at time of this writing)
Fin SMT	Finance Senior Management Team	National Grocers	Top management team with ownership for change; target system was Finance Division	Active
ISD DDT	Information Services Division Design and Development Team	National Grocers	Design team; target system was IS Division	Disbanded, fulfilled purpose (team was on hiatus at time of data collection, disbanded immediately after)
SST	Staff Support Team	Virginia Tech	Resource and staff team to other teams; target system was teams/processes within Project ENABLE	Active
IPCF DDT	IPCF (Property Management Division) Design and Development Team	National Grocers	Design team; target system was IPCF Division	Active
DSOTF DDT	Distribution System of the Future Design and Development Team	National Grocers	Design team; target system was the Distribution System (one level higher than Distribution Centres)	Disbanded, reformulated twice since this team was active (5 months elapsed between time team last met and time of data collection)
DET	Direct Entry Team	Virginia Tech	Design team; target system was the direct entry approval concept and process	Disbanded, fulfilled purpose (1 month elapsed between last team meeting and time of data collection)
OLT	Ottawa Leadership Team	National Grocers	Leadership team; target system was the Ottawa Distribution Centre	On hiatus, due to labor negotiations (was active at time of data collection)
PLT	Peterborough Leadership Team	National Grocers	Leadership team; target system was the Peterborough Distribution Center (warehouse)	Disbanded/ reformed to much smaller size (2 months elapsed between last team meeting and time of data collection)

Table 4.2 (cont'd). Summary of Teams in the Research Sample.

Team Abbrev.	Full Team Name	Organiza-tion	Type of Team and Target System	Status of Team (at the time of this writing)
TELT	Time Entry/Leave Team	Virginia Tech	Design team; target system was the wage time entry and leave process	Full team on hiatus, sub-groups are active (full team was active at time of data collection)
BPR Pln Tm	Business Process Redesign Planning Team	Virginia Tech	Steering and high level design team; target system was all Human Resource systems/processes	Active
DLT	Direct Lending Team	Virginia Tech	Design team; target system was direct lending process	Active
CFLT	City Farms Leadership Team	National Grocers	Leadership team; target system was City Farms store	Active, had significant turnover after time of data collection
SRLT	Surveyor Road Leadership Team	National Grocers	Leadership team; target system was Surveyor Road Distribution Centre	Active, had turnover since time of data collection
RA Tm	Resource Allocation Team	Virginia Tech	Design team; target system was position and salary budgeting process.	Disbanded, fulfilled purpose (2 months elapsed between last team meeting and time of data collection)
SMW Str Tm	Slow Moving Warehouse Steering Team	National Grocers	Project team coordinating design and start-up of new warehouse; target system was Slow Moving Warehouse	Active but in decline

Table 4.3. Research Question 1: Descriptive Attributes of Teams in this Research.

Team and Team Size	Gender† (No. Males/ Female)	Race† (No. mbrs non-"White")	Mean Age†, yrs	Mean Educ Level*†	Mean Orgn Tenure†, yrs	Mean Job Tenure†, yrs
Fin SMT 12/13 mbrs resp	11 Males 1 Female	0 mbrs	38.33	8.08	8.84	3.29
ISD DDT 8/8 mbrs resp	5 Males 3 Females	0 mbrs	40.33	6.88	11.41	2.63
SST 5/5 mbrs resp	3 Males 2 Females	1 mbr	52.00	9.40	18.87	.93
IPCF DDT 4/4 mbrs resp	3 Males 1 Female	0 mbrs	42.25	7.00	10.60	3.88
DSOTF DDT 9/11 mbrs resp	7 Males 2 Females	0 mbrs	40.29	6.67	11.49	1.93
DET 7/7 mbrs resp	4 Males 3 Females	1 mbr	41.86	8.71	13.47	6.49
OLT 15/15 mbrs resp	12 Males 3 Females	0 mbrs	39.00	4.93	14.54	6.58
PLT 15/16 mbrs resp	12 Males 3 Females	1 mbr	38.93	4.87	13.08	6.56
TELT 9/9 mbrs resp	4 Males 5 Females	1 mbr	46.22	7.89	17.80	8.05
BPR Pln Tm 7/7 mbrs resp	3 Males 4 Females	0 mbrs	44.86	8.71	20.83	6.63
DLT 8/8 mbrs resp	5 Males 3 Females	0 mbrs	40.71	8.50	14.91	7.68
CFLT 9/9 mbrs resp	7 Males 2 Females	1 mbr	35.86	6.78	6.55	2.17
SRLT 11/11 mbrs resp	10 Males 1 Females	0 mbrs	34.60	5.50	8.29	3.20
RA Team 6/6 mbrs resp	3 Males 3 Females	0 mbrs	44.80	9.67	14.31	7.28
SMW Str Tm 6/6 mbrs resp	6 Males 0 Females	0 mbrs	35.83	7.67	7.57	1.57
Overall Mean Team Size: 9.0 mbrs	94 Males 36 Females	114 Whites 5 non-Whites 11 Missing	Overall mean††: 40.4 yrs	Overall mean††: 7.04 (some college/univ)	Overall mean††: 12.65 yrs	Overall mean††: 4.76 yrs

*Education Level: 1=some elementary school, 2=completed elementary school, 3=some high school, 4=graduated from high school or HSE, 5=some technical or vocational training beyond high school, 6=graduated from vocational school, 7=some college/univer. education, 8=graduated from college/univer., 9=some graduate school, 10=completed graduate degree.

†Missing values were not replaced for these descriptive summaries.

††Overall means were obtained from the total data file of n=130 individuals, not from averaging the group means.

Table 4.3 (cont'd). Research Question 1: Descriptive Attributes of Teams in this Research.

Team and Team Size	Team Age, months (age at the time team was surveyed or at time disbanded)	Team Methodology for Change/ Redesign*	Cross-Functional Repr.: No. fcnl areas/units represented	Multi-level Repr.: No. organization levels represented	Co-location: No. locations team is dispersed over
Fin SMT 12/13 mbrs resp	20	GSS	9	4	4
ISD DDT 8/8 mbrs resp	20	GSS	7	4	1 (co-located)
SST 5/5 mbrs resp	7	SPT/STR	3	2	1
IPCF DDT 4/4 mbrs resp	4	GSS	9	1	2
DSOTF DDT 9/11 mbrs resp	6	GSS	6	4	6
DET 7/7 mbrs resp	9	BPR/CPI	5	2	2
OLT 15/15 mbrs resp	10	IMPROVE	9	4	1 (co-located)
PLT 15/16 mbrs resp	29	GSS	8	3	1 (co-located)
TELT 9/9 mbrs resp	7	BPR/CPI	9	3	8
BPR Pln Tm 7/7 mbrs resp	6	SPT/STR	6	3	5
DLT 8/8 mbrs resp	8	BPR/CPI	3	1	3
CFLT 9/9 mbrs resp	11	IMPROVE	7	3	3
SRLT 11/11 mbrs resp	9	GSS	5	4	1 (co-located)
RA Team 6/6 mbrs resp	7	BPR/CPI	6	2	5
SMW Str Tm 6/6 mbrs resp	11	SPT/STR	4	1	4
Totals/Averages:	Overall Mean†: 12.4 months	Mode: GSS	Overall Mean†: 6.4 fcnl areas	Overall Mean†: 2.7 levels	Overall Mean†: 3.1 locations

* Team Methodology for Change/Redesign: 1=IMPROVE, 2=Grand Strategy Systems (GSS), 3=Business Process Redesign/Continuous Process Improvement (BPR/CPI), and 4=Support/Steering Team (Spt/Str)
†Overall means for team attributes were not weighted to account for differences in team size.

Table 4.3 (cont'd). Research Question 1: Descriptive Attributes of Teams in this Research.

Team and Team Size	Team Turnover	Team Charter Status	Meeting Frequency, times per month	Mean Percent of Time Devoted to Team	Mean Time Spent in ETD Last 12 Months (Days)
Fin SMT 12/13 mbrs resp	Some turnover	Team-developed charter	4	12.50	6.54
ISD DDT 8/8 mbrs resp	Some turnover	Team-developed charter	4	22.50	9.00
SST 5/5 mbrs resp	Some turnover	Team-developed charter	4	88.75	7.40
IPCF DDT 4/4 mbrs resp	No turnover	No charter	2	10.00	9.25
DSOTF DDT 9/11 mbrs resp	No turnover	No charter	1	14.61	14.56
DET 7/7 mbrs resp	No turnover	Team-reviewed charter	4	13.93	12.71
OLT 15/15 mbrs resp	Some turnover	No charter	4	39.00	27.45
PLT 15/16 mbrs resp	A lot of turnover	No charter	2	23.67	17.43
TELT 9/9 mbrs resp	No turnover	Team-reviewed charter	4	6.56	8.31
BPR Pln Tm 7/7 mbrs resp	No turnover	Team-reviewed charter	4	9.00	20.43
DLT 8/8 mbrs resp	No turnover	Team-developed charter	2	56.25	8.88
CFLT 9/9 mbrs resp	A lot of turnover	No charter	4	32.56	38.20
SRLT 11/11 mbrs resp	A lot of turnover	Team-developed charter	4	28.50	16.60
RA Team 6/6 mbrs resp	No turnover	Team-reviewed charter	4	14.50	10.67
SMW Str Tm 6/6 mbrs resp	Some turnover	Team-reviewed charter	2	37.50	11.33
Totals/Averages:	Mode: No turnover	Mode: No charter	Mean: 3.27 Mode: 4	Weighted Mean: 26.5%	Weighted Mean: 15.76 days

Additional description of teams in this research sample and examples of redesign initiatives teams performed is useful here to supplement the data in the previous tables. There were nine teams at National Grocers that were studied and six teams at Virginia Tech, which were part of Project ENABLE, the university-wide effort to redesign core administrative systems. At National Grocers, four teams were focused on a distribution centre/warehouse (the PLT, OLT, SRLT, and the SMW Steering Team), three teams were in support divisions (Finance, Information Services, and Property Management (IPCF)), one team was at the Distribution System level (one level higher than the distribution centres), and one team was focused on redesign for a store (the CFLT).

At Virginia Tech, there were four design teams focusing on a specific process to redesign, three of which were within the human resource core system (the TELT, RA Team, and the DET) and one was within the student core system (the DLT). A fifth team was a high level design and steering team that coordinated business process redesign efforts within all human resource systems and chartered other focused BPR design teams (the BPR Planning Team). The sixth Virginia Tech team was a resource and support team to all of the teams in Project ENABLE (the Staff Support Team), and focused on establishing processes and systems to support the achievement of the overall Project.

At the time of this writing, eight of the fifteen teams were still active, two were on hiatus for varying reasons, and five were disbanded. Team summaries based on the Design and Leadership Team Survey which team members completed are shown in Appendix F. These team summaries include summary information on: team roles, skills of team members, percent of time the team spent in various stages of the change/redesign process, assessment of the team's effectiveness (using team performance-2), identity of the team's sponsor, the sponsor's expectations for deliverables and for creating results in the target system, results achieved by the team, contributors to team effectiveness, and obstacles to team effectiveness.

As mentioned earlier in this dissertation, the commonality that all teams in this study shared was the responsibility to redesign a sociotechnical system, whether a distribution warehouse, knowledge-work support division or administrative process. Teams had to address technology redesign as well as redesign of the social system. Several examples of the kinds of specific redesign tasks teams were involved with are provided here.

One of the major organization-wide efforts within National Grocers was the reengineering of the distribution supply chain, from acquiring grocery product from suppliers such as Procter & Gamble to stocking store shelves with product. This supply chain spans the entire Distribution System within National Grocers. Part of the reengineering effort involved centralizing all product characterized as "slow-moving" into a new warehouse (called the slow-moving warehouse). Slow-moving products from other warehouses were transferred to the slow-moving warehouse. The SMW Steering Team was responsible for the overall design, construction, and start-up of this new warehouse. This team had to make design choices about technology (for example, what technology would be used for valuable "bond" product, such as cigarettes, and the layout of the warehouse) and about "people" systems (such as how to select new employees and how to train new employees).

Concurrent with the start-up of the slow-moving warehouse, other distribution warehouses were charged with "fast-moving realignment," also part of the supply chain reengineering effort. The other warehouse design teams in this research sample (the PLT, the OLT, and the SRLT) were responsible for realignment of their fast-moving product (retained in these other warehouses). One warehouse design team managed the fast-moving realignment in the following way. The warehouse layout was redesigned and aligned with the layout of the warehouse's major customer (one line of stores). As a result of this redesigned warehouse layout, employees would select product to assemble an order for a store which was laid out in the same way the stores shelves were stocked, so that the unloading process at the store would be much more efficient.

Another example of a redesign initiative of teams in this research sample relates to the education and training system. The Surveyor Road Leadership Team decided to address the problem of very high attrition of new employees by redesigning the new hire training process. After redesigning the process, the percentage of new hire retention after the 8-week training period increased from 33% to 85%, a significant improvement.

A Virginia Tech team, the Direct Lending Team, provides an example of redesigning a core administrative process. This team was responsible for designing a new process, the direct lending process, and redesigning aspects of existing processes in Student Accounts and Financial Aid. Virginia Tech had made the decision to participate in the U.S. Department of Education's program to provide loans directly to students, coordinated by the university without the involvement of banks. The team had to redesign the information technology to provide direct lending, by addressing new computer equipment, software from the Department of Education, and the compatibility of new equipment with the university mainframe. In addition, the team addressed how to train employees in the direct lending process, communicated the new process to students and parents, and specified how Student Accounts and Financial Aid needed to cooperate and share information for the new process to work successfully.

Without providing specifics, other examples of redesign initiatives of teams in this research sample included developing and implementing a performance measurement system (common to all of the National Grocers teams), warehouse and store layout, information technology, and organizational restructuring.

4.2 Research Question 2

This research question asks: Are there differences in team effectiveness for teams using different methodologies for redesign? The research sample included teams using four different methodologies as the guiding structure for change and redesign in the target system (this variable is "TMMETH"): IMPROVE, GSS, BPR/CPI, and Support/Steering teams. As described in Chapter 3, this research question was addressed using multivariate analysis of variance (MANOVA) with the three dependent variables: team performance-1, team performance-2, and team satisfaction (TMPERF1, TMPERF2, and TMSATF), using team methodology (TMMETH) as the independent variable having four levels (IMPROVE, GSS, BPR/CPI, and SPT/STR). All multivariate tests indicate significant overall differences in the dependent variables between the four groups (all multivariate tests $p < 0.001$). MANOVA univariate tests for each dependent variable and group means for the dependent variables are shown in Tables 4.4a and 4.4b.

Table 4.4a. Research Question 2: Univariate Tests for Dependent Variables by Team Methodology.

Dependent Variable	Hypoth. MS	Error MS	F statistic	Significance of F
TMPERF1	15.68	.34	46.20	0.000
TMPERF2	2223.78	48.74	45.63	0.000
TMSATF	4.34	.29	14.63	0.000

Univariate F-tests with (3,126) D. F.

Table 4.4b. Research Question 2: Group Means for Dependent Variables by Team Methodology.

Group (by TMMETH)	Team Performance-1	Team Performance-2	Team Satisfaction
1=IMPROVE (2 teams)	4.52	70.47	5.53
2=GSS (6 teams)	3.36	64.16	4.76
3=BPR/CPI (4 teams)	4.52	80.08	4.75
4=SPT/STR (3 teams)	4.69	80.07	5.26

Univariate tests indicate that there were differences between teams using the four methodologies on team performance-1 (TMPERF1, $p < 0.001$), team performance-2 (TMPERF2, $p < 0.001$), and on team satisfaction (TMSATF, $p < 0.001$). To detect whether the four groups were significantly different from each other (vs. having overall differences between the four groups) one-way ANOVA with Bonferroni's post-hoc multiple range test was used (results are shown in Table 4.4c)[1].

[1] Based on the advice of the Statistical Consulting Center at Virginia Tech, Bonferroni's test was used as a post-hoc multiple range test rather than Duncan's test which was viewed to be too liberal or Scheffe's test which was viewed to be too conservative.

Table 4.4c. Research Question 2: Bonferroni's Multiple Range Test for Dependent Variables by Team Methodology.

Variable **TMPERF1** Group Mean: Tm Perf1 TDS
By Variable TMMETH Team Methodology

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Mean	TMMETH	GSS	IMPROVE	BPR/CPI	SPT/STR
3.3578	GSS				
4.5167	IMPROVE	*			
4.5244	BPR/CPI	*			
5.1667	SPT/STR	*			

Variable **TMPERF2** Group Mean: Tm Perf2 DLTS
By Variable TMMETH Team Methodology

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Mean	TMMETH	GSS	IMPROVE	SPT/STR	BPR/CPI
64.1615	GSS				
70.4708	IMPROVE	*			
80.0732	SPT/STR	*	*		
80.0844	BPR/CPI	*	*		

Variable **TMSATF** Group Mean: Tm Satisfaction
By Variable TMMETH Team Methodology

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Mean	TMMETH	BPR/CPI	GSS	SPT/STR	IMPROVE
4.7500	BPR/CPI				
4.7586	GSS				
5.2593	SPT/STR	*	*		
5.5278	IMPROVE	*	*		

For team performance-1 (TMPERF1), the group means, in order of increasing team performance, were: GSS, IMPROVE, BPR/CPI, and SPT/STR. Bonferroni's test indicates that GSS teams had significantly lower team performance (at the .05 level) than all other teams. In other words, there were two significantly different clusters.

For team performance-2 (TMPERF2), the group means in order of increasing team performance, were: GSS, IMPROVE, SPT/STR, and BPR/CPI. Bonferroni's test indicates that GSS teams had significantly lower team performance than IMPROVE teams, which had significantly lower team performance than BPR/CPI and SPT/STR teams. In other words, there were three significantly different clusters.

For team satisfaction (TMSATF), the group means in order of increasing team satisfaction, were: BPR/CPI, GSS, SPT/STR, and IMPROVE. Bonferroni's test indicates that BPR/CPI and GSS teams had significantly lower team satisfaction than SPT/STR teams and IMPROVE teams. In other words, there were two significantly different clusters.

Considering variables other than team performance and satisfaction, there were significant differences between the four groups on the following additional variables: team skills, defined design process, comprehensive design process, team commitment, team unity, team self-assessment, team roles, team leadership, e-mail capability, clarity in sponsor expectations, keeping stakeholders informed, commitment-building, inter-organizational perspective, percent time on team, education time, organizational support to team, and organizational support to individuals.

4.3. Research Question 3

This research question asks: Which design features have the greatest variation between design teams? To answer this question, the *eta*-between and *eta*-within were calculated for each independent variable (i.e., design feature) and for the three dependent variables. The *eta*-between measures the proportion of variation in a given variable that comes from between teams, while *eta*-within measures the proportion of variation that comes from within teams. These etas were also used to address the Research Question 4 using Within and Between Analysis. The etas were obtained using one-way analysis of variance (ANOVA). The *eta*-between for a variable is equal to the square root of the R^2 from the ANOVA, and the *eta*-within is equal to the square root of $(1 - R^2)$.

The output from SPSS from ANOVAs is shown in Appendix E and is summarized in Table 4.5, where the *eta*-between, *eta*-within, and the p-value from the F-test for the significance of *eta*-between are shown for each variable in the research model[2]. The variables are listed in descending order of *eta*-between. As seen from the table, for all but three variables (job tenure (DMJOBTEN), meeting attendance (MTGATN), and release time (RELTIME)), the *eta*-between (the proportion of variance between teams) was significant at the .05 level. That is, for all but three variables, there was significantly more variation between teams than within teams. These data indicate that using group means to represent a team in further analysis for these variables is meaningful and valid.

4.4. Research Question 4

As described in Chapter 3 and summarized earlier in this chapter, multiple statistical techniques were used to address this research question: Which design features have the most important relationship with team effectiveness? Bivariate correlations are reported first in this chapter (using Pearson's product moment correlation coefficient[3]). Next, Within and Between Analysis was used to identify those variables having a relationship with team effectiveness at the team level. Third, partial correlations were used to streamline the list of variables to include only those which uniquely contributed to explaining variance in the dependent variables. Lastly, the remaining variables were entered into a multiple regression model for each of the three dependent variables. This strategy is portrayed as a flowchart in Figure 4.1 (repeated from Chapter 3).

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[2] Note that none of the variables for which data were obtained using individual interviews were included in addressing this research question. Because only one person on each team was interviewed and provided a response, there was no variation within teams to compare to between-team variation. These variables excluded from this research question were: cross-functional representation (XFCNS), multi-level representation (MLVLS), team turnover (TRNVR), team size (TMSIZE), colocation (LCNS_SZ), team age (TMAGE), team charter (TMCHRT), and meeting frequency (MTGFRQ).

[3] Pearson's product moment correlation coefficients are reported even though much of the data for variables is ordinal data, a fairly common practice in survey research. However, the researcher also calculated nonparametric correlations using Spearman's and Kendall's tau-b correlation coefficients (these results are only mentioned in the chapter if they differed from Pearson's). Very similar results were obtained for parametric and nonparametric correlations.

Table 4.5. Research Question 3: *Eta*-Between and *Eta*-Within for All Variables (Decreasing Order of *Eta*-Between).

Independent Variable	Variable Name	*Eta*-Between	*Eta*-Within	Significance Level for F-test of *Eta*-Between
EMAIL	E-mail capability	.8718	.4899	p< 0.0001
DMEDL	Diversity, education level	.7029	.7127	p< 0.0001
TMPERF1	Team performance-1 (TDS)	.7837	.6212	p< 0.0001
TMUNTY	Team unity	.6826	.7308	p< 0.0001
ORGSPTTM	Organization support to team	.6810	.7323	p< 0.0001
CLRSPNEX	Clarity in sponsor expectations	.6086	.7935	p< 0.0001
CMTBLD	Commitment-building with stakeholders	.6000	.8025	p< 0.0001
TMSKLS	Team skills	.5991	.8007	p< 0.0001
TMSATF	Team satisfaction	.5747	.8184	p< 0.0001
TMDEC	Team decision processes	.5666	.8240	p< 0.0001
TMPERF2	Team performance-2 (DLTS)	.5619	.8272	p< 0.0001
TMCMT	Team commitment	.5610	.8278	p< 0.0001
TMASSMNT	Team self-assessment	.5514	.8342	p= 0.0001
CMPDES	Comprehensive design process	.5397	.8418	p= 0.0001
STKINF	Keeping stakeholders informed	.5357	.8444	p= 0.0002
ETDTIME	Time in education/training	.5315	.8417	p= 0.0002
DMAGE	Diversity in age	.5123	.8588	p= 0.0008
TMLDR	Team leader	.5040	.8637	p= 0.0013
SYSPERS	Systemic perspective	.5034	.8641	p= 0.0013
DMORGTEN	Diversity in organization tenure	.5017	.8650	p= 0.0015
INTRORG	Inter-organizational perspective	.5012	.8653	p= 0.0015
CMFRQ	Communication frequency between meetings	.4978	.8673	p= 0.0018
ORGSPTIN	Organization support to individuals	.4815	.8765	p= 0.0042
INDGLS	Individual goals	.4741	.8805	p= 0.006
TMROLES	Team roles	.4701	.8827	p= 0.0072
DEFPRC	Defined design process	.4449	.8955	p= 0.0213
DMJBTEN	Diversity in job tenure	.4034	.9150	p= 0.0903
RELTIME	Release time	.3709	.9287	p= 0.2118
MTGATN	Meeting attendance	.3063	.9519	p= 0.6376

†F-tests (14,115) d.f.

4.4.1. Bivariate Pearson's Correlation Results

Because the hypotheses that follow were written about teams (e.g., "Design teams that meet more frequently are more effective"), a group mean was used for each variable such that the sample size was 15 teams (and not 130 individual team members). The data were weighted to account for differences in team size (teams ranged from 4 to 16 members). In SPSS, this was done with the "Weight Cases" command, and the frequency variable was the number of people on each team.

For most of the hypotheses, a bivariate correlation was calculated between the independent variable (the design feature) and each of the three dependent variables. Pearson's product moment correlation (also called Pearson's correlation coefficient) was used in addition to nonparametric correlations using Spearman's correlation coefficient and Kendall's tau-b. Nonparametric correlations were not reported unless they provided different results from Pearson's correlation coefficient. Before any correlations were calculated, scatter plots of each independent variable with each of the three dependent variables were examined to check if there were any clear non-linear relationships, for which a correlation would not be an appropriate test of the relationship. With the exception of team turnover (TRNVR), discussed later, the scatter plots did not show evidence of clear non-linear relationships.

For each hypothesis posed as part of this overall research question, a table is presented containing the correlation coefficient, the sample size, and the significance level (p-value). For hypotheses where a direction was stated (e.g., a positive correlation), a one-sided test was used. For questions where there was no direction stated (may be either positive or negative correlation), a two-sided test was used. Significance levels for correlation coefficients were obtained from Table IV "Values of the Correlation Coefficient for Various Levels of Significance" from Fisher (1970).

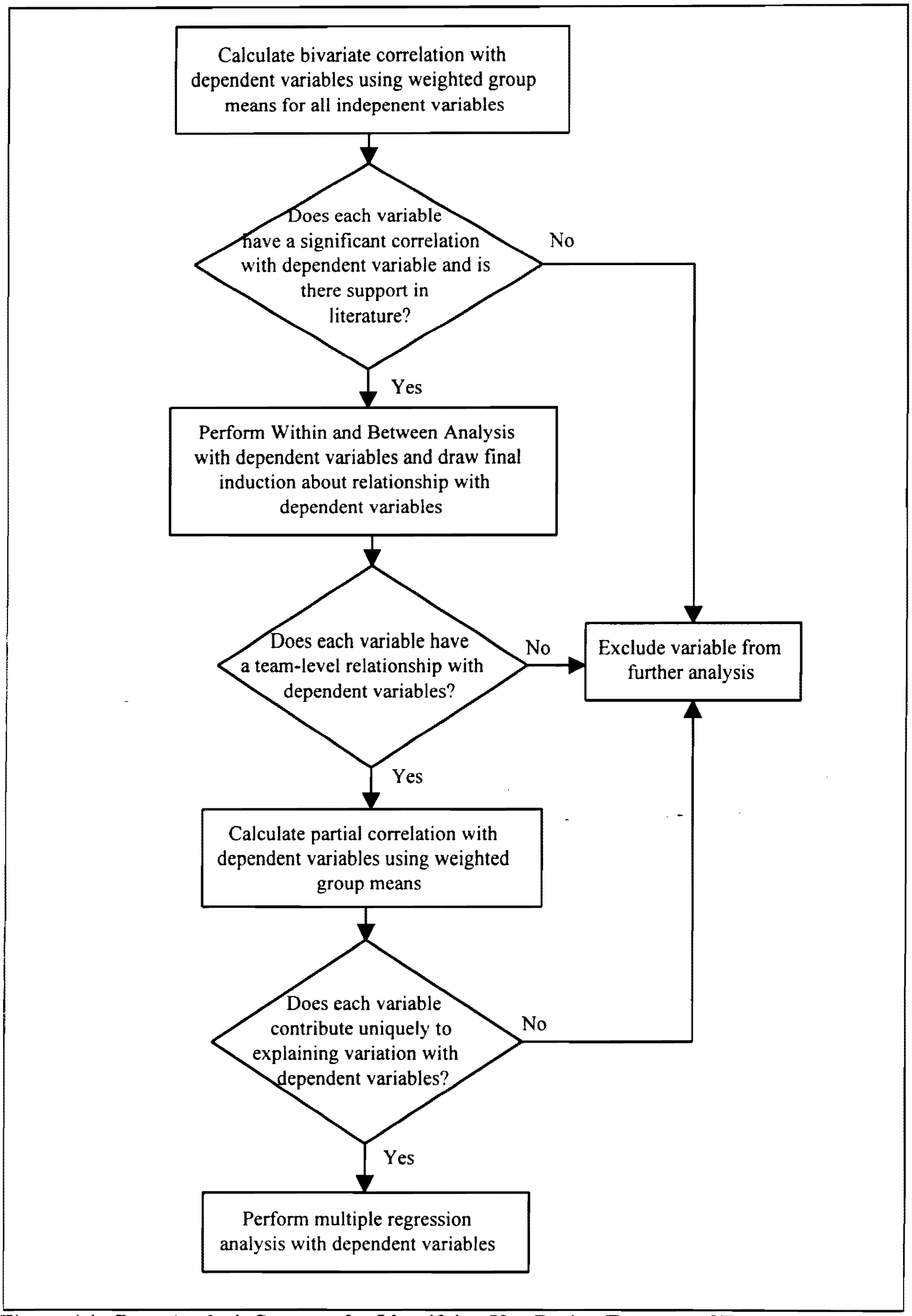

Figure 4.1. Data Analysis Strategy for Identifying Key Design Features of Team Effectiveness (Research Question 4).

Table 4.6. Summary of Pearson's Correlation Coefficient Using Weighted Group Means†.

Independent Variable	Variable Name	Team Performance-1	Team Performance-2	Team Satisfaction
DMGNDR	Diversity in Gender	-0.17	-0.05	-0.20
DMAGE	Diversity in Age	0.08	-0.08	0.06
DMEDL	Diversity in Education level	-0.69***	-0.80***	-0.30
DMORGTEN	Diversity in Organization tenure	-0.01	-0.05	0.19
DMJBTEN	Diversity in Job tenure	0.19	-0.01	0.03
TMSKLS	Team skills	0.83***	0.87***	0.64**
XFCNS	Cross-functional representation	-0.19	-0.45*	-0.17
MLVLS	Multi-level representation	-0.40	-0.60**	-0.04
INDGLS	Individual goals	0.57*	0.47*	0.71***
TRNVR	Team turnover	0.04	0.22	-0.26
TMSIZE††	Team size	-0.37	-0.64**	-0.20
LCNS_SZ††	Co-location (no. locations/size)	0.18	0.28	-0.31
TMAGE††	Team age	-0.32	-0.38	-0.24
DEFPRC	Defined design process	0.62**	0.35	0.52*
SYSPERS	Systemic perspective	0.62**	0.56*	0.66***
CMPDES	Comprehensive design process	0.05	0.09	-0.27
TMCHRT	Team charter	0.53*	0.69***	0.06
TMCMT	Team commitment	0.83***	0.81***	0.81***
TMUNTY	Team unity	0.80***	0.81***	0.69***
TMASSMNT	Team self-assessment	.89***	.84***	.84***
TMDEC	Team decision processes	0.78***	0.76***	0.54*
TMROLES	Team roles	0.55*	0.47*	0.36
TMLDR	Team leadership	0.55*	0.57*	0.32
MTGFRQ††	Meeting frequency	0.63**	0.49*	0.62**
EMAIL††	E-mail capability	0.14	0.43	-0.04
CMFRQ††	Communication frequency between meetings	-0.08	-0.10	0.28
MTGATN††	Meeting attendance	-0.21	-0.17	0.39
CLRSPNEX	Clarity in sponsor expectations	0.89***	0.78***	0.64**
STKINF	Keeping stakeholders informed	0.49*	0.58*	0.21
CMTBLD	Commitment-building with stakeholders	0.85***	0.72***	0.58*
INTRORG	Inter-organizational perspective	0.72***	0.74***	0.36
RELTIME	Release time	-0.04	0.20	0.02
ETDTIME	Time in education/ training/ devel.	0.16	-0.14	0.33
ORGSPTTM	Organization support to team	0.14	-0.00	0.27
ORGSPTIN	Organization support to individuals	0.77***	0.73***	0.75***

†Correlations, rounded to two decimal points, were based on weighted group means of 15 teams to account for differences in team size *(df=15-2)*

*p < 0.05,**p < 0.01, ***p < 0.005. All other p-values were greater than 0.05. P-values were obtained from Table IV "Values of the Correlation Coefficient for Various Levels of Significance" from Fisher (1970).

†† Signifies a two-sided test; all other significance levels were from a one-sided test.

Readers who are interested only in seeing the summary of bivariate correlations for independent variables with dependent variables should refer to Table 4.6 and skip to Section 4.4.2 (where Within and Between Analysis is described, which is the next step in data analysis for Research Question 4). For readers who are interested, the detailed analyses and results supporting Research Question 4 (i.e., each sub-hypothesis/question) are shown following Table 4.6.

4.4.1.1. Team Composition

There were nine variables clustered under the category team composition, all relating to attributes of the team or to the collection of individuals on the team: demographics, team skills (TMSKLS), cross-functional representation (XFCNS), multi-level representation (MLVLS), individual goals of team members (INDGLS), team turnover (TRNVR), team size (TMSIZE), co-location of team members (LCNS_SZ), and the age of the team (TMAGE).

Research Hypothesis 4.1: Design teams that are demographically heterogeneous are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Demographic heterogeneity was operationalized using six variables: age, gender, race, education level, job tenure, and organizational tenure. Because there was almost no variation on race (only 5 out of 130 people classified themselves as something other than "white"), this variable was excluded from further analysis. To test this research hypothesis, a measure of dispersion was needed because the hypothesis predicted that teams with more variability (i.e., heterogeneity) along demographic variables would be more effective. For age, education level, job tenure, and organizational tenure, the coefficient of variation was computed (the standard deviation divided by the mean) for each variable as a measure of dispersion. When a team is most diverse on these variables, the coefficient of variation is maximized. Because gender is a binary variable (male/female), the standard deviation rather than the coefficient of variation is maximized when a team is most heterogeneous, therefore, this dispersion measure was used instead. Below are the Pearson correlations between demographic variables and the dependent variables. The Pearson's correlation coefficients, sample size, and p-values for a one-sided test are shown in Table 4.7.

Table 4.7. Research Hypothesis 4.1: Bivariate Correlations Between Demographic Variables and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
DMGNDR (Diversity in Gender, std dev)	-.1665 n.s.	-.0473 n.s.	-.1999 n.s.
DMAGE (Diversity in Age, coef var)	.0752 n.s.	-.0776 n.s.	.0588 n.s.
DMEDL[4] (Diversity in Education Level, coef var)	-.6884 $p< 0.005$	-.8010 $p< 0.005$	-.3044 n.s.
DMORGTEN (Diversity in Orgn Tenure, coef var)	-.0069 n.s.	-.0463 n.s.	.1929 n.s.
DMJBTEN (Diversity in Job Tenure, coef var)	.1895 n.s.	-.0077 n.s.	.0253 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that demographically heterogeneous design teams, for any of the demographic variables, were more effective. And, in fact, the results indicate that heterogeneity in education level had a significant negative correlation with team performance as measured by both TMPERF1 and TMPERF2. Nonparametric correlations yield consistent results as compared to above.

[4] The between-group (between-team) correlations in this table are equivalent to the r_b in Within and Between Analysis used in the next step of the data analysis strategy for Research Question 4. In conjunction with this correlation, the within-team correlation (r_w) and the difference between the two correlations (r_w and r_b) must be examined (Z). Because diversity in education level (specifically, the coefficient of variation) was a team-level measure (variation within the team), r_w and Z are not applicable.

Research Hypothesis 4.2: Design teams whose members have relevant skills for the team task are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.8.

Table 4.8. Research Hypothesis 4.2: Bivariate Correlations Between Team Skills and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMSKLS[5] (Team skills)	.8290 $p < 0.005$	.8740 $p < 0.005$	.6405 $p < 0.01$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables. The results indicate that teams whose members perceive the team has the necessary skills were more effective (have higher team performance and higher team satisfaction). Nonparametric correlations provide consistent results.

Research Hypothesis 4.3: Design teams that have a higher degree of cross-functional representation are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.9.

[5] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for team skills are reported. For TMPERF1, r_w=.61*** and Z=1.58*. For TMPERF2, r_w=.58*** and Z=2.14*. For TMSATF, r_w=.44*** and Z=0.95 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for team skills and team satisfaction.

Table 4.9. Research Hypothesis 4.3: Bivariate Correlations Between Cross-functional Representation and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
XFCNS[6] (Cross-functional representation)	-.1893 n.s.	-.4450 $p< 0.05$	-.1689 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that teams having a higher degree of cross-functional representation (i.e., more functions represented on the team) were more effective. In fact, the correlation between XFCNS and TMPERF2 was negative and significant at the .05 level, which indicates that teams with more functions represented on the team had lower team performance as measured by TMPERF2. Nonparametric correlations yield consistent results.

Research Hypothesis 4.4: Design teams that have a higher degree of multi-level representation are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.10.

Table 4.10. Research Hypothesis 4.4: Bivariate Correlations Between Multi-Level Representation and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
MLVLS (Multi-level representation)	-.3966 n.s.	-.5909 $p< 0.025$	-.0352 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that teams with a higher number of organizational levels represented on the team

6 Because there was no variation within teams for this variable (data were collected using an interview with one team member), r_w and Z from WABA are not applicable. The same is true for the following variables (and therefore they were not included in WABA and r_w and Z are not reported): multi-level representation, turnover, team size, co-location, team age, comprehensive design process, team charter, and meeting frequency.

were more effective. The correlation between MLVLS and TMPERF2 was negative (in the opposite direction as hypothesized) and significant at the .01 level, which indicates that teams with more organizational levels represented on the team had lower team performance as measured by TMPERF2. Nonparametric correlations yield consistent results.

Research Hypothesis 4.5: Design teams whose members have individual goals are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.11.

Table 4.11. Research Hypothesis 4.5: Bivariate Correlations Between Individual Goals and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
INDGLS[7] (Individual goals)	.5702 $p< 0.025$	.4662 $p< 0.05$	.7132 $p< 0.005$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables, with the strongest relationship between INDGLS and TMSATF ($p< 0.005$). Results indicate that teams with members having clear individual goals for what they want to accomplish on the team were more effective (had higher team performance and higher team satisfaction). Spearman's correlation was significant for TMSATF ($p< 0.005$) and TMPERF1 ($p< 0.025$). Kendall's correlation coefficient was significant only for TMSATF ($p< 0.025$).

[7] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for individual goals are reported. For TMPERF1, r_w=.52*** and Z=0.23 (n.s.). For TMPERF2, r_w=.22* and Z=0.95 (n.s.). For TMSATF, r_w=.54*** and Z=0.96 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for individual goals and team performance-1, team performance-2, and team satisfaction.

Research Hypothesis 4.6: Design teams with lower turnover in membership are more effective.

Team turnover was operationalized in the following manner, using interview data: a team was classified as having 3=no turnover (no new members joined the team and no one left the team), 2=some turnover (only 1 or 2 people on the team changed, either new or left the team), 1=a lot of turnover (more than 2 people either joined the team or left the team). Because of varying team size, an alternative measure — percent of original team members remaining on team — could not be used as a valid measure.

The scatter plot for turnover (TRNVR) indicates that turnover does not appear to have a linear relationship with TMPERF1, TMPERF2, or TMSATF. Therefore, a correlation was not appropriate. A multivariate analysis of variance was used with TRNVR as the independent variable with three levels (no, some, a lot of turnover) and the three dependent variables. Bivariate correlations between TRNVR and the dependent variables are shown in Table 4.12 only to compare MANOVA results, which are summarized in Tables 4.13a and 4.13b.

Table 4.12. Research Hypothesis 4.6: Bivariate Correlations Between Team Turnover and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TRNVR (Turnover)	.0405 n.s.	.2212 n.s.	-.2642 n.s.

Degrees of freedom=15-2

Table 4.13a. Research Hypothesis 4.6: Univariate Tests for Dependent Variables by Turnover.

Dependent Variable	Hypoth. MS	Error MS	F statistic	Significance of F
TMPERF1	1.64	.68	2.40	0.094
TMPERF2	394.18	94.67	4.16	0.018
TMSATF	4.34	.33	13.21	0.000

Univariate F-tests with (2,127) D. F.

Table 4.13b. Research Hypothesis 4.6: Group Means for Dependent Variables by Turnover.

Group (by TRNVR)	Team Performance-1	Team Performance-2	Team Satisfaction
1=A lot of turnover (3 teams)	3.84	67.09	5.02
2=Some turnover (5 teams)	4.23	72.36	5.26
3=No turnover (7 teams)	3.97	72.94	4.67

Bivariate correlations between TRNVR and the dependent variables show no significant relationship. The multivariate tests indicate that overall there were significant differences on the dependent variables between teams having no, some, or a lot of turnover ($p<.001$ on all multivariate tests). The univariate tests indicate that there were no significant differences between teams on TMPERF1 ($p= 0.094$), although this is borderline. For the other two dependent variables, the univariate tests indicate that there were significant differences between teams on TMPERF2 ($p= 0.018$) and on TMSATF ($p< 0.001$).

The results do not support the hypothesis exactly as stated, and the results indicate a different trend for TMPERF2 and TMSATF. Bonferroni's multiple range test was used to determine if there were significant differences between groups (see Table 4.13c).

Table 4.13c. Research Hypothesis 4.6: Bonferroni's Multiple Range Test for Dependent Variables by Turnover.

Variable **TMPERF1** Group Mean: Tm Perf1 TDS
By Variable TRNVR Team Turnover

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

No two groups are significantly different at the .050 level.

Variable **TMPERF2** Group Mean: Tm Perf2 DLTS
By Variable TRNVR Team Turnover

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Mean	TRNVR	A lot	Some	No
67.0872	A lot			
72.3601	Some			
72.9397	No	*		

Table 4.13c (cont'd).

Variable **TMSATF**		Group Mean: Tm Satisfaction		
By Variable TRNVR		Team Turnover		
Multiple Range Tests: Scheffe test with significance level .05				
(*) Indicates significant differences which are shown in the lower triangle				
Mean	TRNVR	No	A lot	Some
4.6633	No			
5.0196	A lot	*		
5.2609	Some	*		

For TMPERF1, Bonferroni's test did not detect significant differences between any two groups. For TMPERF2, the group means in order of increasing team performance were: a lot of turnover, some turnover, no turnover. This order is as hypothesized, however, Bonferroni's test detected differences only between teams with a lot vs. no turnover. In other words, teams with no turnover had significantly higher team performance than teams with a lot of turnover (as measured by TMPERF2). For TMSATF, the group means in order of increasing team satisfaction were: no turnover, a lot of turnover, some turnover. This order is not as hypothesized. Bonferroni's test clustered teams into significantly different groups of teams having no turnover vs. teams having any turnover at all (whether some or a lot). In other words, teams that had any turnover, even if a lot, were more satisfied than teams with no turnover, which did not support the hypothesis for TMSATF.

Research Question 4.1: What effect does design team size have on team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values are shown in Table 4.14. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.14. Research Question 4.1: Bivariate Correlations Between Team Size and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMSIZE (Team Size)	-.3728 n.s.	-.6382 $p< 0.02$	-.2003 n.s.

Degrees of freedom=15-2, two-sided test

Results show that TMSIZE and TMPERF2 were negatively correlated, significant at the .01 level, which indicates that larger teams had lower team performance as measured by TMPERF2. The relationship between TMSIZE and TMPERF1 and TMSATF was also negative, but not statistically significant. Nonparametric correlations yield consistent results.

Research Question 4.2: What effect does co-location have on team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient for the variable LCNS_SZ, which is the number of locations over which a team was dispersed divided by the team size. (Different buildings within the same town or city were counted as distinct locations, as were different towns/cities). This variable was used to test this hypothesis because the variable "number of locations" by itself might be a surrogate measure for team size. Using LCNS_SZ addressed this problem. A team that was co-located (NLCNS=1) would have small values of LCNS_SZ (closer to 0 than 1), while a team whose members were dispersed over as many locations as the team size would have a value of 1 for LCNS_SZ. Correlations, sample size, and p-values are shown in Table 4.15. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.15. Research Question 4.2: Bivariate Correlations Between Co-location and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
LCNS_SZ (Number locations/ team size)	.1774 n.s.	.2810 n.s.	-.3094 n.s.

Degrees of freedom=15-2, two-sided test

The results were not significant for any of the dependent variables, and the hypothesis was not supported. Kendall's correlations yield consistent results, but Spearman's correlation between LCNS_SZ and TMPERF2 was .4703 ($p < 0.05$), which borders on being significant at the .05 level. This correlation indicates that teams that were less "co-located" had higher team performance as measured by TMPERF2.

Research Question 4.3: What effect does team age have on team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values are shown in Table 4.16. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.16. Research Question 4.3: Bivariate Correlations Between Team Age and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMAGE (Team Age)	-.3193 n.s.	-.3734 n.s.	-.2352 n.s.

Degrees of freedom=15-2, two-sided test

The results indicate that TMAGE had a negative correlation with all three dependent variables but none of them were statistically significant. Nonparametric correlations yield consistent results.

4.4.1.2. Team Technology and Task

The variables related to the design team's task and technology (methods and processes used to accomplish its task) were: defined design process (DEFPRC), systemic perspective (SYSPERS), comprehensive design process (CMPCHG), electronic mail capability (EMAIL), and team charter (TMCHRT).

Research Hypothesis 4.7: Design teams using a defined process for change/redesign are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.17.

Table 4.17. Research Hypothesis 4.7: Bivariate Correlations Between Defined Process and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
DEFPRC[8] (Defined Design Process)	.6220 $p < 0.01$	.3434 n.s.	.5160 $p < 0.025$

Degrees of freedom=15-2

The hypothesis was supported for TMPERF1 and TMSATF, but not for TMPERF2. These results indicate that teams whose members believe that the design process used is more defined had higher team performance as measured by TMPERF1 and had higher team satisfaction. None of the Kendall correlations were significant at the .05 level, but Spearman's were for TMPERF1 and TMSATF.

Research Hypothesis 4.8: Design teams using a process with a systemic perspective are more effective.

[8] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for defined design process are reported. For TMPERF1, r_w=.32*** and Z=1.32 (p=0.09). For TMSATF, r_w=.06 and Z=1.68*.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.18.

Table 4.18. Research Hypothesis 4.8: Bivariate Correlations Between Systemic Perspective and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
SYSPERS[9] (Systemic Perspective)	.6241 $p< 0.01$	.5607 $p< 0.025$	.6612 $p< 0.005$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables, and results indicate that teams using a design process having a systemic perspective (considering all key sub-systems in the target system) were more effective (had higher team performance and higher team satisfaction). Nonparametric correlations yield consistent results.

Research Hypothesis 4.9: Design teams using a comprehensive design process are more effective.

This hypothesis was tested using Pearson's correlation between comprehensive design process (CMPDES) and the dependent variables. The coefficient of variation of the percent of team time spent across stages of the design/change process was used to operationalize the concept of a "comprehensive" design, or change, process. With this operational measure, the hypothesis tested whether teams that spread their working time more across the stages of design/change were more effective as compared to those that did not (for example, teams that spent little or no time in scoping the team's task, in

[9] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for systemic perspective are reported. For TMPERF1. r_w=.31*** and Z=1.35 (p=0.09). For TMPERF2, r_w=.43*** and Z=0.56 (n.s.). For TMSATF, r_w=.26** and Z=1.71*. Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for systemic perspective and team performance-2.

education for team members, etc.). Correlations, sample size, and p-values for a one-sided test are shown in Table 4.19.

Table 4.19. Research Hypothesis 4.9: Bivariate Correlations Between Comprehensive Design Process and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
CMPDES (Comprehensive Design Process, coef var)	.0529 n.s.	.0920 n.s.	-.2652 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that teams using a more comprehensive change process were more effective. Nonparametric correlations yield consistent results.

Research Question 4.4: What effect does the capability to communicate with team members using electronic mail have on design team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values are shown in Table 4.20. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.20. Research Question 4.4: Bivariate Correlations Between Electronic Mail Capability and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
EMAIL (Electronic mail capability)	.1412 n.s.	.4284 n.s.	-.0375 n.s.

Degrees of freedom=15-2, two-sided test

Results indicate that EMAIL did not have a significant correlation with any of the dependent variables, which means there was no relationship between capability for e-mail communication and team effectiveness. Kendall's correlation yield consistent results, but Spearman's correlation between EMAIL and TMPERF2 was significantly positive (r=.5940, p< 0.02). This result indicates that teams with members who can communicate through electronic mail had higher team performance as measured by TMPERF2.

Research Hypothesis 4.10: Design teams that have a team-reviewed charter are more effective than those that develop their own charter which are more effective than those that have no charter.

The variable team charter (TMCHRT) was operationalized in the following way. A team was classified using interview data as either: 1=team did not have a charter, 2=team developed their own charter, and 3=team reviewed/gave input to a charter developed outside the team (by team leader or sponsor). The hypothesis, then, tested whether teams having a "team-reviewed charter" were more effective than teams having a "team-developed charter" which were more effective than teams with "no charter."

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.21.

Table 4.21. Research Hypothesis 4.10: Bivariate Correlations Between Team Charter and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMCHRT (Team Charter)	.5308 p< 0.025	.6906 p< 0.005	.0580 n.s.

Degrees of freedom=15-2

The hypothesis was supported for TMPERF1 and TMPERF2 but not for TMSATF. Results indicate that teams with charters had higher team performance as measured by both TMPERF1 and TMPERF2. Nonparametric correlations yield consistent results.

This hypothesis was also tested using multivariate analysis of variance with charter as a factor with three levels (1=no charter, 2=team-developed charter, and 3=team-reviewed charter). Results are shown in Tables 4.22a and Table 4.22b.

Table 4.22a. Research Hypothesis 4.10: Univariate Tests for Dependent Variables by Team Charter.

Dependent Variable	Hypoth. MS	Error MS	F statistic	Significance of F
TMPERF1	12.99	.50	25.88	0.000
TMPERF2	3076.62	52.43	58.67	0.000
TMSATF	1.39	.37	3.72	0.027

Univariate F-tests with (2,127) D. F.

Table 4.22b. Research Hypothesis 4.10: Group Means for Dependent Variables by Team Charter.

Group (by TMCHRT)	Team Performance-1	Team Performance-2	Team Satisfaction
No charter (5 teams)	3.59	63.49	4.85
Team-developed charter (5 teams)	3.99	73.13	5.17
Team-reviewed charter (5 teams)	4.71	80.30	4.90

Multivariate test results indicate that overall there were significant differences between the three groups on the three dependent variables ($p < 0.001$ for all multivariate). Univariate tests indicate that there were differences between groups on TMPERF1 ($p < 0.001$), on TMPERF2 ($p < 0.001$), and on TMSATF ($p = 0.027$). Next, group means and multiple range tests were examined to determine whether there were significant differences between groups (see Table 4.22c).

Table 4.22c. Research Hypothesis 4.10: Bonferroni's Multiple Range Test for Dependent Variables by Team Charter.

Variable **TMPERF1** Group Mean: Tm Perf1 TDS
By Variable TMCHRT Team Charter Status

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Mean	TMCHRT	No chrtr	Tm-Dev chrtr	Tm-Revw chrtr
3.5933	No chrtr			
3.9930	Tm-dev chrtr	*		
4.7067	Tm-revw chrtr	*	*	

Variable **TMPERF2** Group Mean: Tm Perf2 DLTS
By Variable TMCHRT Team Charter

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Table 4.22c (cont'd).

Mean	TMCHRT	No chrtr	Tm-Dev chrtr	Tm-Revw chrtr
63.4879	No chrtr			
73.1284	Tm-dev chrtr	*		
80.3034	Tm-revw chrtr	*	*	

Variable **TMSATF** Group Mean: Tm Satisfaction
By Variable TMCHRT Team Charter

Multiple Range Tests: Bonferroni's test with significance level .05
(*) Indicates significant differences which are shown in the lower triangle

Mean	TMCHRT	No chrtr	Tm-Revw chrtr	Tm-Dev chrtr
4.8462	No chrtr			
4.8952	Tm-revw chrtr			
5.1744	Tm-dev chrtr	*		

For TMPERF1, Bonferroni's test detected significant differences at the .05 level between each of the three groups. In other words, the group with team-reviewed charters had significantly higher team performance than the group with team-developed charters which had significantly higher team performance than the group of teams with no charter (order is as hypothesized). For TMPERF2, the result is the same: each group was significantly different from each other and the order was as hypothesized. The order of group means differed for TMSATF (in increasing order of team satisfaction, the group means were: no charter, team-reviewed charter, and team-developed charter). Bonferroni's test did not detect significant differences between each group (as it did with TMPERF1 and TMPERF2), but did show that teams having a team-developed charter had significantly higher team satisfaction than teams with no charter. Therefore, this hypothesis was supported, in the order hypothesized, for TMPERF1 and TMPERF2, but was not for the order precisely as hypothesized for TMSATF.

4.4.1.3. Design Team Processes

Design team processes were grouped into two types. The first type was intrateam processes that occur within the team: commitment to team (TMCMT), team unity (TMUNTY), team self-assessment (TMASSMNT), team decision processes (TMDEC), team roles (TMRLS), team leadership (TMLDR), meeting frequency (MTGFRQ), communication frequency between meetings (CMFRQ), and meeting attendance (MTGATN). The second type of team processes were boundary management processes: clarity in sponsor expectations (CLRSPNEX), keeping stakeholders outside the team informed (STKINF), commitment-building with stakeholders (CMTBLD), and inter-organizational perspective (INTRORG).

Research Hypothesis 4.11: Design teams with higher commitment among team members are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.23.

Table 4.23. Research Hypothesis 4.11: Bivariate Correlations Between Commitment to Team and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMCMT[10] (Commitment to Team)	.8252 $p < 0.005$	.8106 $p < 0.005$	.8131 $p < 0.005$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables. Results indicate that teams with higher commitment to the team among members were more effective (had higher team performance and higher team satisfaction). Nonparametric correlations yield consistent results.

Research Hypothesis 4.12: Design teams with higher team unity are more effective.

[10] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for team commitment are reported. For TMPERF1, r_w=.61*** and Z=1.58 (p=0.06). For TMPERF2, r_w=.58*** and Z=1.55 (p=0.06). For TMSATF, r_w=.57*** and Z=1.58 (p=0.06).

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.24.

Table 4.24. Research Hypothesis 4.12: Bivariate Correlations Between Team Unity and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMUNTY[11] (Team Unity)	.8001 $p < 0.005$	.8086 $p < 0.005$	.6866 $p < 0.005$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables. That is, results indicate that teams with higher team unity were more effective (had higher team performance and higher team satisfaction). Nonparametric correlations yield consistent results, except that for Kendall's tau-b, the correlation between TMUNTY and TMSATF was not statistically significant (r=.4098, n.s.).

Research Hypothesis 4.13: Design teams which perform team self-assessment are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.25.

Table 4.25. Research Hypothesis 4.13: Bivariate Correlations Between Team Self-Assessment and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMASSMNT[12] (Team Self-Assessment)	.8932 $p < 0.005$	.8426 $p < 0.005$	.8389 $p < 0.005$

Degrees of freedom=15-2

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[11] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for team unity are reported. For TMPERF1, r_w=.43*** and Z=2.11*. For TMPERF2, r_w=.34*** and Z=2.57**. For TMSATF, r_w=.50*** and Z=0.99 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for team unity and team satisfaction.

[12] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for team self-assessment are reported. For TMPERF1, r_w=.55*** and Z=2.80**. For TMPERF2, r_w=.48*** and Z=1.68*. For TMSATF, r_w=.44*** and Z=2.60***.

The hypothesis was supported for all three dependent variables. Results indicate that teams which perform team self-assessment were more effective (had higher team performance and higher team satisfaction). Nonparametric correlations yield consistent results.

Research Hypothesis 4.14: Design teams that have effective decision processes are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.26.

Table 4.26. Research Hypothesis 4.14: Bivariate Correlations Between Team Decision Processes and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMDEC[13] (Team Decision Processes)	.7808 $p< 0.005$	.7596 $p< 0.005$	.5356 $p< 0.025$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables, although the relationship was stronger for TMPERF1 and TMPERF2. Results indicate that teams which have effective decision processes were more effective (higher team performance as measured by both TMPERF1 and TMPERF2 and had higher team satisfaction). Nonparametric correlations yield consistent results.

Research Hypothesis 4.15: Design teams that have effective team roles are more effective.

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[13] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for team decision processes are reported. For TMPERF1, r_w=.55*** and Z=1.42 (p=0.08). For TMPERF2, r_w=.56*** and Z=1.22 (n.s.). For TMSATF, r_w=.37*** and Z=0.69 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for team decision processes and team performance-2 and team satisfaction.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.27.

Table 4.27. Research Hypothesis 4.15: Bivariate Correlations Between Team Roles and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMROLES[14] (Team Roles)	.5533 $p< 0.025$	.4727 $p< 0.05$	.3637 n.s.

Degrees of freedom=15-2

The hypothesis was supported for TMPERF1 and TMPERF2 but not for TMSATF. Results indicate that teams which have effective team roles had higher team performance as measured by both TMPERF1 and TMPERF2. Nonparametric correlations yield consistent results, although Spearman's correlation for TMROLES and TMPERF1 was highly significant (=.6063, $p< 0.01$), a higher correlation than Pearson's.

Research Hypothesis 4.16: Design teams that have an effective team leader are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.28.

[14] The between-team correlations in this table are equivalent to the r_b in WABA. Although team roles was not included WABA, to ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) are reported. For TMPERF1, r_w= .35*** and Z= 1.15 (n.s.). For TMPERF2, r_w= .43*** and Z= 0.16 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for team roles and team performance-1 and team performance-2.

Table 4.28. Research Hypothesis 4.16: Bivariate Correlations Between Team Leadership and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMLDR[15] (Team Leadership)	.5540 p< 0.025	.5752 p< 0.025	.3206 n.s.

Degrees of freedom=15-2

The hypothesis was supported for TMPERF1 and TMPERF2 but not for TMSATF. Results indicate that teams which have an effective team leader had higher team performance as measured by both TMPERF1 and TMPERF2. Spearman's correlation results were consistent with Pearson's, but none of the Kendall correlation coefficients were significant at the .01 level.

Research Question 4.5: What effect does meeting frequency have on design team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values are shown in Table 4.29. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.29. Research Question 4.5: Bivariate Correlations Between Meeting Frequency and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
MTGFRQ (Meeting Frequency)	.6300 p< 0.02	.4999 p< 0.10	.6210 p< 0.02

Degrees of freedom=15-2, two-sided test

Results indicate that MTGFRQ had a significant positive correlation with TMPERF1 and TMSATF and was borderline significant with TMPERF2. That is, teams that meet

[15] The between-team correlations in this table are equivalent to the r_b in WABA. Although team leadership was not included WABA, to ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) are reported. For TMPERF1, r_w= .50*** and Z= .0.23 (n.s.). For TMPERF2, r_w= .39*** and Z= 0.82 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for team leadership and team performance-1 and team performance-2.

more frequently (more times per month) were more effective (had higher team performance as measured by TMPERF1 and had higher team satisfaction). Nonparametric correlations yield consistent results.

Research Question 4.6: What effect does the frequency of communication within the team between team meetings have on design team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values are shown in Table 4.30. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.30. Research Question 4.6: Bivariate Correlations Between Communication Frequency and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
CMFRQ (Communication Frequency Between Meetings)	-.0797 n.s.	-.1022 n.s.	.2825 n.s.

Degrees of freedom=15-2, two-sided test

Results indicate that CMFRQ did not have a significant correlation with any of the dependent variables; there was no evidence that teams whose members communicate more frequently between meetings were more effective.

Research Question 4.7: What effect does attendance at team meetings have on design team effectiveness?

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values are shown in Table 4.31. Because no direction was hypothesized (neither positive or negative correlation), a two-sided test was used.

Table 4.31. Research Question 4.7: Bivariate Correlations Between Meeting Attendance and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
MTGATN (Attendance at Team Meetings)	-.2083 n.s.	-.1690 n.s.	.3872 n.s.

Degrees of freedom=15-2, two-sided test

Results indicate that MTGATN did not have a significant correlation with any of the dependent variables; there was no evidence that teams whose members attend a higher percentage of team meetings were more effective. Nonparametric correlations yield consistent results.

Research Hypothesis 4.17: Design teams with higher clarity in sponsor expectations are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.32.

Table 4.32. Research Hypothesis 4.17: Bivariate Correlations Between Clarity in Sponsor Expectations and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
CLRSPNEX[16] (Clarity in Sponsor Expectations)	.8882 $p< 0.005$	.7839 $p< 0.005$	.6372 $p< 0.01$

The hypothesis was supported for all three dependent variables. Results indicate that teams which have higher clarity in sponsor expectations on mission and scope of work

[16] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for clarity in sponsor expectations are reported. For TMPERF1, r_w=.70*** and Z=1.81*. For TMPERF2, r_w=.57*** and Z=1.32 (p=0.09). For TMSATF, r_w=.52*** and Z=0.59 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for clarity in sponsor expectations and team satisfaction.

were more effective (had higher team performance and higher team satisfaction). Nonparametric correlations yield consistent results.

Research Hypothesis 4.18: Design teams which are more effective at keeping stakeholders informed are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.33.

Table 4.33. Research Hypothesis 4.18: Bivariate Correlations Between Keeping Stakeholders Informed and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
STKINF[17] (Keeping Stakeholders Informed)	.4879 $p < 0.05$	.5772 $p < 0.025$	.2094 n.s.

Degrees of freedom=15-2

The hypothesis was supported for TMPERF1 and TMPERF2 but not for TMSATF. Results indicate that teams which are more effective at keeping stakeholders informed of plans and progress had higher team performance as measured by both TMPERF1 and TMPERF2. Nonparametric correlations yield consistent results.

Research Hypothesis 4.19: Design teams which are more effective at building commitment from stakeholders are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.34.

[17] The between-team correlations in this table are equivalent to the r_b in WABA. Although keeping stakeholders informed is not included WABA, to ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) are reported. For TMPERF1, r_w= .30 and Z=0.76 (n.s.). For TMPERF2, r_w= .29 and Z= .1.19 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for keeping stakeholders informed and team performance-1 and team performance-2.

Table 4.34. Research Hypothesis 4.10: Bivariate Correlations Between Commitment-Building and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
CMTBLD[18] (Commitment-building with Stakeholders)	.8505 $p< 0.005$	.7178 $p< 0.005$	.5792 $p< 0.025$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables. Results indicate that teams which are more effective at building commitment from stakeholders for the team's plans and decisions were more effective (had higher team performance and higher team satisfaction). Spearman's correlations were consistent, but Kendall's correlation was only significant at the .05 level only for TMPERF1.

Research Hypothesis 4.20: Design teams which maintain an inter-organizational perspective are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.35.

Table 4.35. Research Hypothesis 4.20: Bivariate Correlations Between Interorganizational Perspective and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
INTRORG[19] (Inter-organizational Perspective)	.7209 $p< 0.005$	.7410 $p< 0.005$	.3605 n.s.

Degrees of freedom=15-2

[18] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for commitment-building are reported. For TMPERF1, r_w=.50*** and Z=2.34**. For TMPERF2, r_w=.43*** and Z=1.48 (p=0.07). For TMSATF, r_w=.29** and Z=1.18 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for commitment-building and team satisfaction.

[19] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for inter-organizational perspective are reported. For TMPERF1, r_w=.37*** and Z=1.71*. For TMPERF2, r_w=.34*** and Z=1.98*.

The hypothesis was supported for TMPERF1 and TMPERF2 but not for TMSATF. Results indicate that teams which maintain an inter-organizational perspective had higher team performance. Nonparametric correlations yield consistent results.

4.4.1.4. Organizational Resources Available

Variables representing resources available to a design team were: release time available for design team efforts (RELTIME), time spent in education and training (ETDTM), organizational support to the team (ORGSPTM), and organizational support to individuals on the team (ORGSPTIN).

Research Hypothesis 4.21: Design teams whose members have sufficient release time for work on the team are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.36.

Table 4.36. Research Hypothesis 4.21: Bivariate Correlations Between Release Time and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
RELTIME (Release Time)	-.0390 n.s.	.1996 n.s.	.0201 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that teams whose members perceive they have sufficient release time were more effective. Nonparametric correlations yield consistent results.

Research Hypothesis 4.22: Design teams whose members spend more time in education and training are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.37.

Table 4.37. Research Hypothesis 4.22: Bivariate Correlations Between Education/Training Time and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
ETDTIME (Education/Training Time)	.1588 n.s.	-.1398 n.s.	.3298 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that teams whose members spent more time in education and training were more effective. Nonparametric correlations yield consistent results.

Research Hypothesis 4.23: Design teams which perceive support for the team from the organization are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.38.

Table 4.38. Research Hypothesis 4.23: Bivariate Correlations Between Organizational Support to Team and Dependent Variables Using Weighted Group Means.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
ORGSPTTM (Organizational Support to Team)	.1416 n.s.	-.0003 n.s.	.2651 n.s.

Degrees of freedom=15-2

The hypothesis was not supported for any of the dependent variables. Results did not indicate that teams which perceive greater organizational support to the team (information, feedback, general supportive context) were more effective. Nonparametric correlations yield consistent results.

Research Hypothesis 4.24: Design teams whose members perceive individual support from the organization are more effective.

This hypothesis was tested using Pearson's correlation coefficient. Correlations, sample size, and p-values for a one-sided test are shown in Table 4.39.

Table 4.39. Research Hypothesis 4.24: Bivariate Correlations Between Organizational Support to Individual and Dependent Variables.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
ORGSPTIN[20] (Organizational Support to Individual)	.7666 $p< 0.005$	.7314 $p< 0.005$	.7500 $p< 0.005$

Degrees of freedom=15-2

The hypothesis was supported for all three dependent variables. Results indicate that teams whose members perceive organizational support to individuals on the team were more effective (had higher team performance and higher team satisfaction). Nonparametric correlations yield consistent results.

The next step in the data analysis strategy is to examine the relationship between each design feature and the dependent variables using Within and Between Analysis. However, before moving on to this next step, the relationship between design features and an alternative measure of team performance is considered.

As mentioned in Chapter 3, one external stakeholder for each team was asked their perception of the team's performance with the same operational measure used for team members, team performance-2. Items in this operational measure were specific to design teams (such as percent effectiveness in quality of team deliverables, in improving

[20] The between-team correlations in this table are equivalent to the r_b in WABA. To ensure technical correctness, the within-team correlation (r_w) and the difference between r_w and r_b (Z) for organizational support to individuals are reported. For TMPERF1, r_w=.54*** and Z=1.38 (p=0.08). For TMPERF2, r_w=.42*** and Z=1.58 (p=0.06). For TMSATF, r_w=.53*** and Z=1.25 (n.s.). Because r_b and r_w were not significantly different, great caution should be exercised in interpreting the between-team correlation for organizational support to individuals and team satisfaction.

business results in the target system, etc.). The researcher was interested in examining how results compared for the two team performance measures: team performance-2 and stakeholder performance. The overall correlation between team performance-2 (using group means) and stakeholder performance was .82 ($p < 0.005$). This result indicates that team members' viewpoint on team performance was aligned with an external stakeholder viewpoint.

Another way to compare results for these two team performance measures is to examine the bivariate correlations obtained using team performance-2 to those obtained using stakeholder performance as the dependent variable instead. These correlations are summarized in Table 4.40.

As shown in the table, the results obtained for team performance-2 and stakeholder performance were very consistent. This comparison provides additional confidence in the results obtained using the self-report data on members' viewpoint of team performance because it is consistent with an external viewpoint.

4.4.2. Within and Between Analysis

Using results from the bivariate Pearson's correlation coefficients from the previous section and group effectiveness theory and literature, a set of independent variables was identified believed to have the most important relationship with team effectiveness. The relationship between these variables and team effectiveness (i.e., the three dependent variables) were examined more closely using Within and Between Analysis, the next step used to address Research Question 4.

Table 4.40. A Comparison of Team Member Vs. Stakeholder Perception of Team Performance.

Independent Variable	Variable Name	Team Performance-1	Stakeholder Performance
DMGNDR	Diversity in Gender	-0.17	-0.01
DMAGE	Diversity in Age	0.08	0.28
DMEDL	Diversity in Education level	-0.69***	-0.62**
DMORGTEN	Diversity in Organization tenure	-0.01	0.06
DMJBTEN	Diversity in Job tenure	0.19	0.33
TMSKLS	Team skills	0.83***	0.76***
XFCNS	Cross-functional representation	-0.19	-0.22
MLVLS	Multi-level representation	-0.40	-0.43
INDGLS	Individual goals	0.57*	0.38
TRNVR	Team turnover	0.04	0.05
TMSIZE††	Team size	-0.37	-0.44
LCNS_SZ††	Co-location (no. locations/size)	0.18	0.33
TMAGE††	Team age	-0.32	-0.30
DEFPRC	Defined design process	0.62**	0.50*
SYSPERS	Systemic perspective	0.62**	0.63**
CMPDES	Comprehensive design process	0.05	0.20
TMCHRT	Team charter	0.53*	0.66***
TMCMT	Team commitment	0.83***	0.67***
TMUNTY	Team unity	0.80***	0.75***
TMASSMNT	Team self-assessment	.89***	.82***
TMDEC	Team decision processes	0.78***	0.88***
TMROLES	Team roles	0.55*	0.76***
TMLDR	Team leadership	0.55*	0.54*
MTGFRQ††	Meeting frequency	0.63**	0.57*
EMAIL††	E-mail capability	0.14	0.09
CMFRQ††	Communication frequency between meetings	-0.08	0.02
MTGATN††	Meeting attendance	-0.21	-0.33
CLRSPNEX	Clarity in sponsor expectations	0.89***	0.77***
STKINF	Keeping stakeholders informed	0.49*	0.56*
CMTBLD	Commitment-building with stakeholders	0.85***	0.84***
INTRORG	Inter-organizational perspective	0.72***	0.84***
RELTIME	Release time	-0.04	-0.05
ETDTIME	Time in education/ training/ devel.	0.16	0.10
ORGSPTTM	Organization support to team	0.14	0.13
ORGSPTIN	Organization support to individuals	0.77***	0.58*

†Correlations, rounded to two decimal points, were based on weighted group means of 15 teams to account for differences in team size (*df=15-2*)

*$p < 0.05$, **$p < 0.01$, ***$p < 0.005$. All other p-values were greater than 0.05. P-values were obtained from Table IV "Values of the Correlation Coefficient for Various Levels of Significance" from Fisher (1970).

†† Signifies a two-sided test; all other significance levels were from a one-sided test.

Those variables having the highest correlations with the dependent variables and/or having support in the group effectiveness literature were identified: team skills, individual goals, defined design process, systemic perspective, team commitment, team unity, team self-assessment, team decision processes, clarity in sponsor expectations, commitment-building, inter-organizational perspective, and organizational support to individuals.

The same set of variables was considered for each of the three dependent variables so that results for team performance variables could be compared to team satisfaction. For example, although defined design process did not have a significant bivariate correlation with team performance-2 ($r=.35$, n.s.), it was retained so that the same set of independent variables was considered for both team performance variables. Not all of the variables which had a significant bivariate correlation with the dependent variables were retained. The set of variables was narrowed using the group effectiveness literature to identify those believed to have the most important relationship with team effectiveness based on the literature.

Within and Between Analysis (WABA) was described in Chapter 3, and only the essential information is repeated here. The covariance equation (or WABA equation) is shown below, which partitions the variation and covariation between variables into a "between component" (the first three components) and a "within component" (the last three components).

WABA can be divided into three overall steps. First, WABA I assesses the variation for a single variable to determine whether it varies primarily between groups (or teams for this research), within groups or both. An inference is drawn from the WABA I statistical tests using the F-test from one-way analysis of variance. Second, in WABA II, the relationship between two variables is considered to determine whether the variables covary primarily between groups, within groups or both. An inference is drawn from the WABA II statistical tests, which examine the magnitude of the between-group correlation and the difference between the between-group and within-group correlation. Third, the results from WABA I and WABA II are compared for consistency, and a final induction is drawn.

The four inductions possible when combining the results of WABA I and II tests are (Markham, 1988; Yammarino & Markham, 1992):

- variation and covariation are more likely to occur between rather than within groups which leads to a "wholes" inference (there is a clear "team effect")
- variation and covariation are more likely to occur within groups rather than between groups, which leads to a "parts" inference.
- variation is found both between and within groups, which leads to an equivocal inference.
- variation is found neither between nor within groups, which leads to a null condition.

The research focus in this dissertation was on teams, and the researcher wished to draw conclusions about relationships between variables *at the team level.* WABA, through its use of the covariance equation to partition the variance and covariance between two variables, allowed the researcher to determine the appropriate level of focus for a relationship between two variables.

In order for a strong wholes (Category I) inference to be drawn for a relationship between two variables, there are several criteria in WABA that must be met. The first criteria is that teams are significantly different from each other for both variables, assessed by the WABA I F-tests. The second criteria is that teams which score higher on average on one variable also score higher on average on the second variable, which is assessed by the WABA II test for the between-team correlation, r_b. Third, the between-team correlation, r_b, must be significantly higher than the within-team correlation, r_w, as assessed by the WABA II Z-test (a *difference* test of *statistical* significance). An additional test, of *practical significance*, is a comparison of the "between component" of the covariance equation to the "within component." This practical significance test is aligned with a wholes condition if the between component is greater than the within component, although this is not required for a wholes inference.

The covariance equation is repeated below from Chapter 3, and is shown for each of the relationships and results from WABA tests which follow in the next three sections. The degrees of freedom for WABA tests were based on N=130 individuals and J=15 teams, which makes degrees of freedom for r_T=N-2=128, the degrees of freedom for r_b=J-2=13, and the degrees of freedom for r_w N-J-1=114.

Covariance Equation

$r_{xy,T} = (\eta_{bx})(\eta_{by})(r_{xy,b}) + (\eta_{Wx})(\eta_{Wy})(r_{xy,w})$

where

$r_{xy,T}$ =	total correlation between X and Y, *df=N-2=128*
η_{Bx} =	between-eta correlation for variable X, *df=(J-1,N-J)=(14,115)*
η_{By} =	between-eta correlation for variable Y, *df=(J-1,N-J)=(14,115)*
$r_{xy,b}$ =	between-group correlation between X and Y using group means, *df=J-2=13*
η_{Wx} =	within-eta correlation for variable X, *df=(N-J,J-1)=(115,14)*
η_{Wy} =	within-eta correlation for variable Y, *df=(N-J,J-1)=(115,14)*
$r_{xy,w}$ =	correlation between X and Y using within-group deviation scores (within-group correlation), *df=N-J-1=114*

Readers who are interested only in the summary of results from WABA should refer to Table 4.41 (which shows the final induction for each relationship), and then skip to Section 4.4.3. A wholes induction in Table 4.41 means that there was a relationship at the team level for the two variables (a team effect). A Category I induction is a stronger inference than a Category II induction because there is more evidence for a team effect. Only independent variables for which there was a wholes induction were retained for further data analysis after WABA. For readers who are interested in more detail, the analyses and results from WABA for each relationship between variables are shown following Table 4.41.

4.4.2.1. WABA Results for Team Performance-1

This section presents the results and indicators from WABA for team performance-1 (TMPERF1): team skills, individual goals, defined design process, systemic perspective, team commitment, team unity, team self-assessment, team decision processes, clarity in sponsor expectations, commitment-building, inter-organizational perspective, and organizational support to individuals.

Table 4.41. Final Inductions for Variables Using Within and Between Analysis.

Independent Variable	Dependent Variable 1: Team Performance-1	Dependent Variable 2: Team Performance-2	Dependent Variable 3: Team Satisfaction
Team skills	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	Equivocal (None)
Individual Goals	None	None	None
Defined Design Process	Wholes (Category I)	Wholes (Category II)	Wholes (Category I)
Systemic Perspective	Wholes (Category I)	None	Wholes (Category I)
Team Commitment	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	Wholes (Category I - but not practical magnitude)
Team Unity	Wholes (Category I)	Wholes (Category I)	None
Team Self-Assessment	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	Wholes (Category I - but not practical magnitude)
Team Decision Processes	Wholes (Category I)	None	None
Clarity in Sponsor Expectations	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	None
Commitment-building with Stakeholders	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	None
Inter-organizational Perspective	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	Wholes (Category II)
Organizational Support to Individuals	Wholes (Category I)	Wholes (Category I - but not practical magnitude)	None

The covariance equation for the relationship between team skills (TMSKLS) and team performance-1 (TMPERF1) is shown in Table 4.42. Based on the statistical significance and practical significance tests, there was a relationship between team skills and team performance-1 at the team level. Those teams that on average reported higher levels of team skills reported higher team performance as measured by TMPERF1.

Table 4.42. Group Level WABA Results for Team Skills and Team Performance-1.

Team skills (TMSKLS)	Induction
Covariance Equation: (.6917)*** = (.5991)***(.7837)***(.8290)***^{z} + (.8007)(.6212)(.6082)***	
WABA I Tests: TMSKLS: F = 4.60, p<.0001 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.8290, p<.005 Difference between r_b and r_w: Z'= 1.58, p=.0571	WHOLES (weak)
COMPONENTS: Between: .3892 Within: .3025	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between individual goals (INDGLS) and team performance-1 (TMPERF1) is shown in Table 4.43. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was made. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between individual goals and team performance-1 could be made.

Table 4.43. Group Level WABA Results for Individual Goals and Team Performance-1.

Individual Goals (INDGLS)	**Induction**
Covariance Equation: (.4949)*** = (.4741)**(.7837)***(.5702)* + (.8805)(.6212)(.5175)***	
WABA I Tests: INDGLS: $F = 2.38$, $p=.006$ TMPERF1: $F=13.07$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.5702$, $p<.01$ Difference between r_b and r_w: $Z'= 0.23$, n.s.	EQUIVOCAL
COMPONENTS: Between: .2118 Within: .2831	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between defined design process (DEFPRC) and team performance-1 (TMPERF1) is shown in Table 4.44. Based on the statistical significance and practical significance tests, there was a relationship between defined design process and team performance-1 at the team level. Those teams that on average reported using a defined design process reported higher team performance as measured by TMPERF1.

Table 4.44. Group Level WABA Results for Defined Design Process and Team Performance-1.

Defined design process (DEFPRC)	**Induction**
Covariance Equation: (.3955) = (.4449)*(.7837)***(.6220)**^{z} + (.8955)(.6212)(.3210)***	
WABA I Tests: DEFPRC: $F = 2.03$, $p=.0213$ TMPERF1: $F=13.07$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b =.6220$, $p<.01$ Difference between r_b and r_w: $Z'= 1.32$, $p=.0934$	WHOLES (weak)
COMPONENTS: Between: .2196 Within: -.0024	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between systemic perspective (SYSPERS) and team performance-1 (TMPERF1) is shown in Table 4.45. Based on the statistical significance and practical significance tests, there was a relationship between systemic perspective and team performance-1 at the team level. Those teams that on average reported using a more systemic perspective reported higher team performance as measured by TMPERF1.

Table 4.45. Group Level WABA Results for Systemic Perspective and Team Performance-1.

Systemic perspective (SYSPERS)	**Induction**
Covariance Equation: (.4144) = (.5034)(.7837)(.6241)**^{z} + (.8641)(.6212)(.3135)***	
WABA I Test: SYSPERS: F = 2.79, p=.0013 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.6241, p<.01 Difference between r_b and r_w: Z'=1.35, p=.0885	WHOLES (weak)
COMPONENTS: Between: .2462 Within: .1683	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team commitment (TMCMT) and team performance-1 (TMPERF1) is shown in Table 4.46. Based on the statistical significance and practical significance tests, there was a relationship between team commitment and team performance-1 at the team level. Those teams that on average reported higher team commitment reported higher team performance as measured by TMPERF1.

Table 4.46. Group Level WABA Results for Team Commitment and Team Performance-1.

Team commitment (TMCMT)	**Induction**
Covariance Equation: $(.6761)^{***} = (.5610)^{***}(.7837)^{***}(.8252)^{***z} + (.8278)(.6212)(.6092)^{***}$	
WABA I Tests: TMCMT: F = 3.77, p<.0001 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8252, p<.005 Difference between r_b and r_w: Z'= 1.58, p=.0571	WHOLES (weak)
COMPONENTS: Between: .3628 Within: .3133	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team unity (TMUNTY) and team performance-1 (TMPERF1) is shown in Table 4.47. Based on the statistical significance and practical significance tests, there was a relationship between team unity and team performance-1 at the team level. Those teams that on average reported higher team unity reported higher team performance as measured by TMPERF1.

Table 4.47. Group Level WABA Results for Team Unity and Team Performance-1.

Team unity (TMUNTY)	**Induction**
Covariance Equation: $(.6240)^{***} = (.6826)^{***}(.7837)^{***}(.8001)^{***z} + (.7308)(.6212)(.4317)^{***}$	
WABA I Tests: TMUNTY: F = 7.16, p<.0001 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8001, p<.005 Difference between r_b and r_w: Z'= 2.11, p=.0174	WHOLES
COMPONENTS: Between: .4280 Within: .1960	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team self-assessment (TMASSMNT) and team performance-1 (TMPERF1) is shown in Table 4.48. Based on the statistical significance and practical significance tests, there was a relationship between team self-assessment and team performance-1 at the team level. Those teams that on average reported using team self-assessment reported higher team performance as measured by TMPERF1.

Table 4.48. Group Level WABA Results for Team Self-Assessment and Team Performance-1.

Team self-assessment (TMASSMNT)	**Induction**
Covariance Equation: (.6709)*** = (.5514)***(.7837)***(.8973)***^{z} + (.8342)(.6212)(.5463)***	
WABA I Tests: TMASSMNT: F= 3.60, p<.0001 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8973, p<.005 Difference between r_b and r_w: Z'= 2.80, p=.0026	WHOLES
COMPONENTS: Between: .3878 Within: .2831	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team decision processes (TMDEC) and team performance-1 (TMPERF1) is shown in Table 4.49. Based on the statistical significance and practical significance tests, there was a relationship between team decision processes and team performance-1 at the team level. Those teams that on average reported more effective decision processes reported higher team performance as measured by TMPERF1.

Table 4.49. Group Level WABA Results for Team Decision Processes and Team Performance-1.

Team decision processes (TMDEC)	**Induction**
Covariance Equation: $(.6304)^{***} = (.5666)^{***}(.7837)^{***}(.7808)^{***z} + (.8240)(.6212)(.5544)^{***}$	
WABA I Tests: TMDEC: $F= 3.88$, $p<.0001$ TMPERF1: $F=13.07$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .7808$, $p<.005$ Difference between r_b and r_w: $Z' = 1.42$, $p=.0778$	WHOLES (weak)
COMPONENTS: Between: .3467 Within: .2838	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between clarity in sponsor expectations (CLRSPNEX) and team performance-1 (TMPERF1) is shown in Table 4.50. Based on the statistical significance and practical significance tests, there was a relationship between clarity in sponsor expectations and team performance-1 at the team level. Those teams that on average reported a higher degree of clarity in sponsor expectations reported higher team performance as measured by TMPERF1.

Table 4.50. Group Level WABA Results for Clarity in Sponsor Expectations and Team Performance-1.

Clarity in sponsor expectations (CLRSPNEX)	**Induction**
Covariance Equation: $(.7684)^{***} = (.6086)^{***}(.7837)^{***}(.8882)^{***z} + (.7935)(.6212)(.6994)^{***}$	
WABA I Tests: CLRSPNEX: $F= 4.83$, $p<.0001$ TMPERF1: $F=13.07$, $p<.0001$	WHOLES
WABA II Test: Magnitude of r_b: $r_b =.8882$, $p<.005$ Difference between r_b and r_w: $Z' = 1.81$, $p=.0352$	WHOLES
COMPONENTS: Between: .4236 Within: .3447	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between commitment-building (CMTBLD) and team performance-1 (TMPERF1) is shown in Table 4.51. Based on the statistical significance and practical significance tests, there was a relationship between commitment-building and team performance-1 at the team level. Those teams that on average reported more effective commitment-building with stakeholders reported higher team performance as measured by TMPERF1.

Table 4.51. Group Level WABA Results for Commitment-building and Team Performance-1.

Commitment-building with stakeholders (CMTBLD)	**Induction**
Covariance Equation: (.6472)*** = (.6000)***(.7837)***(.8505)***^{z} + (.8025)(.6212)(.4977)***	
WABA I Tests: CMTBLD: F= 4.62, p<.0001 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8505, p<.005 Difference between r_b and r_w: Z'= 2.34, p=.0096	WHOLES
COMPONENTS: Between: .3999 Within: .2481	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between inter-organizational perspective (INTRORG) and team performance-1 (TMPERF1) is shown in Table 4.52. Based on the statistical significance and practical significance tests, there was a relationship between inter-organizational perspective and team performance-1 at the team level. Those teams that on average reported maintaining an inter-organizational perspective reported higher team performance as measured by TMPERF1.

Table 4.52. Group Level WABA Results for Inter-organizational Perspective and Team Performance-1.

Inter-organizational perspective (INTRORG)	Induction
Covariance Equation: $(.4811)^{*} = (.5012)^{***}(.7837)^{***}(.7209)^{***z} + (.8653)(.6212)(.3681)^{***}$	
WABA I Tests: INTRORG: F= 2.76, p=.0015 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.7209, p<.005 Difference between r_b and r_w: Z'= 1.71, p=.0436	WHOLES
COMPONENTS: Between: .2832 Within: .1979	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between organizational support to individuals (ORGSPTIN) and team performance-1 (TMPERF1) is shown in Table 4.53. Based on the statistical significance and practical significance tests, there was a relationship between organizational support to individuals and team performance-1 at the team level. Those teams that on average reported greater organizational support to individual team members reported higher team performance as measured by TMPERF1.

Table 4.53. Group Level WABA Results for Organizational Support to Individuals and Team Performance-1.

Organizational Support to Individuals (ORGSPTIN)	Induction
Covariance Equation: $(.5817)^{***} = (.4815)^{***}(.7837)^{***}(.7661)^{***z} + (.8765)(.6212)(.5371)^{***}$	
WABA I Tests: ORGSPTIN: F = 2.48, p=.0042 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.7661, p<.005 Difference between r_b and r_w: Z'= 1.38, p=.0838	WHOLES (weaker)
COMPONENTS: Between: .2891 Within: .2924	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

4.4.2.2. WABA Results for Team Performance-2

This section presents the results and indicators from WABA for team performance-2 (TMPERF2). The same set of variables considered for TMPERF1 were also considered for TMPERF2.

The covariance equation for the relationship between team skills (TMSKLS) and team performance-2 (TMPERF2) is shown in Table 4.54. Based on the statistical significance tests, there was a relationship between team skills and team performance-2 at the team level. The practical significance (components) test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still made because the between-cell correlation (r_b=.8740) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.5841, Z'=2.14, p=.0162).

Table 4.54. Group Level WABA Results for Team Skills and Team Performance-2.

Team skills (TMSKLS)	Induction
Covariance Equation: (.6811)*** = (.5991)***(.5619)***(.8740)***^{z} + (.8007)(.8272)(.5841)***	
WABA I Tests: TMSKLS: F = 4.60, p<.0001 TMPERF2: F = 3.70, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8740, p<.005 Difference between r_b and r_w: Z'= 2.14, p=.0162	WHOLES
COMPONENTS: Between: .2942 Within: .3869	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between individual goals (INDGLS) and team performance-2 (TMPERF2) is shown in Table 4.55. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was made. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between individual goals and team performance-2 could be made.

Table 4.55. Group Level WABA Results for Individual Goals and Team Performance-2.

Individual Goals (INDGLS)	Induction
Covariance Equation: (.2857)*** = (.4741)**(.5619)***(.4662)* + (.8805)(.8272)(.2218)*	
WABA I Tests: INDGLS: F = 2.38, p=.006 TMPERF2: F=3.70, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.4662, p<.05 Difference between r_b and r_w: Z'= 0.95, n.s.	EQUIVOCAL
COMPONENTS: Between: .1242 Within: .1615	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between defined design process (DEFPRC) and team performance-2 (TMPERF2) is shown in Table 4.56. Based on the WABA I statistical significant tests, a wholes inference was drawn. Based on the WABA II statistical tests, a null inference was drawn — there was not evidence for significant between- or within-cell correlation (r_b was not statistically significant and it was not significantly different from r_w).

Combining these WABA I and WABA II results, a Category II (weaker) wholes inference was drawn as a final induction; in other words, there was evidence of a relationship between defined design process and team performance-2 at the team level.

Table 4.56. Group Level WABA Results for Defined Design Process and Team Performance-2.

Defined design process (DEFPRC)	Induction
Covariance Equation: (.3439) = (.4449)*(.5619)***(.3434) + (.8955)(.8272)(.3484)***	
WABA I Tests: DEFPRC: $F = 2.03$, $p=.0213$ TMPERF2: $F = 3.70$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .3434$, n.s.	NULL
COMPONENTS: Between: .0858 Within: .2581	PARTS
FINAL Induction	WHOLES (Category II — weaker)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between systemic perspective (SYSPERS) and team performance-2 (TMPERF2) is shown in Table 4.57. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between systemic perspective and team performance-2 could be made.

Table 4.57. Group Level WABA Results for Systemic Perspective and Team Performance-2.

Systemic perspective (SYSPERS)	Induction
Covariance Equation: (.4625)* = (.5034)***(.5619)***(.5607)* + (.8641)(.8272)(.4253)***	
WABA I Tests: SYSPERS: $F = 2.79$, $p=.0013$ TMPERF2: $F = 3.70$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .5607$, $p<.025$ Difference between r_b and r_w: $Z'=.56$, n.s.	EQUIVOCAL
COMPONENTS: Between: .1586 Within: .3040	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team commitment (TMCMT) and team performance-2 (TMPERF2) is shown in Table 4.58. Based on the statistical significance tests, there was a relationship between team commitment and team performance-2 at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was drawn because the between-cell correlation (r_b=.8106) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.5784, Z'=1.55, p=.0606, leading to a weak wholes induction for WABA II).

Table 4.58. Group Level WABA Results for Team Commitment and Team Performance-2.

Team commitment (TMCMT)	**Induction**
Covariance Equation: (.6516)*** = (.5610)***(.5619)***(.8106)***^{z} + (.8278)(.8272)(.5784)***	
WABA I Tests: TMCMT: F = 3.77, p<.0001 TMPERF2: F = 3.70, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8106, p<.005 Difference between r_b and r_w: Z'= 1.55, p=.0606	WHOLES (weak)
COMPONENTS: Between: .2556 Within: .3961	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team unity (TMUNTY) and team performance-2 (TMPERF2) is shown in Table 4.59. Based on the statistical significance and practical significance tests, there was a relationship between team unity and team performance-2 at the team level. Those teams that reported higher team unity on average reported higher team performance as measured by TMPERF2.

Table 4.59. Group Level WABA Results for Team Unity and Team Performance-2.

Team unity (TMUNTY)	**Induction**
Covariance Equation: $(.5177)^{*} = (.6826)^{***}(.5619)^{***}(.8086)^{***z} + (.7308)(.8272)(.3443)^{***}$	
WABA I Tests: TMUNTY: $F = 7.16, p<.0001$ TMPERF2: $F = 3.70, p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .8086, p<.005$ Difference between r_b and r_w: $Z' = 2.57, p=.0051$	WHOLES
COMPONENTS: Between: .3101 Within: .2081	WHOLES
FINAL Induction	WHOLES (Category I)

$^{*}p<.05$, $^{**}p<.01$, $^{***}p<.005$

The covariance equation for the relationship between team self-assessment (TMASSMNT) and team performance-2 (TMPERF2) is shown in Table 4.60. Based on the statistical significance tests, there was a relationship between team self-assessment and team performance-2 at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was drawn because the between-cell correlation (r_b=.8430) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.4757, Z'=1.68, p=.0465).

Table 4.60. Group Level WABA Results for Team Self-Assessment and Team Performance-2.

Team self-assessment (TMASSMNT)	**Induction**
Covariance Equation: $(.5895)^{**} = (.5514)^{***}(.5619)^{***}(.8430)^{***z} + (.8342)(.8272)(.4757)^{***}$	
WABA I Tests: TMASSMNT: $F= 3.60, p<.0001$ TMPERF2: $F = 3.70, p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .8430, p<.005$ Difference between r_b and r_w: $Z' = 1.68, p=.0465$	WHOLES
COMPONENTS: Between: .2612 Within: .3283	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

$^{*}p<.05$, $^{**}p<.01$, $^{***}p<.005$

The covariance equation for the relationship between team decision processes (TMDEC) and team performance-2 (TMPERF2) is shown in Table 4.61. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between team decision processes and team performance-2 could be made.

Table 4.61. Group Level WABA Results for Team Decision Processes and Team Performance-2.

Team decision processes (TMDEC)	**Induction**
Covariance Equation: (.6215)*** = (.5666)***(.5619)***(.7596)*** + (.8240)(.8272)(.5570)***	
WABA I Tests: TMDEC: F= 3.88, p<.0001 TMPERF2: F = 3.70, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b: .7596, p<.005 Difference between r_b and r_w: Z'= 1.22, n.s.	EQUIVOCAL
COMPONENTS: Between: .2418 Within: .3797	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between clarity in sponsor expectations (CLRSPNEX) and team performance-2 (TMPERF2) is shown in Table 4.62. Based on the statistical significance tests, there was a relationship between clarity in sponsor expectations and team performance-2 at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still drawn because the between-cell correlation (r_b=.7839) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.5689, Z'=1.32, p=.0934, leading to a weak wholes induction for WABA II).

Table 4.62. Group Level WABA Results for Clarity in Sponsor Expectations and Team Performance-2.

Clarity in sponsor expectations (CLRSPNEX)	**Induction**
Covariance Equation: (.6415)*** = (.6086)***(.5619)***(.7839)***^{z} + (.7935)(.8272)(.5689)***	
WABA I Tests: CLRSPNEX: F= 4.83, p<.0001 TMPERF2: F = 3.70, p<.0001	WHOLES
WABA II Test: Magnitude of r_b: r_b =.7839, p<.005 Difference between r_b and r_w: Z'= 1.32, p=.0934	WHOLES (weak)
COMPONENTS: Between: .2681 Within: .3734	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between commitment-building (CMTBLD) and team performance-2 (TMPERF2) is shown in Table 4.63. Based on the statistical significance tests, there was a relationship commitment-building and team performance-2 at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still drawn because the between-cell correlation (r_b=.7178) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.4346, Z'=1.48, p=.0694, leading to a weak wholes induction for WABA II).

Table 4.63. Group Level WABA Results for Commitment-building and Team Performance-2.

Commitment-building (CMTBLD)	**Induction**
Covariance Equation: $(.5295)^{*} = (.6000)^{***}(.5619)^{***}(.7178)^{***z} + (.8025)(.8272)(.4346)^{***}$	
WABA I Tests: CMTBLD: F= 4.62, p<.0001 TMPERF2: F = 3.70, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.7178, p<.005 Difference between r_b and r_w: Z'= 1.48, p=.0694	WHOLES (weak)
COMPONENTS: Between: .2420 Within: .2885	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between inter-organizational perspective (INTRORG) and team performance-2 (TMPERF2) is shown in Table 4.64. Based on the statistical significance tests, there was a relationship between inter-organizational perspective and team performance-2 at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still drawn because the between-cell correlation (r_b=.7410) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.3400, Z'=1.98, p=.0239).

Table 4.64. Group Level WABA Results for Inter-organizational Perspective and Team Performance-2.

Inter-organizational perspective (INTRORG)	Induction
Covariance Equation: $(.4520)^{*} = (.5012)^{***}(.5619)^{***}(.7410)^{***2} + (.8653)(.8272)(.3400)^{***}$	
WABA I Tests: INTRORG: $F = 2.76$, $p = .0015$ TMPERF2: $F = 3.70$, $p < .0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .7410$, $p < .005$ Difference between r_b and r_w: $Z' = 1.98$, $p = .0239$	WHOLES
COMPONENTS: Between: .2087 Within: .2434	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between organizational support to individuals (ORGSPTIN) and team performance-2 (TMPERF2) is shown in Table 4.65. Based on the statistical significance tests, there was a relationship between organizational support to individuals and team performance-2 at the team level. The practical significance (components) test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still drawn because the between-cell correlation (r_b=.7314) was statistically significant ($p<.005$) *and* was significantly greater than the within-cell correlation (r_w=.4203, Z'=1.58, p=.0571, leading to a weak wholes induction for WABA II).

Table 4.65. Group Level WABA Results for Organizational Support to Individuals and Team Performance-2.

Organizational Support to Individuals (ORGSPTIN)	Induction
Covariance Equation: (.5026)*** = (.4815)***(.5619)***(.7314)***^{z} + (.8765)(.8272)(.4203)***	
WABA I Tests: ORGSPTIN: F = 2.48, p=.0042 TMPERF2: F=3.70, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.7314, p<.005 Difference between r_b and r_w: Z'= 1.58, p=.0571	WHOLES (weaker)
COMPONENTS: Between: .1979 Within: .3947	PARTS
FINAL Induction	WHOLES (Category I - but not practical magnitude)

*p<.05, **p<.01, ***p<.005

4.4.2.3. WABA Results for Team Satisfaction

This section presents the results and indicators from WABA for team satisfaction (TMSATF). The same set of variables was considered for team satisfaction as for the team performance variables: team skills, individual goals, defined design process, systemic perspective, team commitment, team unity, team self-assessment, team decision processes, clarity in sponsor expectations, commitment-building, inter-organizational perspective, and organization support to individuals.

The covariance equation for the relationship between team skills (TMSKLS) and team satisfaction (TMSATF) is shown in Table 4.66. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between team skills and team satisfaction could be made.

Table 4.66. Group Level WABA Results for Team Skills and Team Satisfaction.

Team skills (TMSKLS)	**Induction**
Covariance Equation: (.5112)*** = (.5991)***(.5747)***(.7132)** + (.8007)(.8184)(.4426)***	
WABA I Tests: TMSKLS: $F = 4.60$, $p<.0001$ TMSATF: $F=4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.7132$, $p<.01$ Difference between r_b and r_w: $Z'= .95$, n.s.	EQUIVOCAL
COMPONENTS: Between: .2205 Within: .2906	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between individual goals (INDGLS) and team satisfaction (TMSATF) is shown in Table 4.67. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between individual goals and team satisfaction could be made.

Table 4.67. Group Level WABA Results for Individual Goals and Team Satisfaction.

Individual goals (INDGLS)	**Induction**
Covariance Equation: (.5843)** = (.4741)**(.5747)***(.7132)*** + (.8805)(.8184)(.5412)***	
WABA I Tests: INDGLS: $F = 2.38$, $p=.006$ TMSATF: $F = 4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b =.7132$, $p<.005$ Difference between r_b and r_w: $Z'= 0.96$, n.s.	EQUIVOCAL
COMPONENTS: Between: .1943 Within: .3900	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between defined design process (DEFPRC) and team satisfaction (TMSATF) is shown in Table 4.68. Based on the statistical significance and practical significance tests, there was a relationship between defined design process and team satisfaction at the team level. Those teams that reported using a defined design process on average reported higher team satisfaction.

Table 4.68. Group Level WABA Results for Defined Design Process and Team Satisfaction.

Defined design process (DEFPRC)	**Induction**
Covariance Equation: (.1804) = (.4449)*(.5747)***(.5160)*^{z} + (.8955)(.8184)(.0662)	
WABA I Tests: DEFPRC: F = 2.00, p=.0237 TMSATF: F = 4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.5160, p<.025 Difference between r_b and r_w: Z'= 1.68, p=.0465	WHOLES
COMPONENTS: Between: .1319 Within: .0485	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship systemic perspective (SYSPERS) and team satisfaction (TMSATF) is shown in Table 4.69. Based on the statistical significance and practical significance tests, there was a relationship between organizational support to individuals and team performance-1 at the team level. Those teams that reported using systemic perspective on average reported higher team satisfaction.

Table 4.69. Group Level WABA Results for Systemic Perspective and Team Satisfaction.

Individual Goals (INDGLS)	Induction
Covariance Equation: $(.3745)^{***} = (.5034)^{***}(.5747)^{***}(.6612)^{***z} + (.8641)(.8184)(.2592)^{**}$	
WABA I Tests: SYSPERS: F = 2.79, p=.0013 TMSATF: F=4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.6612, p<.005 Difference between r_b and r_w: Z'= 1.71, p=.0436	WHOLES
COMPONENTS: Between: .1913 Within: .1833	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team commitment (TMCMT) and team satisfaction (TMSATF) is shown in Table 4.70. Based on the statistical significance tests, there was a relationship commitment-building and team performance-2 at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still drawn because the between-cell correlation (r_b=.8183) was statistically significant (p<.005) *and* was significantly greater than the within-cell correlation (r_w=.5695, Z'=1.58, p=.0571, leading to a weak wholes induction for WABA II).

Table 4.70. Group Level WABA Results for Team Commitment and Team Satisfaction.

Team commitment (TMCMT)	Induction
Covariance Equation: $(.6480)^{***} = (.5610)^{***}(.5747)^{***}(.8131)^{***z} + (.8278)(.8184)(.5695)^{***}$	
WABA I Tests: TMCMT: F = 3.77, p<.0001 TMSATF: F = 4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8131, p<.005 Difference between r_b and r_w: Z'= 1.58, p=.0571	WHOLES (weak)
COMPONENTS: Between: .2621 Within: .3858	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team unity (TMUNTY) and team satisfaction (TMSATF) is shown in Table 4.71. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between team unity and team satisfaction could be made.

Table 4.71. Group Level WABA Results for Team Unity and Team Satisfaction.

Team unity (TMUNTY)	**Induction**
Covariance Equation: (.5697)** = (.6826)***(.5747)***(.6866)*** + (.7308)(.8184)(.5023)***	
WABA I Tests: TMUNTY: $F = 7.16$, $p<.0001$ TMSATF: $F = 4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b = .6866$, $p<.005$ Difference between r_b and r_w: $Z' = .99$, n.s.	EQUIVOCAL
COMPONENTS: Between: .2693 Within: .3004	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team self-assessment (TMASSMNT) and team satisfaction (TMSATF) is shown in Table 4.72. Based on the statistical significance tests, there was a relationship team self-assessment and team satisfaction at the team level. The practical significance test does not indicate that the between-group variation was larger than the within-group variation. However, a Category I wholes inference was still drawn because the between-cell correlation

(r_b=.8467) was statistically significant ($p<.005$) *and* was significantly greater than the within-cell correlation (r_w=.4338, Z'=2.60 p=.0047).

Table 4.72. Group Level WABA Results for Team Self-Assessment and Team Satisfaction.

Team self-assessment (TMASSMNT)	Induction
Covariance Equation: (.5645)** = (.5514)***(.5747)***(.8467)***^{z} + (.8342)(.8184)(.4338)***	
WABA I Tests: TMASSMNT: F= 3.60, p<.0001 TMSATF: F = 4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b =.8467, p<.005 Difference between r_b and r_w: Z'= 2.60, p=.0047	WHOLES
COMPONENTS: Between: .2683 Within: .2962	PARTS
FINAL Induction	WHOLES (Category I — but not practical magnitude)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between team decision processes (TMDEC) and team satisfaction (TMSATF) is shown in Table 4.73. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between team decision processes and team satisfaction could be made.

Table 4.73. Group Level WABA Results for Team Decision Processes and Team Satisfaction.

Team Decision Processes (TMDEC)	Induction
Covariance Equation: (.4253)*** = (.5666)***(.5747)***(.5356)* + (.8240)(.8184)(.3721)***	
WABA I Tests: TMDEC: $F = 3.88$, $p<.0001$ TMSATF: $F=4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.5356$, $p<.025$ Difference between r_b and r_w: $Z'= 0.69$, n.s.	EQUIVOCAL
COMPONENTS: Between: .1744 Within: .2509	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between clarity in sponsor expectations (CLRSPNEX) and team satisfaction (TMSATF) is shown in Table 4.74. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between clarity in sponsor expectations and team satisfaction could be made.

Table 4.74. Group Level WABA Results for Clarity in Sponsor Expectations and Team Satisfaction.

Clarity in sponsor expectations (CLRSPNEX)	Induction
Covariance Equation: (.5611)** = (.6086)***(.5747)***(.6372)*** + (.7935)(.8184)(.5209)***	
WABA I Tests: CLRSPNEX: $F= 4.83$, $p<.0001$ TMSATF: $F = 4.05$, $p<.0001$	WHOLES
WABA II Test: Magnitude of r_b: $r_b =.6372$, $p<.005$ Difference between r_b and r_w: $Z'= 0.59$, n.s.	EQUIVOCAL
COMPONENTS: Between: .2229 Within: .3383	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between commitment-building (CMTBLD) and team satisfaction (TMSATF) is shown in Table 4.75. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between commitment-building and team satisfaction could be made.

Table 4.75. Group Level WABA Results for Commitment-building and Team Satisfaction.

Commitment-building (CMTBLD)	**Induction**
Covariance Equation: (.3890)*** = (.6000)***(.5747)***(.5792)* + (.8025)(.8184)(.2891)**	
WABA I Tests: CMTBLD: F = 4.62, p<.0001 TMSATF: F=4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.5792, p<.025 Difference between r_b and r_w: Z'= 1.18, n.s.	EQUIVOCAL
COMPONENTS: Between: .1997 Within: .1899	WHOLES
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between inter-organizational perspective (INTRORG) and team satisfaction (TMSATF) is shown in Table 4.76. Based on the WABA I statistical significant tests, a wholes inference was drawn. Based on the WABA II statistical tests, a null inference was drawn — there was neither evidence for significant between- or within-cell correlation (r_b was not statistically significant and was not significantly different from r_w).

Combining these WABA I and WABA II results, a Category II (weaker) wholes inference is drawn as a final induction; in other words, there was evidence of a relationship between inter-organizational perspective and team satisfaction at the team level.

Table 4.76. Group Level WABA Results for Inter-organizational Perspective and Team Satisfaction.

Inter-organizational Perspective (INTRORG)	**Induction**
Covariance Equation: (.3886)*** = (.5012)***(.5747)***(.3605) + (.8653)(.8184)(.4021)***	
WABA I Tests: INTRORG: $F = 2.76$, $p=.0015$ TMSATF: $F=4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.3605$, n.s.	NULL
COMPONENTS: Between: .1038 Within: .2847	PARTS
FINAL Induction	WHOLES (Category II — weaker)

*p<.05, **p<.01, ***p<.005

The covariance equation for the relationship between organization support to individuals (ORGSPTIN) and team satisfaction (TMSATF) is shown in Table 4.77. Based on the WABA I statistical significance tests, a wholes inference was drawn. Based on the WABA II statistical significance tests, an equivocal inference was drawn. In other words, there was evidence of significant between- and within-cell correlation (both r_b and r_w were statistically significant, yet they were not significantly different from each other).

Combining these WABA I and II results, no inference about the relationship between organization support to individuals and team satisfaction could be made.

Table 4.77. WABA Results for Organization Support to Individuals and Team Satisfaction.

Organization support to individuals (ORGSPTIN)	Induction
Covariance Equation: (.5902)** = (.4815)***(.5747)***(.7500)*** + (.8765)(.8184)(.5335)***	
WABA I Tests: ORGSPTIN: F= 4.83, p<.0001 TMSATF: F = 4.05, p<.0001	WHOLES
WABA II Test: Magnitude of r_b: r_b =.7500, p<.005 Difference between r_b and r_w: Z'= 1.25, n.s.	EQUIVOCAL
COMPONENTS: Between: .2075 Within: .3827	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

4.4.2.4. Summary of WABA Results

Based on the WABA results for team performance-1 (TMPERF1), all independent variables except for individual goals (INDGLS) were retained for further analysis because they all had a wholes inference. For some variables, the inference was stronger than for others because the practical magnitude test was met.

For team performance-2 (TMPERF2), only the following independent variables which had a wholes inference were retained for further analysis: team skills (TMSKLS), defined design process (DEFPRC), team commitment (TMCMT), team unity (TMUNTY), team self-assessment (TMASSMNT), clarity in sponsor expectations (CLRSPNEX), commitment-building (CMTBLD), inter-organizational perspective (INTRORG), and organizational support to individuals (ORGSPTIN). Other variables were excluded because there was not evidence of a clear "team effect" to describe the relationship between these variables and team performance-1.

For team satisfaction (TMSATF), only the following variables which had a wholes inference were retained for further analysis: defined design process (DEFPRC), systemic perspective (SYSPERS), team commitment (TMCMT), team self-assessment

(TMASSMNT), and inter-organizational perspective (INTRORG). All other variables were excluded because there was not evidence of a clear "team effect.".

The next step in the methodology to address this research question was to examine the zero-order and partial Pearson's correlations for relationships of these remaining variables.

4.4.3. Partial Correlations

Partial correlations helped to develop an understanding of the unique contribution of each variable to explaining variance in a dependent variable. This process is an important step to screen out any variables before multiple regression was used in the next step. A variable may appear to have an important relationship with dependent variables when considering the zero-order correlation, but in actuality may not contribute uniquely to explaining the variance in dependent variables (or may in fact have a negative relationship) when other variables are controlled for (i.e., held constant) using partial correlations. This step was particularly important given that many of the independent variables in this research were correlated had shared variance in the correlation with team effectiveness. In addition, there were limited degrees of freedom (n=15 teams) for multiple regression, which required that only a few predictor variables at most were entered into a regression model.

Variables relating to team performance-1 (TMPERF1) were considered first. When team skills and clarity in sponsor expectations were controlled (i.e., held constant), the partial correlations between the remaining variables showed that none of the remaining variables had a correlation with TMPERF1 that was significantly different than zero (there were both positive and negative correlations but none were significant), and so do not contribute significantly to explaining TMPERF1 (see Table 4.78). Therefore, these variables were excluded from further analysis, and TMSKLS and CLRSPNEX were retained for multiple regression.

Table 4.78. Partial Correlations for Team Performance-1 Using Weighted Group Means Controlling for Team Skills and Clarity in Sponsor Expectations.

Independent Variable	Partial Correlation with Team Performance-1 (TMPERF1)
Defined Design Process (DEFPRC)	.38
Systemic Perspective (SYSPERS)	.17
Team Unity (TMUNTY)	.09
Team Self-Assessment (TMASSMNT)	.05
Team Decision Processes (TMDEC)	-.09
Commitment-building (CMTBLD)	-.04
(Inter-organizational Perspective) INTRORG	.17

Degrees of freedom are df=15-2-2=11[21].
Correlations greater than .476 are significant at the .05 level.

Next, variables relating to team performance-2 (TMPERF2) were considered. When team skills and clarity in sponsor expectations were controlled for, partial correlations with TMPERF2 show that defined design process and commitment-building had a significant negative correlation with TMPERF2 (at the .05 level with 11 degrees of freedom)[22]. In addition, team commitment, team unity, team self-assessment, inter-organizational perspective, and organizational support to individuals did not significantly contribute to explaining team performance-2 (see Table 4.79). These seven variables were therefore excluded from further analysis. Team skills and clarity in sponsor expectations were retained for multiple regression.

[21] The degrees of freedom were N-2 = 15 - 2, which is then penalized for the number of variables being held constant, in this case 2 variables (d.f.=11).

[22] Defined design process and commitment-building were not retained for further analysis using multiple regression even though there was a significant (negative) relationship with team performance-2. Defined designed process was not significantly correlated with team performance-2 at the group level (r_b=.34, n.s.; it was retained after WABA only because of a Wholes Category II (weaker) induction). Because this was a single-item scale and because it was not related to team performance-1 at the group level, the researcher was not confident in the strength of the relationship between defined design process and team performance-2. Even if commitment-building were retained and entered into a regression model with team skills and clarity in sponsor expectations, it was not a significant predictor of team performance-2.

Table 4.79. Partial Correlations for Team Performance-2 Using Weighted Group Means Controlling for Team Skills and Clarity in Sponsor Expectations.

Independent Variable	Partial Correlation with Team Performance-2 (TMPERF2)
Defined Design Process (DEFPRC)	-.69***
Team Commitment (TMCMT)	.11
Team Unity (TMUNTY)	.02
Team Self-Assessment (TMASSMNT)	-.30
Commitment-building (CMTBLD)	-.51*
Inter-organizational Perspective (INTRORG)	.20

Degrees of freedom are df=15-2-2=11
Correlations greater than .476 are significant at the .05 level.
*p<.05, ***p<.005.

Variables relating to team satisfaction were considered last. When team self-assessment was controlled for, partial correlations show that inter-organizational perspective had a significant negative relationship with team satisfaction[23]. In addition, defined design process, systemic perspective, and team commitment did not contribute significantly to explaining additional variance in team satisfaction (see Table 4.80). Therefore, only team self-assessment was retained for multiple regression.

Table 4.80. Partial Correlations for Team Satisfaction Using Weighted Group Means Controlling for Team Self-Assessment.

Independent Variable	Partial Correlation with Team Satisfaction (TMSATF)
Defined Design Process (DEFPRC)	.11
Systemic Perspective (SYSPERS)	.24
Team Commitment (TMCMT)	.32
Inter-organizational Perspective (INTRORG)	-.67**

Degrees of freedom are df=15-2-1=12
Correlations greater than .458 are significant at the .05 level.
**p<.01.

23 Inter-organizational perspective was not retained for further analysis using multiple regression even though there was a significant (negative) relationship with team satisfaction. Inter-organizational perspective was not significantly correlated with team satisfaction at the group level (r_b=.36, n.s.; it was retained after WABA only because of a Wholes Category II (weaker) induction). Because it was not related to team satisfaction at the group level, the researcher was not confident in the strength of the relationship between inter-organizational perspective and team satisfaction.

4.4.4. Multiple Regression Results

Using the results from the previous step with partial correlations, a regression analysis using "ENTER" as the method for entering variables was used to test a model for each dependent variable. In each regression in this section, group means were used. Significance levels for the F-test and t-tests were based on unweighted group means (i.e., differences in group size were not accounted for) so as not to inflate the degrees of freedom in the regression analysis. All other information in the tables including the R^2 and adjusted R^2 were based on weighted group means.

The regression model for team performance-1 (TMPERF1) had two variables: team skills (TMSKLS) and clarity in sponsor expectations (CLRSPNEX). The output from SPSS is summarized in Table 4.81. The overall model was significant ($p<.0001$), and the adjusted R^2 was .969. The collinearity diagnostics (VIFs) for all predictor variables were within acceptable range (i.e., no more than 10, as recommended by Montgomery and Peck, 1982). The predictor variables TMSKLS and CLRSPNEX were both highly significant ($p< 0.0001$).

Scatterplots for each predictor variable with team performance-1 are shown in Figures 4.2a and 4.2b[24]. Note that even with a single predictor variable, the R^2 was fairly high (.69 and .78 for team skills and clarity in sponsor expectations, respectively), and the model explains much of the variance in team performance-1. Figure 4.2c is a scatterplot with both predictor variables and team performance-1, while Figure 4.2d is a graphical portrayal of the predictive strength of the regression model and is a scatterplot of actual values of team performance-1 versus predicted values.

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24 The R^2 for the regression line shown on the scatterplots in this section were based on unweighted group means; the reported R^2 in the tables of output for the regression models were based on weighted group means which are correct.

Table 4.81. Multiple Regression Model for Team Performance-1 With Group Means.

Variable(s) Entered into Equation						
1. CLRSPNEX	Group Mean: Clarity in Sponsor Expectations					
2. TMSKLS	Group Mean: Team Skills					
Multiple R	.985					
R Square	.969					
Adjusted R Square	.969					
Standard Error	.147					
Signif F = .0000						
------------------------ Variables in the Equation ------------------------						
Variable	B	SE B	Beta	Tolerance	VIF	Sig T
TMSKLS	.769039	.028042	.499903	.722804	1.384	.0000
CLRSPNEX	.875420	.025532	.624987	.722804	1.384	.0000
(Constant)	-3.111587	.113963				.0000

All significance levels were based on unweighted group means[25].
Regression degrees of freedom were df=2 and for residual df=12.

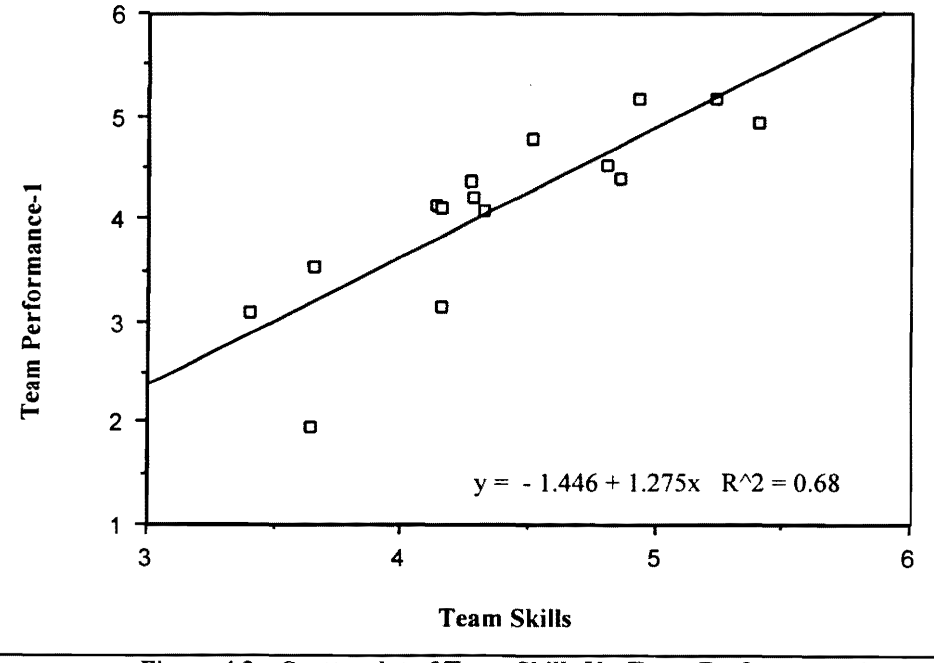

Figure 4.2a. Scatterplot of Team Skills Vs. Team Performance-1

[25] Significance levels for the overall regression model and for the predictor variables were based on unweighted group means, the reported R^2 and adjusted R^2 in Table 4.81 were based on weighted group means. However, the difference in R^2 for weighted vs. unweighted group means is minimal. The adjusted R^2 using unweighted group means was .967 as compared to .969 for weighted group means. For team performance-2, the difference in R^2 was also minimal (.90 compared to .91 using weighted group means), as was the difference for team satisfaction (.68 compared to .71 using weighted group means).

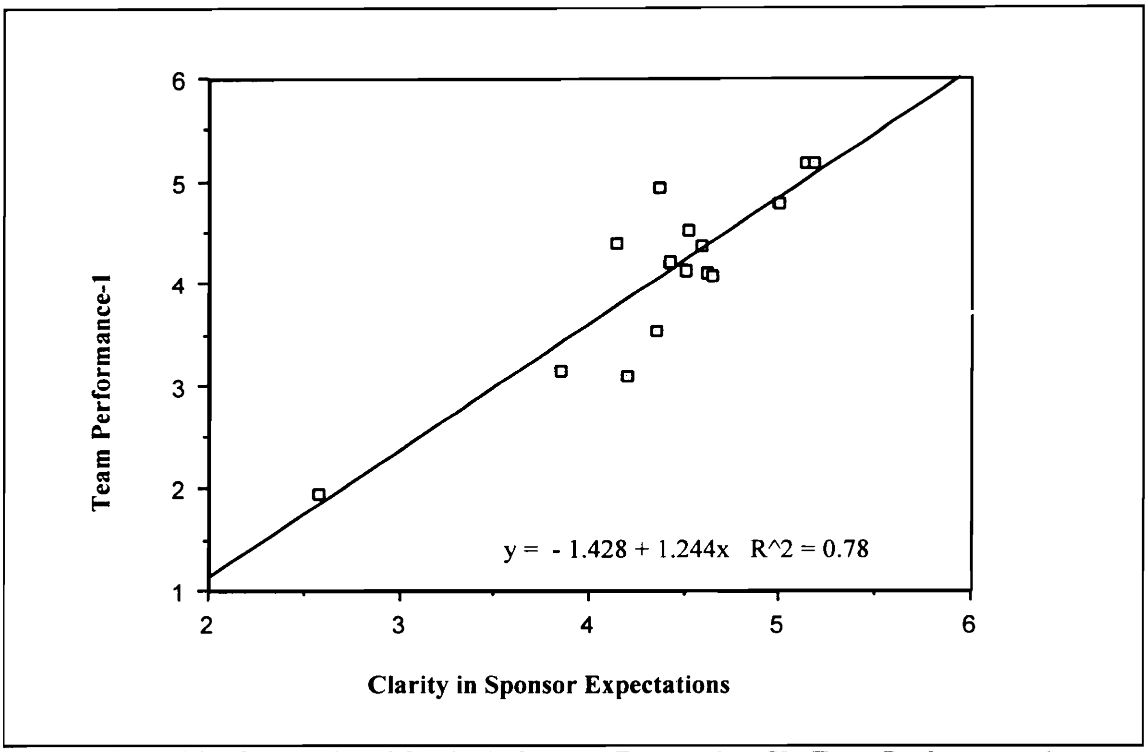

Figure 4.2b. Scatterplot of Clarity in Sponsor Expectations Vs. Team Performance-1.

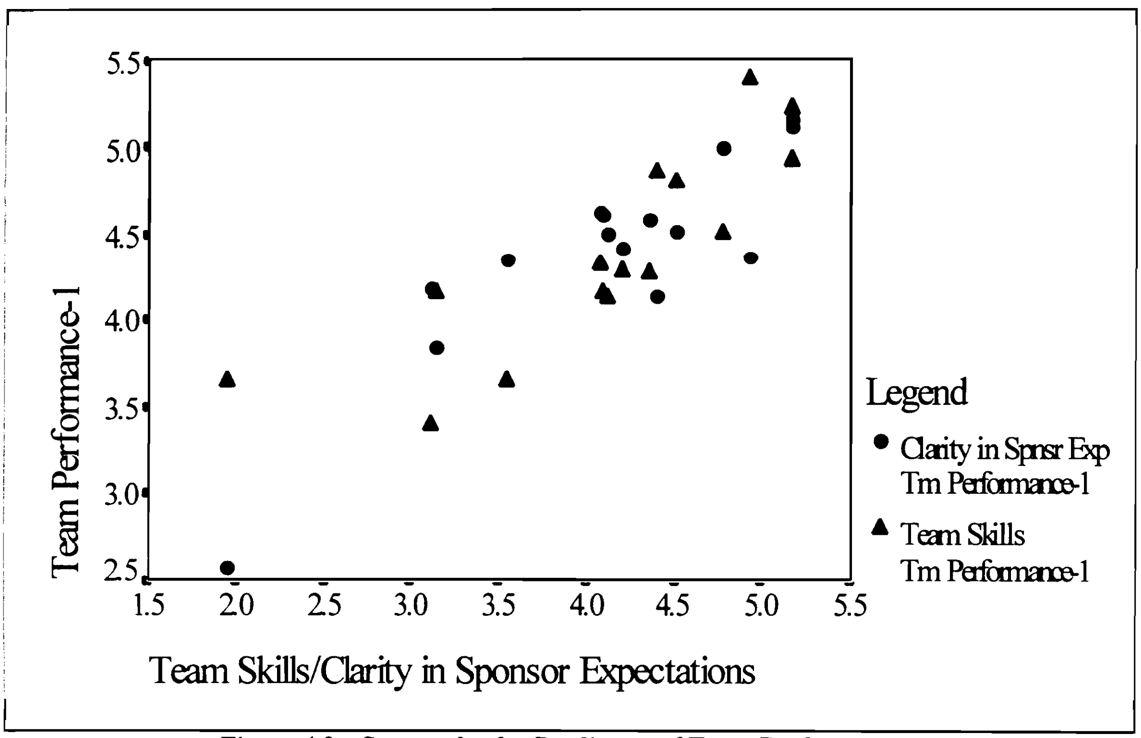

Figure 4.2c. Scatterplot for Predictors of Team Performance-1.

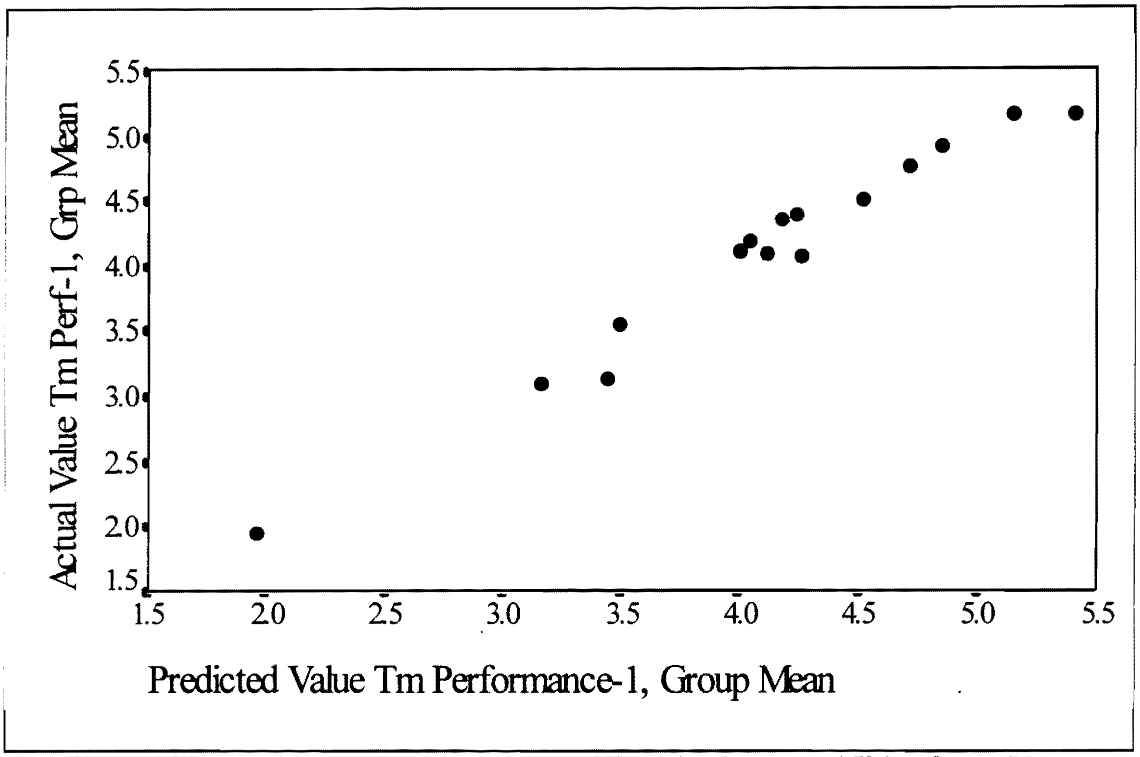

Figure 4.2d. Actual Versus Predicted Values of Team Performance-1 Using Group Means.

The model for team performance-2 had the same two variables entered as the previous regression model: team skills (TMSKLS) and clarity in sponsor expectations (CLRSPNEX). The output from SPSS is summarized in Table 4.82. The overall model was significant ($p< 0.0001$), and the adjusted R^2 was .908. The collinearity diagnostics (VIFs) for predictor variables were within acceptable range. Both predictor variables, TMSKLS and CLRSPNEX, were significant ($p= 0.0001$ and $p= 0.0004$, respectively).

Scatterplots for each predictor variable with team performance-2 are shown in Figures 4.3a and 4.3b. Figure 4.3c is a scatterplot with both predictor variables and team performance-2. Figure 4.3d is a graphical portrayal of the predictive strength of the regression model and is a scatterplot of actual values of team performance-2 versus predicted values.

Table 4.82. Multiple Regression Model for Team Performance-2 With Group Means.

TMPERF2

Variable(s) Entered into Equation
1. CLRSPNEX Group Mean: Clarity in Sponsor Expectations
2. TMSKLS Group Mean: Team Skills

Multiple R	.953
R Square	.909
Adjusted R Square	.908
Standard Error	3.03051

Signif F = .0000

------------------------- Variables in the Equation -------------------------

Variable	B	SE B	Beta	Tolerance	VIF	Sig T
TMSKLS	11.727575	.578658	.638226	.722804	1.384	.0001
CLRSPNEX	7.493848	.526871	.447907	.722804	1.384	.0004
(Constant)	-11.960849	2.351714			.1814	

All significance levels are based on unweighted group means.
Regression degrees of freedom are df=2 and for residual df=12.

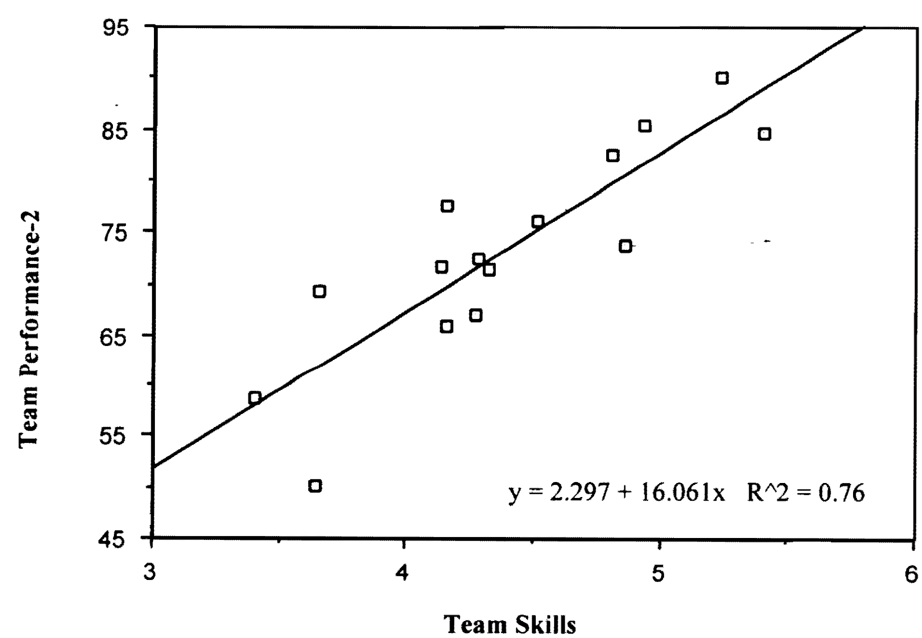

Figure 4.3a. Scatterplot of Team Skills Vs. Team Performance-2.

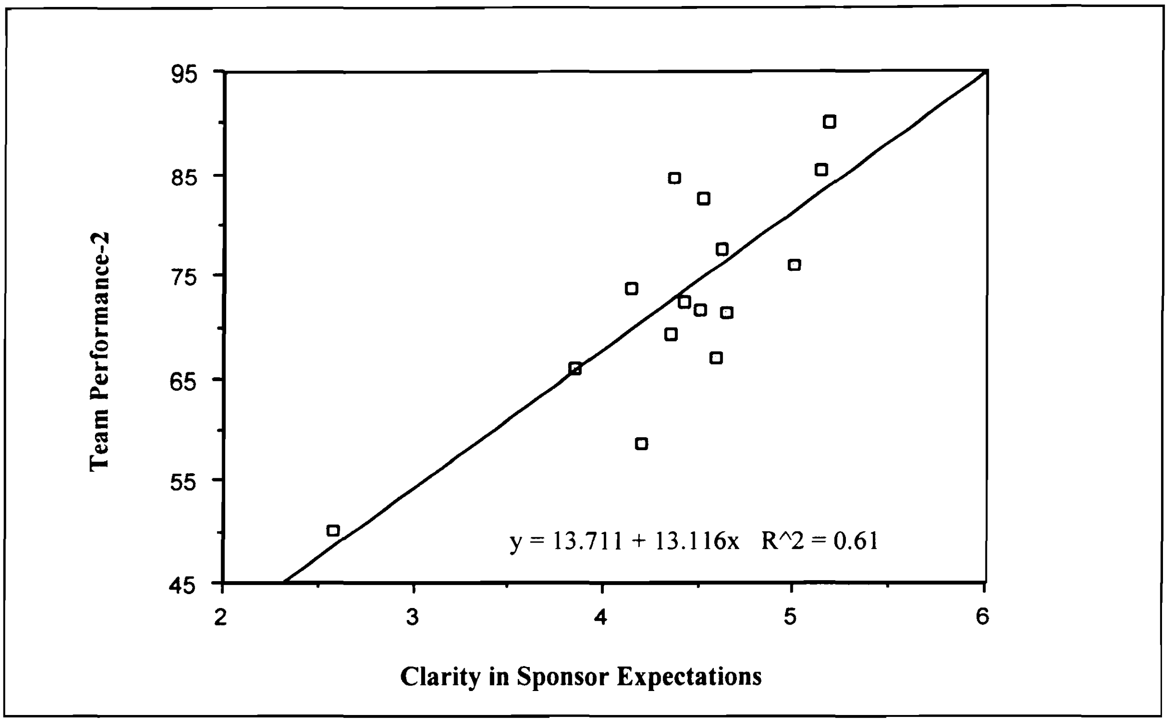

Figure 4.3b. Scatterplot of Clarity in Sponsor Expectations Vs. Team Performance-2.

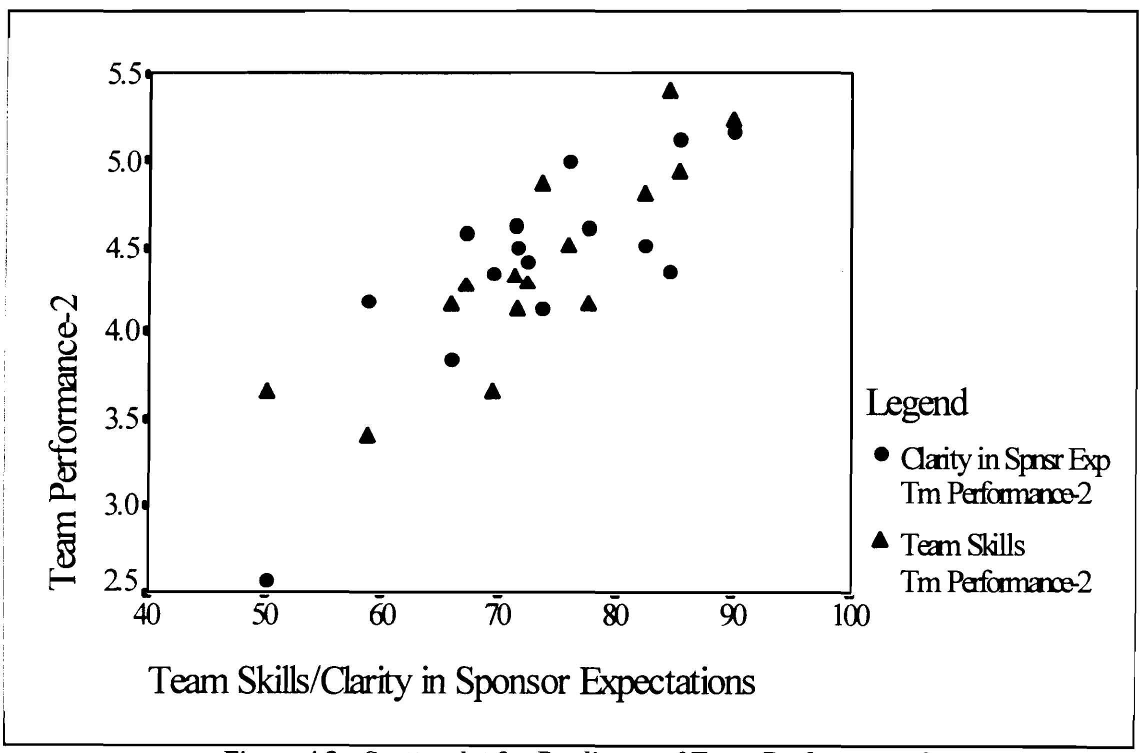

Figure 4.3c. Scatterplot for Predictors of Team Performance-2.

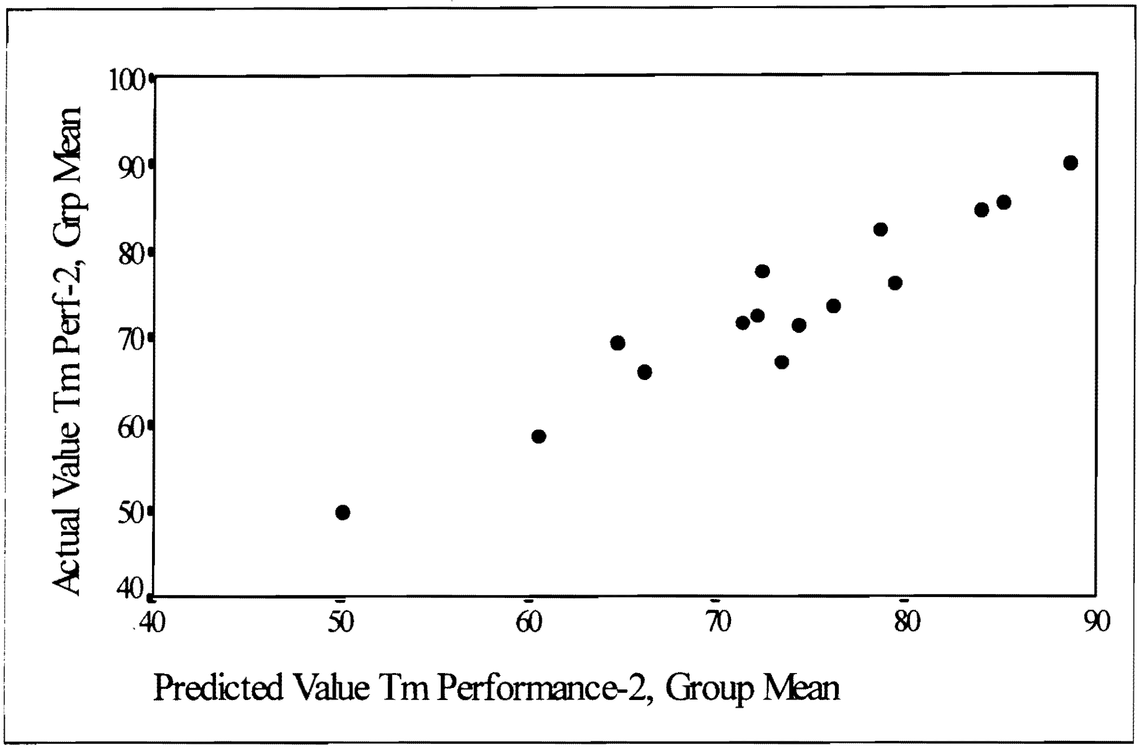

Figure 4.3d. Actual Versus Predicted Values of Team Performance-2 Using Group Means.

The regression model for team satisfaction had one variable entered: team self-assessment (TMASSMNT). The output from SPSS is summarized in Table 4.83. The overall model was significant (p= 0.0013), the adjusted R^2 was .715, and team self-assessment was a significant predictor of team satisfaction (p= 0.0001).

A scatterplot for the predictor variable, team self-assessment, with team performance-2 is shown in Figure 4.4a. Figure 4.4b is a graphical portrayal of the predictive strength of the regression model and is a scatterplot of actual values of team satisfaction versus predicted values.

Table 4.83. Multiple Regression Model for Team Satisfaction with Group Means.

TMSATF
Variable(s) Entered into Equation:
1. TMASSMNT Group Mean: Team Self-Assessment

Multiple R	.847
R Square	.717
Adjusted R Square	.715
Standard Error	.334

Signif F = .0013

------------------------ Variables in the Equation -------------------------

Variable	B	SE B	Beta	Tolerance	VIF	Sig T
TMASSMNT	1.043020	.057935	.846691	1.00000	1.000	.0001
(Constant)	.757757	.235684				.2457

All significance levels are based on unweighted group means.
Regression degrees of freedom are df=1 and for residual df=13.

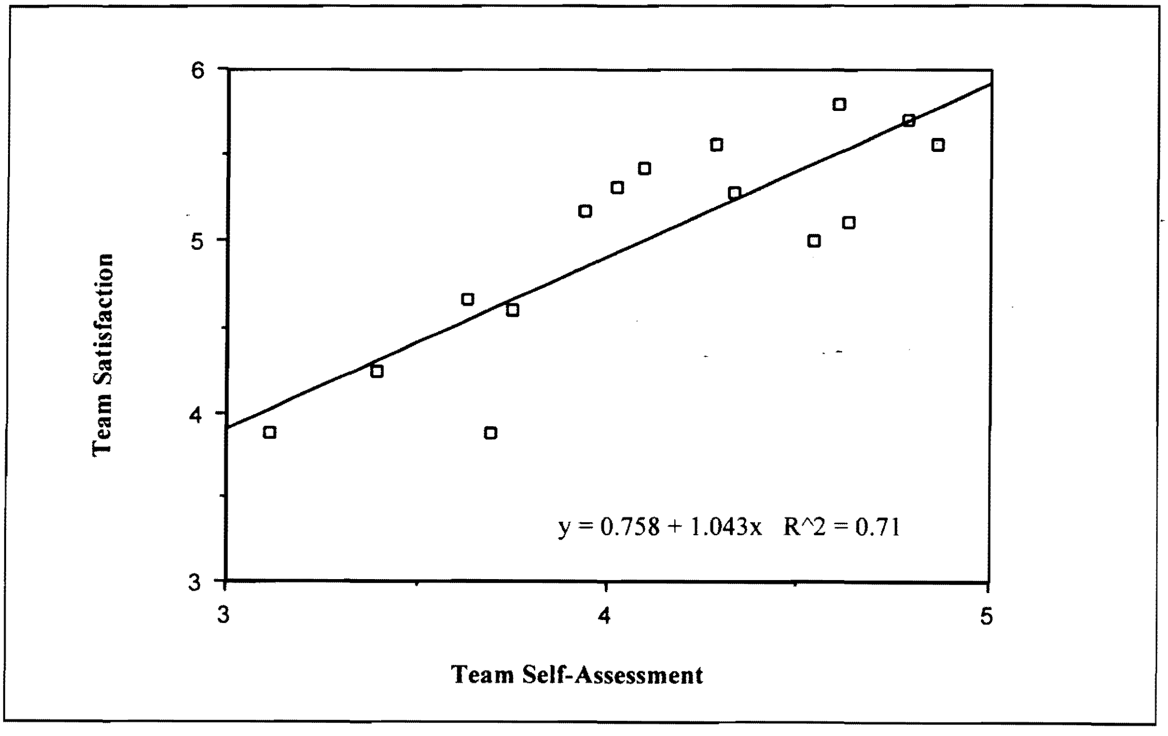

Figure 4.4a. Scatterplot of Team Self-Assessment Vs. Team Satisfaction.

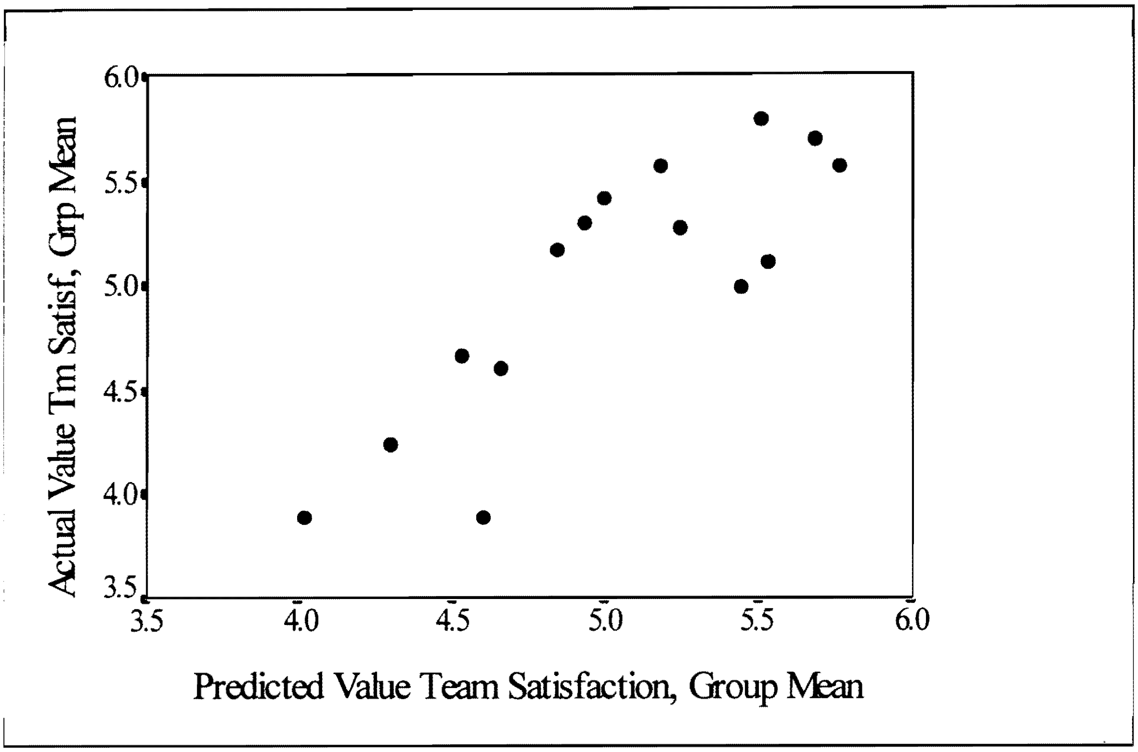

Figure 4.4b. Actual Versus Predicted Values of Team Satisfaction Using Group Means.

The regression results and in particular the adjusted $\bar{R}^2$ values obtained in this research (e.g., .97 for team performance-1), may seem unusually high to some researchers, particularly those accustomed to much larger sample sizes. The high values of R^2 obtained for the dependent variables in this research may be a result of several things. First, there were either one or two predictor variables entered into the regression models for the dependent variables, and the sample size (fifteen teams) is relatively small. With a larger sample of teams, such a high value for R^2 would be less likely. Second, because data about independent and dependent variables were obtained through self-report, it is impossible to determine how much of the explained relationship is due to common-method variance versus true variance. Third, this result may represent the true relationship between predictors and team effectiveness. For example, in a laboratory experiment having the same research purpose as this study (to identify the determinants of group effectiveness), Bowen (1992) found that the variable "knowledge-skill" of team members was the most significant determinant of group effectiveness and obtained an R^2 of .92 with a single predictor in a regression model.

Regression analysis provides information about the significance of a subset of predictor variables in explaining total variation in a dependent variable (the F-test for the regression model), and about the significance of each predictor variable in uniquely explaining variance in the dependent variable (the t-test for each predictor). However, conclusions cannot be drawn about the relative importance of the predictor variables. For example, it is not clear whether team skills is a more important predictor of team performance-1 than clarity in sponsor expectations, or vice versa.

4.5. Research Question 5

This question asks: What are the key learnings from organizations using design teams? There are two ways this question was addressed. First, research findings about contributors to and obstacles to team effectiveness are presented. These data were collected as part of the survey questionnaire that members of design teams completed (which also produced the quantitative data). Second, overall learnings from Eastman Chemical Company (Eastman) are presented, as an organization in its eighth year of work redesign using design teams. These learnings were obtained from individual and focus group interviews with team leaders, internal consultants, in addition to one person who can best be described as a strategy designer for design teams.

4.5.1. Themes in Contributors and Obstacles to Team Effectiveness

The survey questionnaire completed by participants of this research included the following two open-ended questions: What are the biggest things **contributing** to the team's effectiveness? What are the biggest **obstacles** to the team's effectiveness? Responses to these questions, and other questions, were summarized and condensed for each team. These team summaries from the Design and Leadership Team Survey are shown in Appendix F. The responses to these two questions were clustered into overall "themes" relating to key variables in this research. A comprehensive table of all comments and how they cluster into themes is presented in Appendix F which also includes a discussion of how the themes were ranked. Table 4.84 presents each theme, how it ranked as both a contributor to team effectiveness and an obstacle to team effectiveness, and illustrative comments from the survey questionnaires. A "+" in Table 4.84 indicates that the comment was a response to the question about contributors to team effectiveness while a "-" indicates a response to the question on obstacles to team effectiveness.

The highest ranked themes on contributors to team effectiveness (i.e., what things contributed the most to team effectiveness) were: 1) commitment, attitude, willingness within the team; 2) knowledge, skills, abilities, experience of team members; 3) teamwork and ability to work as a team; 4) internal team leadership; and 5) communication and trust within the team.

The highest ranked themes on obstacles to team effectiveness (i.e., what things were the biggest obstacles to team effectiveness) were: 1) organizational context and culture; 2) making time for the team; 3) purpose, direction, and scope of the team; 4) commitment, attitude, willingness within the team; and 5) communication and trust within the team.

Table 4.84. Themes in Contributors and Obstacles to Team Effectiveness.

Contributor/Obstacle	Illustrative Comments from Survey Questionnaires
Team Composition Rank #7 as a Contributor Rank #11 as an Obstacle	+ The right people are involved (they are committed and have authority to change the Division) + Team membership and leadership + Representation from all shifts + Viewpoints (from a broad base) - Not enough staff to handle work load - Team is scattered across campus which minimizes opportunity for informal communications to easily take place - High turnover (including facilitator)
Knowledge, Skills, Abilities, & Experience of Team Members Rank #2 as a Contributor Rank #9 as an Obstacle	+ Individual competence and knowledge + Wide range of skill in group + Team members with the right skills + Broad and detailed knowledge of team members - Skill requirements - clearly the members of this group are not equipped with the knowledge/skill/ability to drive organization change - Lack of experience
Purpose, Direction, and Scope of Team Rank #10 as a Contributor Rank #3 as an Obstacle	+ Larger feeling of a common purpose + Clear charter + Charter (kept us focused) + Understanding of goals for the team and buy-in by team members that those goals are worthwhile + Defined plan and sense of direction - Ability to stay focused on what's important - Too many initiatives - Direction change each 6 months - Not having clarity of our specific expectations - Trying to change too much given the complexities of the problem - Lack of clear expectations and requirements from sponsors
Role of Team in Improvement Infrastructure Rank #15 as an Obstacle	- Senior management team vs. DDT line blurred - Lack of integration of A and B structures
Change/Redesign Methodology and Processes Used by Team Rank #7 as a Contributor Rank #8 as an Obstacle	+ Planning process + The GSS method + IMPROVE + Knowing the current state and results we want and then mapping how to achieve them - Lack of a "cohesive" approach to deliverables/tasks (i.e., Gap analysis, activity plans, etc.) - Keeping approaches and processes simple - Lack of consistency in approach

Table 4.84 (cont'd). Themes in Contributors and Obstacles to Team Effectiveness.

Contributor/Obstacle	Illustrative Comments from Survey Questionnaires
Commitment, Attitude, Willingness Within Team Rank #1 as a Contributor Rank #4 as an Obstacle	+ Willingness to change + Commitment to improve the Division + Enthusiasm as team members + Willingness to learn and share + Willingness to work in a team + The commitment to make this project work + Overall dedication and commitment to doing the job right and taking failures as learning experiences + (Members') dedication - Not all team members committed to team or process - Closed minds - Lack of enthusiasm and ownership - Apathy or disinterest - Different levels of commitment from members - Commitment to the deadlines and deliverables
Teamwork & Ability to Work as a Team Rank #3 as a Contributor Rank #6 as an Obstacle	+ Working as a team, working together to resolve differences + Ability to work together - no big egos + Team synergy + Team ground rules + Well-rounded team we work well together + A respect for everybody's ideas and inputs + Team chemistry - Not following our 7 principles - Closing conversations and arriving at a decision - Too much work being done individually not enough collective results - Personal agendas - Situations still arise which bring out the "turf" mentality
Participation Within the Team Rank #10 as a Contributor Rank #12 as an Obstacle	+ Regular meetings + Active members of team taking increased responsibility of leading team discussion + The active participation of each member - Better understanding of roles we may play as a team member - Lack of regular attendance by several members
Communication and Trust Within Team Rank #5 as a Contributor Rank #5 as an Obstacle	+ Many team members quite outspoken and articulate + Open and honest + Team members felt comfortable in expressing opinions openly and without criticism from other team members - Communication - we are still not able to have "crystal conversations" with other team members on a consistent basis — leads to certain degree of mistrust - Specialized information not shared - Open and honest communication still not practiced (afraid to hurt each other), affecting trust - Lack of open and honest dialogue
Internal Team Leadership Rank #4 as a Contributor Rank #13 as an Obstacle	+ Convener did good job of preparing and guiding meetings + Leader's energy + Team leaders' knowledge/skills/experience + Excellent project leader with good facilitation skills + Strong leadership on the part of the team leader - Team leader sends mixed messages by saying one thing and doing another - The distribution manager sometimes negatively impacted the team's performance

Table 4.84 (cont'd). Themes in Contributors and Obstacles to Team Effectiveness.

Contributor/Obstacle	Illustrative Comments from Survey Questionnaires
Resources for Team (Training & Facilitation) Rank #6 as a Contributor Rank #16 as an Obstacle	+ Bootcamp experience + Outside facilitation and guidance from external facilitators + Continued education/development of team members - Lack of education
Guidance and Support from Team Sponsor(s) Rank #13 as a Contributor Rank #10 as an Obstacle	+ Sponsor focus/commitment + Continued support from the sponsor + Strong vision of sponsors which rolls down to business plans for warehouse - Unclear/vacillating leadership from sponsors, as characterized by their difficulty in articulating goals, objectives - Lack of leadership and direction from sponsors - We had to define our purpose, charter ourselves and educate all levels of management above us - Sponsors making decisions not supported by team members - Unwillingness of sponsors and others to devote time to this task
Boundary Management with Stakeholders (Employees, Customers, Upper Management/Leadership) Rank #12 as a Contributor Rank #7 as an Obstacle	+ Staff input + Team leader's ability to understand the customer needs and communicate them to upper management - Communication to the many areas of the business affected, the stores (over 600 affected), to ensure the information reaches those who need it (e.g., night crews, clerks, etc.) - Cooperation from other divisions - Being able to communicate and get people to understand what the Project is all about - Coordination with other PATs - Relaying the message to the workforce i.e., vision, commitment, attitude - Promoting customer commitment and buy-in
Organizational Context and Culture Rank #7 as a Contributor Rank #1 as an Obstacle	+ Willing to invest in strategic initiative + We are supported by senior management + Trust from National Grocers + The support from all levels of management + What's recognized/rewarded, time spent on initiatives or "regular job" - Internal silos - Resistance to change - Union negotiations - Lack of coherent and consistent commitment to quality initiatives and process redesign at a university level - Lack of understanding that "improvement" efforts are part of the "real" work of the store - Expectations of quick results - Old paradigms - Employee distrust, resentment and disinterest
Making Time for the Team Rank #14 as a Contributor Rank #2 as an Obstacle	- Conflicting demands on time - Getting things done on time - Balancing of business priorities and time to allow proper focus and dedication to the team's responsibilities and initiatives is extremely difficult - Difficulty in managing time commitments - Team members missing meetings due to other priorities taking precedence - Freeing up time to work on improvements outside of team meetings - Daily work responsibilities outside team

4.5.2. Overall Key Learnings About Creating and Managing Design Teams

The data from individual and focus group interviews with design team leaders, internal team consultants, and strategy designers at Eastman were analyzed to extract key learnings about creating and managing design teams. Additionally, a presentation made by the strategy designer for work redesign teams at Eastman was used as data for these key learnings (Grabar & Schaffer, 1994). The key learnings were organized into the following categories (see Table 4.85): team start-up, team functioning and development, team transition and hand-off, and lastly, learnings about the overall strategy for utilizing design teams. Illustrative quotes from interviews are included in the table.

Within team start-up, key learnings were clustered into team composition and team chartering. Based on learnings from Eastman, the composition of design teams should:

- include the formal leader of the target system,
- not be too large because of an attempt to include representation from many stakeholders,
- have a diverse demographic profile,
- be based on ability to contribute to the team rather than representation, and
- have the right mix of skills.

One learning related to composition was the balance of technicians versus management on design teams, in which opinions were mixed (see Table 4.85).

The second clustering of key learnings related to team start-up was chartering a team. Key learnings in this area suggest that a charter is an important tool to provide direction, expectations, and boundaries for a team, and the process for developing a charter should be standardized with the sponsor developing a draft charter for a team to review.

Team functioning and development included learnings related to managing a design team throughout its design life cycle. More emphasis must be placed on implementation and transition planning rather than trying to create the perfect design and spending too much time in the design phase. In addition, the design team must manage communication and share knowledge with internal stakeholders as design team members also learn and develop.

During team transition and hand-off, the following key learnings were shared. There must be overlap in membership between the design team and implementation team (if a separate team). In addition, commitment and buy-in to the design must be created in the implementation and transition process (and not in the design stage).

The last category of key learnings related to the organization's overall strategy for creating and managing design teams. First, Eastman recognized the need to design in structures for both continuous improvement of the technical system (the core work processes) and the design of the work system itself. Second, throughout a team's life cycle (from start-up to transition and hand-off), a design team must keep focused on business results, the fundamental reason for work redesign. Third, there is a need to establish a clear vision, strategy, and philosophy to support work redesign one level higher up than the design team's target system. This higher-level strategy should guide the design team's choices and decisions as the work system is designed and implemented. And lastly, a champion for change at a high organizational level is necessary for pervasive support and commitment to work redesign.

Over the approximately eight years that Eastman has used design teams to support work redesign, the company has been able to reduce the cycle time on the design process (not including implementation time) from about 18 months for the first design down to about 4 months for the most recent designs. This cycle time reduction is attributed to a number of factors, based on interview data.

First, after having gone through a number of designs in manufacturing areas, more "global solutions" were created by teams, thus creating more "givens" in the charter of subsequent teams. For example, if one design team included a redesigned pay system for a departmental design, that solution becomes a "given" to teams redesigning other departments within the same division.

Second, some issues were taken on as site issues within a division; in other words, the issue was addressed at a division level and the solution cascaded down to departments, thus reducing the scope of what departmental design teams needed to address.

Third, standardizing the chartering process and the elements within a charter created opportunities for cycle time reduction on design efforts. Earlier design teams struggled with defining their scope and what products the team needed to produce — things that are now defined in a draft charter by the sponsor (whether a leadership team or steering team).

Fourth, some of the pre-work required in the design process (using sociotechnical systems design) is now done off-line by a leadership team before the design team even starts. For example, the leadership team may do some of the business analyses, environmental scans, and customer analyses required in the design process.

Lastly, the emphasis on creating a "perfect" design was shifted to one of creating a good design to allow time to focus on transition planning and implementation. This emphasis shift enabled teams to execute the design process more quickly and not try to solve all organizational problems with the design.

Table 4.85. Key Learnings from Eastman Chemical Company in Creating and Managing Design Teams.

Team Start-up: Team Composition	Key learning #1: The formal leader of the target organizational system (department manager) needs to be a member of the design team. *"There's one or two experiences where they ended up with a design team [without the] department manager. They ended up not agreeing to everything the design team did so we ended up [having to] rework the design — would have been better to have him on there to start with."*
	Key learning #2: Early design teams were too large, trying to build broad representation; later design teams were smaller and more focused in membership. *"First design teams were too large, tried to get large representation, thought that extensive analysis would be required; spent too much time and analysis to get things ready. But afterthought is that analysis was too extensive. We have evolved to smaller teams and less up front study."* *"Early on... problems with large teams — 15-18 — too big, 8-12 more acceptable."* *"Wrong people on team causes problems, get the right people, some people there [were] only needed for 16 hours, but they stayed the whole time."*
Team Start-up: Team Composition	Key learning #3: Design team must have diverse demographic profile. *"I think there's got be a demographic profile because people see things in a different perspective."* *"I'm convinced that diversity is in fact a strength for a team... there may be more conflicts in the team processes, but if that's managed well, if the team really comes together and develops good processes that diversity will invariably result in a better product."* *"Diversity within the team, and demographics I think is important... getting different people's point of view from older folks that have been with the company for a long time to what's the needs of the younger employees — male, female point of view, minority point of view... I think all that is important to have a good demographics and representation of the work force that you're going to be designing."*
	Key learning #4: Membership on the team must be for contribution not representation. *"One of the very first things that invariably happens when you put together a design team is that people think they're on the team representing somebody. When they start out, 'well, I'm representing crew 2' or 'I'm representing this group over here' and until you get over that hump, you can't get anything accomplished."* *"At the early stages when they first started in to this, I think it was some trust issues...between the management and the folks as well as some of the peer problems — 'if I'm on this team, I've got to make sure that my crew, my co-workers' viewpoints are heard as opposed to being there to design the system and work on the problems. I think you had to overcome 'I'm here to represent my group's point of view and make sure that nobody gets shafted.' Turf protect if you want to call it that."*
	Key learning #5: The team must have the right mix of skills and team member selection should be driven by what skills are needed to accomplish the team's objective. *"The more you can do it to ensure that the people who are on the design team have the skills you need to start with, the better off you are in terms of getting what you want."* *"Any team has got to have the right skills profile to enable it to do what it has to do. And I think if the team is selected based on what's needed to achieve the objective, the team has a lot better shot at being effective."* *"I think one of the big things to consider if you're starting up a team is having the knowledge of the organization that they're going to be designing — a broad range of knowledge."*

Table 4.85. (cont'd) Key Learnings from Eastman Chemical Company in Creating and Managing Design Teams.

	Key learning #6: The views on the necessary balance of management vs. technicians on teams is mixed. *"My experience suggests to me that a regional work system design needs to be carried out by a group of managers who are truly empowered leaders.... I think these people need to create the design, and then they need to bring ...some resources to develop and carry forward the transition plan. And I think 12, 18, 24 months down the road whenever a formal renewal needs to take pace and this is the point in which the technicians become the major contributors to the design of the system."* *"I think it's important to have more technicians on the team than management."* *"Looked at original assumption that vertical slice would create a better design and would bring along a broader commitment to the design, but looking back I don't think we supported either of those assumptions, don't really know why."*
Team Start-up: Team Chartering	Key learning #7: The charter is an effective tool to provide direction, expectations, and boundaries for a team. Common charter elements are: purpose or mission statement, products and services for the team to produce, team effectiveness measures and goals, time lines, relationship to other teams, givens, boundaries, resources available to a team, membership guidelines. *"Charter — keeping the end goal in mind."* *"Detailing boundaries in the charter, early on [teams had] loose boundaries, teams would go to steering team and [steering team] would shoot it down to boundary problems."*
	Key learning #8: The team chartering process is standard, with sponsor creating a draft charter which the design team reviews/renegotiates as necessary. *"Usually start off with a draft charter for the renewal team or for the design team written by the steering team saying here is the scope of what we'd like you to look at and here's the givens and guiding principles. Here are the deliverables. In terms of capabilities, give them the scope and product we want delivered. So the steering team will lay out direction for a design or renewal team."* *"Part of our chartering process and one that I absolutely insist on is that negotiation. The commissioning body approves the draft charter. The team that's being chartered processes that — receives their commission, receives the draft charter, and then develops an understanding of all the provisions, and then renegotiates that charter with the commissioning body. So there's a commissioning body. Here is the time line we agree on, here is specifically what we will produce, here is generally the process we will use, here are the resources."* *"As far as the chartering process, one of the things that we thought helpful in shortening the time period is to have that charter developed by the leadership group. Early on, we were forming a group, we really didn't understand what the products were, and the team itself was trying to identify those and get agreement with the next team up. I think one of the things that's been real helpful to us is having this charter given to the team and communicated to the team by the leadership team but also having that team have input to it. If they don't understand anything or some things the leadership team may not have thought of, we really have a communication session."*

Table 4.85. (cont'd) Key Learnings from Eastman Chemical Company in Creating and Managing Design Teams.

Team Functioning and Development	Key learning #9: Success is ultimately in implementation not in the design: early design efforts were overly focused on creating the perfect design and did not spend enough time in transition planning or in implementation. *"I think part of good transition is ownership of the effectiveness of the transition. And we used to kind of do a design and get it sanctioned and turn it over to management. And management has 101 other things to do and that one transitioning could easily get short attention."* *"We focused too much on the design process approach believing there was some sort of magic about the process. Have now defined the destination in key features allowing each unit to take an approach consistent with empowerment principles that best fits their situation. Recognize that brilliance is in implementation with regular PDSA process, not initial design."* *"I think the feeling was that you had to come out with the perfect design and solve all the problems in the design. The way we do it now with the recognition that you might want to solve all the problems, but you might want to identify some issues, and it is okay not to have all the answers."* *"Recognize that you're not creating the perfect design. I think a lot of people fall into that trap."*
	Key learning #10: Design team must work on design but must also communicate and share knowledge about the work system design. *"The design team's got two responsibilities: not only do they have to design the work system, they've got to communicate with co-workers what's happening. There's going to be two learning curves that takes place during this process. Everybody starts at ground zero. The design team is on the fairly sharp curve and then it gets steeper with their learning. Where everybody else is on the learning curve also and the bigger that gap is between the design team and everybody else when you start rolling out, the longer the more difficult the transition's going to be."*
Team Transition and Hand-off	Key learning #11: There must be overlap in membership of design team with transition/implementation team.
	Key learning #12: Cannot achieve commitment to the design in the design process (through representative membership on the team) but instead commitment is achieved in transition planning and implementation. *"I think our preferred solution is your transition plan needs to include heavy involvement of the existing organizational structures. Let's go back to the line organization and keep them informed and have meetings with them and let them bring the crews along. Expecting someone off of the crew who has had a few weeks of experience with what's going on jump in there and defends decisions that that person themselves may not have fully bought into or understood just didn't work out for us. Don't tell your design team to do your stake-building."* *"See things happen during implementation, commitment doesn't build in design but implementation. The design was the framework; department leadership team coordinated all implementation teams... overlapping membership by 1 member with department leadership team and all implementation teams... department leadership team member was a member to provide leadership, coordinate transition activities broadly, multiple implementation teams."*

Table 4.85. (cont'd) Key Learnings from Eastman Chemical Company in Creating and Managing Design Teams.

Learnings about Overall Strategy for Creating and Managing Design Teams	Key learning #13: The need to design into the work system structures for improving the technical system (the core work) and the design of the work system itself. Natural unit (core work) teams are not effective at continuous improvement of technical processes. The model of design team-renewal team (the cycle of intensive design, followed by less intensive renewal team several years later) does not work — design is becoming a process of continual alignment and attunement over time. *"I'm a very strong believer in creating a structure for continuous improvement — both for the design and for the technical system."* *"Continuous improvement in the technical system is most successful when teams are designed to have experienced people from operations and technical staffs involved in the problem solving. Natural unit teams are not as successful in improving the technical system. Continuous improvement teams are now designed into the empowered work systems. They are tied into the functional planning system. CI teams are supported by management, technical staffs."* *"So the notion was that perhaps the design team or some group when the design team is finished with its' work, that maybe it ought to become a work system effectiveness team.... And not wait three years or two years before you say 'hey, this thing doesn't work.' Instead, you're in continual renewal."* *"So it's the idea that you don't wait three years until a renewal. As things aren't working, you try to make a new course correction then so you don't have to go through this pattern again."* *"We have division leadership teams, department leadership teams and each department has what we call a business effectiveness team. The roles of the leadership team is focusing on the big block —functional plans, making sure that things are aligned as they need to be, working on strategy, vision — while the business effectiveness teams are working on implementing the design and implementing those strategies, determining what works well around the designs and strategies, and what doesn't work well and providing that feedback back to the leadership teams."* *"Design process moving more towards design being an alignment process as opposed to an initiator of change."*
	Key learning #14: Need to be clear about and communicate that the purpose of work redesign and a design team is focused on business results. *"The only reason that you would ever undertake a design is to improve business results. That's the only reason you would do it. The really world class managers are those who recognize that in order to improve business results there needs to be involvement of the people."* *"One of the things that we always had trouble with was people want to go and start changing other things... issues about how they feel that management treats them rather than work design so one of the times we had to pull back and say we hear you, but that's not a design issue. Strong focus on business results with secondary focus on people issues. I think the first time through it may have been flip-flopped."* *"Major goals [of work redesign] must support business objectives, if not must align goals."*

Table 4.85. (cont'd) Key Learnings from Eastman Chemical Company in Creating and Managing Design Teams.

	Key learning #15: Need to first establish a clear vision, strategy, and philosophy one level higher up than the design team's target system. *"Dealing with external boundary issues up-front, establishing a clear divisional strategy and direction, establishing a commonly shared division philosophy that provides the decision making tools that were necessary. In manufacturing, we were tempted to design around the core work first."* *"For a departmental design, there should be a division strategy. What this does is provide the design team a framework to operate within. Our early design teams floundered a great deal because they did not have those things. We set the departmental design teams to resolve division issues."* *"Visions, philosophy, strategy, I would probably do that in a different process instead of each department going off and trying to do that. I would look at a divisional process to do that and set direction for the whole division around the same vision, philosophy, standards to make decisions, the same principles and values that we want to live by so that we don't have departments doing their own thing and then trying to merge those into a division process."* *"In one division... the up front time with division team served them well, year of studying, then in a position to make it happen as opposed to let it happen."*
	Key learning #16: A champion for change at a very high organizational level is critical. The president of Tennessee Eastman was the champion for high performance work systems. Future may be uncertain because no other champion exists. *"The jury's out on the next 3-5 years, lost champion and haven't had one emerge."*

4.6. Summary

The purpose of this chapter has been to present the results from analysis of quantitative and qualitative data. The chapter was organized by the overall research questions for this study, summarized below:

- What are the team characteristics and attributes for design teams in this research?
- Are there differences in team effectiveness for teams using different redesign methodologies?
- Which design features have the greatest variation between design teams?
- Which design features have a significant relationship with design team effectiveness?
- What are the key learnings from organizations using design teams?

The statistical and analysis techniques used to address each research question were described in Chapter 3 and results were presented throughout this chapter.

The majority of the chapter was devoted to presenting results from Research Question 4, to identify design features significantly related to team effectiveness, in which a multiple data analysis strategy was used: bivariate correlations using group means, Within and Between Analysis (which uses correlations, analysis of variance, and analysis of covariance), partial correlations, and multiple regression. Using this strategy, the researcher was able to identify, from a total of thirty-six design features, a set of three (team skills, clarity in sponsor expectations, and team self-assessment) which together were significantly related to team effectiveness at the team level and predicted team effectiveness.

Research Question 5 represented a qualitative analysis separate from quantitative analysis. This analysis represented a departure from much of the group effectiveness research, which may utilize qualitative data to supplement quantitative results (as was done in this research), however, does not present separate analyses from qualitative data.

Conclusions and interpretations about the results in this chapter are discussed in the next chapter. Supporting and conflicting results from analysis for the overall research questions, particularly between quantitative results in Research Question 4 and qualitative results in Research Question 5, are explored.

Chapter 5 Conclusions and Interpretations

The purpose of this chapter is to develop conclusions about and interpret the research results presented in Chapter 4. One way to view the distinction between Chapters 4 and 5, is that while Chapter 4 (Results) focuses on converting data to information, Chapter 5 (Conclusions and Interpretations) focuses on converting information to knowledge.

Because the primary focus of this research was studying the relationship between design features of cross-functional design teams and team effectiveness (Research Question 4), this chapter focuses on results from this research question[1]. The data analysis strategy used to address Research Question 4 was one of successively narrowing the candidate variables for a final analysis using multiple regression, in which the impact of a variable on team effectiveness is examined in the context of other variables. Because of the quantity of variables identified in the operational research model, there was a need to narrow this list, given the limited number of variables that could be entered into a multiple regression model with the degrees of freedom available. Using this multiple analysis method strategy, variables were identified which:

1. had a significant relationship with team effectiveness (through bivariate correlations, results in section 4.4.1)
2. had a team-level relationship with team effectiveness (i.e., teams are distinct from each other on the variables and teams that report high levels of the independent variables also report high team performance/satisfaction) (through Within and Between Analysis, results in section 4.4.2)
3. uniquely contributed to explaining the variation in team effectiveness (through partial correlations, section 4.4.3)
4. significantly predict team effectiveness (through multiple regression, section 4.4.4).

Qualitative data and analysis are used to lend support to and illuminate quantitative findings, as well as provide a comparison to quantitative findings.

[1] Other research questions either did not have specific hypotheses that were tested (e.g., Research Question 1), were not the focus of this research (e.g., Research Question 2), or were analyses that represented input to Within and Between Analysis (e.g., Research Question 3). Where relevant, however, any conclusions or interpretations from other research questions will be integrated in this chapter.

The key conclusions from the results of this research are:

1. Team skills and clarity in sponsor expectations were significant predictors of team performance (the same result was obtained for both team performance measures used in this research). Qualitative data supported the importance of team skills and clarity in sponsor expectations on team performance.
2. Team self-assessment was a significant predictor of team satisfaction. Qualitative data did not provide clear support for the importance of team self-assessment on team satisfaction.
3. The design features most related to team performance were NOT the same as design features related to team satisfaction.
4. The research findings support the main precepts of sociotechnical systems theory of joint optimization and redundancy in skill.
5. The research findings support the importance of team start-up (where team skill and clarity in expectations are primarily established) in influencing team performance.
6. In qualitative data, team members attributed factors internal to the team as contributing to team effectiveness while they attributed factors external to the team as obstacles to team effectiveness. This finding provides support for Gladstein's (1984) finding about members' attribution process uncovered in qualitative data.

These conclusions are further discussed and supported in this chapter. Before discussing point #1 above, a comparison of results obtained for the two team performance measures is provided.

5.1. The Two Team Performance Measures Produced Similar Results

The various methods used in quantitative data analysis provide evidence that the two dependent variables for team performance (TMPERF1 and TMPERF2) are highly related, for the following reasons (discussed in more detail in this section):

1. The same two design features (team skills and clarity in sponsor expectations) emerged from all of the data analysis methods used for Research Question 4 as strongly related to team performance and as significant predictors of team performance.
2. The two team performance measures themselves were strongly correlated at the individual and team level.
3. Within and Between Analysis indicates that teams which on average reported high levels of team performance-1 also on average reported high levels of team performance-2.

First, the same two independent variables, or design features (team skills and clarity in sponsor expectations), were found to be strongly related to TMPERF1 and TMPERF2, and were found to be significant predictors of both TMPERF1 and TMPERF2 using multiple regression. After the successive elimination of variables using bivariate correlations, Within and Between Analysis (WABA), and partial correlations, the same results were obtained for both team performance measures in terms of significant predictor variables. Furthermore, the regression model for TMPERF1 and TMPERF2 using team skills and clarity in sponsor expectations performed comparably in accounting for variance in team performance (the adjusted R^2 was 0.97 and 0.91, respectively).

A second result that provides evidence of the relationship between TMPERF1 and TMPERF2 was the bivariate correlations between them. At the individual level, TMPERF1 and TMPERF2 were significantly correlated ($r=0.67$, $p< 0.005$), and at the group level, the correlation was even higher ($r=0.91$) (as shown in Table 5.1).

Table 5.1. Correlations Between Dependent Variables.

Total Correlation Between Three Dependent Variables			
	TMPERF1	TMPERF2	TMSATF
TMPERF1	1.0000		
TMPERF2	.6663	1.0000	
TMSATF	.5824	.4774	1.0000

Correlations Between Three Dependent Variables Using Weighted Group Means			
	TMPERF1	TMPERF2	TMSATF
TMPERF1	1.0000		
TMPERF2	.9134	1.0000	
TMSATF	.7218	.6266	1.0000

Correlation Between Team Performance-2 and Stakeholder Performance Using Weighted Group Means		
	STKOVPRF	TMPERF2
STKOVPRF	1.0000	
TMPERF2	.8186	1.0000

Third, a post-hoc Within and Between Analysis supported the relationship between TMPERF1 and TMPERF2 (the WABA equation and tests are shown in Appendix G). As expected, given the previous two results, a wholes inference was drawn as a final induction. That is, WABA results lead us to conclude that teams which on average reported high levels of TMPERF1 also on average reported high levels of TMPERF2.

Team performance-1 (the operational measure from the Campbell-Hallam Team Development Survey) was written somewhat generically, to apply to all kinds of teams. For example, two of the scale items were "our work is high quality" and "reports on our performance are favorable." Team performance-2, on the other hand, was developed for this research to more specifically measure dimensions of team performance for cross-functional design teams. Team members were asked to assess the team's performance on "quality of deliverables (plans, reports, etc.)" and "improving business results in the *target system*," as well as other dimensions. Because of the previous conclusions about the relationship between TMPERF1 and TMPERF2, it appears that when team members responded to more general questions about team performance, the specific performance dimensions listed for TMPERF2 were an appropriate reflection of what team members perceived to represent performance as they responded to TMPERF1.

Although the two team performance measures were strongly related as discussed above, there were some differing results obtained for some of the analyses. For example, the bivariate correlations for TMPERF1 and TMPERF2 differ for some independent variables, and the results from WABA differ to some extent. The same set of variables was examined using WABA, and fewer variables had a wholes induction for TMPERF2 than for TMPERF1. Because the within-team variation was greater in general with TMPERF2 (see *eta*-within for TMPERF2 from Table 4.5 in Chapter 4), the WABA results for some variables led to an equivocal inference (significant between-team and within-team variation was found). More within-team variation on TMPERF2 was likely due to the more sensitive measurement scale on TMPERF2. Team members could fill in any number from 0 to 100 percent to assess the team along performance dimensions for TMPERF2, while for TMPERF1, team members had only six response choices (from strongly agree to strongly disagree) for the survey items.

In comparing a team's view of its performance to a stakeholder viewpoint (i.e., sponsor or external team facilitator), Pearson's correlation coefficient indicates that they were strongly related ($r=.82$ at the group level using weighted group means, $p< 0.005$). It appears that teams' perception of their performance is aligned with an external viewpoint, and thus serves as a check that team members were realistic about their team's performance (as measured by TMPERF2) compared with an external viewpoint. Cohen, Mohrman, and Mohrman (1993) presented a similar analysis of team versus stakeholder viewpoint of team performance.

This comparison between the two team performance measures is important to provide evidence that TMPERF2 (a newly-developed measure) was an appropriate way to measure team performance for these types of teams. There was evidence of criterion validity, in particular concurrent validity, for TMPERF2, because of its relationship to TMPERF1, an existing measure for which evidence of reliability and validity is provided in Hallam and Campbell (1994).

5.2. Team Skills and Clear Expectations Were Strongly Related to Team Performance

The design features (independent variables) which had the strongest relationship with team performance were team skills and clarity in sponsor expectations. Both had a significant bivariate correlation with team performance, both emerged as having a team-level relationship with team performance, and both were significant predictors of team performance (as shown in Figure 5.1). What does this enable us to conclude about these two design features?

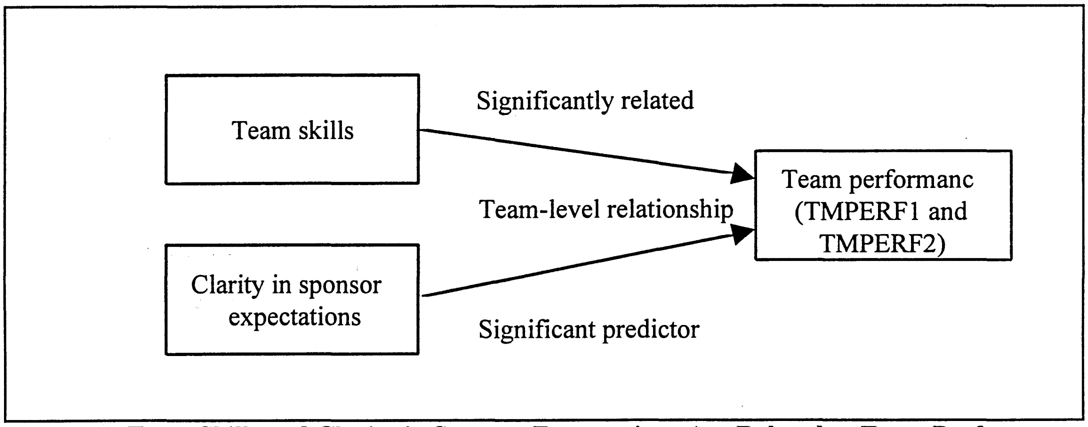

Figure 5.1. Team Skills and Clarity in Sponsor Expectations Are Related to Team Performance.

We can conclude that on average, members within teams shared a common perception about the relevance of skills the team had and about the clarity in expectations from the team's sponsor(s). We can also conclude that teams in this research sample were significantly different in their reported level of skills and clarity of expectations (based on WABA I results; a graphical portrayal of differences between teams on team skills, clarity in sponsor expectations, and the dependent variables is provided in Appendix G). This conclusion provides evidence that there is something unique about teams which reported high team skills and high clarity in expectations that warrants a closer look to understand what is different about these teams (see Table 5.2 which summarizes team skills and clarity on sponsor expectations for the four highest-performing teams and four lowest-performing teams as measured by TMPERF1[2]). The next sections explore in more detail what is different about high-performing and low-performing teams on team skills and clarity in sponsor expectations.

[2] Using Duncan's post-hoc test, these two clusters of teams are significantly different at the .05 level on team performance (as measured by TMPERF1).

Table 5.2. Group Means for Team Performance, Team Skills, and Clarity in Sponsor Expectations

Team Name	Team Performance-1 (scale of 1 to 6)	Team Performance-2 (scale of 0 to 100)	Team Skills (scale of 1 to 6)	Clarity in Sponsor Expectations (scale of 1 to 6)
Highest-performing teams:				
Direct Entry Team	5.17	89.95	5.23	5.17
Slow Moving Warehouse Steering Team	5.17	85.42	4.93	5.13
Resource Allocation Team	4.93	84.64	5.40	4.37
City Farms Leadership Team	4.78	76.07	4.51	5.00
Lowest-performing teams:				
IPCF DDT	3.55	69.38	3.65	4.35
ISD DDT	3.14	65.18	4.15	3.85
Peterborough Leadership Team	3.11	58.79	3.40	4.19
DSOTF DDT	1.96	50.08	3.64	2.58
Overall Mean Standard Deviation	4.03 .83	71.2 9.97	4.29 .54	4.38 .60

5.2.1. Teams Reporting High Skill Level Had a Different Skill Set

To further explore the relationship between team skills and team performance, we can ask the question: what specific skills did teams which reported a high level of team skills have that teams reporting a low level of team skills didn't have (or had less of)? The questions in the scale for team skills are shown below (Cronbach's alpha for this scale is 0.77, as shown in Appendix D).

1. Our team members are skilled and competent.
2. *This team suffers from a lack of training or experience.*
3. Team members strive to develop skills that can benefit the team.
4. There are team members who have the skill or knowledge to back me if up necessary.
5. Team members have been carefully selected to create the right mix of skills.

In this research, team members were asked to assess their individual skill level in a skill set believed to be important for design teams[3]. A one-way ANOVA with Bonferroni's test was used to identify "high-skill" and "low-skill" teams (as reported by team members). The output from SPSS is shown in Appendix G. The four teams

[3] This skill list was compiled from reviewing the practitioner literature related to organizational design teams and gaining practitioner input on important skills for design team members.

reporting the highest skill level (the Resource Allocation Team, the Direct Entry Team, the Slow-Moving Warehouse Team, and the BPR Planning Team) were classified as "high-skill" teams, and the following four teams were classified as "low-skill" teams: the Peterborough Leadership Team, the DSOTF DDT, the IPCF DDT, and the Time/Entry Leave Team[4]. Using this classification variable as a factor with two levels (1=high-skill, 2=low-skill), a series of ANOVAs were performed to determine if there were differences on specific skills for high-skill teams as compared to low-skill teams. Output from these ANOVAs are also shown in Appendix G.

Out of the list of nineteen skills for which team members assessed their individual skill, there were significant differences between high- and low-skill teams for the following: computer skills (p= 0.0042), communication skills (p= 0.0435), organizational redesign skills (p= 0.0454), and writing skills (p= 0.0143). Scatterplots of these four specific skills with the variable team skills are shown in Appendix G. For all other skills listed (see the Design and Leadership Team Survey in Appendix B for a full listing), there were no significant differences between high-skill and low-skill teams. The difference on organizational redesign skills and communication skills is not surprising, given the nature of the team's task. The difference between high- and low-skill teams on computer skills should be interpreted with caution. When looking at the four high-skill teams, three of them were Virginia Tech teams, all three of which had team members who were devoted full-time to Project Enable and who were previously part of University Systems Analysis (an internal computer systems support function). Therefore, this result may be due to teams having members whose previous jobs required them to have well-developed computer skills and expertise.

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[4] Bonferroni's test indicates that all four of the high-skill teams identified (the BPR Planning Team, the Slow Moving Warehouse Steering Team, the Direct Entry Team, and the Resource Allocation Team) report a significantly higher level of team skills than the Peterborough Leadership Team (which had the lowest reported skill level). Further, the Direct Entry Team and the Resource Allocation Team reported significantly higher team skills than the DSOTF DDT (the team with the second lowest reported skill level). Bonferroni's test did not indicate that the four low-skill teams are a significantly different cluster as compared to the four high-skill teams. However, for the purpose of this analysis, the same number of teams at either end of the spectrum was desired.

5.2.2. Qualitative Data Supported the Importance of Team Skills

Qualitative data from the survey questionnaire supported the importance of team skills for an effective team. Considering all teams in the research sample, the knowledge, skills, abilities, and experience of team members emerged as one of the top-ranked themes contributing to team effectiveness from qualitative survey data. As an obstacle, lack of team skills did not emerge as a top-ranked theme. For the BPR Planning Team, one of the four high-skill teams identified, the collective knowledge/skill of team members was listed as a contributor to team effectiveness by four out of seven team members, and for the Direct Entry Team (another high-skill team) knowledge/skill was listed as a contributor by two-thirds of the team. Some representative comments from the survey question on contributors to team effectiveness are shown below:

- *"broad and detailed knowledge of team members" (1110)*[5]
- *"team members with the right skills" (1106)*
- *"skilled competent team members" (1205)*

The following comments about team skills were made in the survey by two of the low-skill teams:

> *"...clearly the members of this group are not equipped with the knowledge/skill/ability to drive organization change." (1201)*
>
> *"... our collective skills for this type of work could be of a higher level to be effective." (1212)*

Qualitative *interview* data also supported the importance of team skills, although it was not as strong a theme as in the qualitative survey data:

> *"One of the things that keeps coming up - a particular skill - strong facilitation skills, it's critical, we keep struggling with .... really just the whole forming, storming, norming..." (2201)*
>
> *"I would ensure that on the team somewhere there were key individuals that had experience with project management, with process management, with measurement, with finance.... with CPI methodology, with facilitation" (2212)*

[5] This coding scheme enables the researcher to maintain the "chain of evidence" (Miles & Huberman, 1984) by tracing back these qualitative comments and quotes to the method of data collection (survey or interview), the organization, and the team.

The following comment was made in an interview with a team member from one of the low-skill teams:

> *"...[team members are] not educated... they needed to be taught how to run a meeting... before you started up, I'd send them to bootcamp ... to get educated." (2208)*

Although it is difficult to identify a "bottom-line" result with qualitative data, the qualitative data in this research provide clear support for the impact of team skills on team effectiveness.

As summarized in Chapter 1, other research has included team skills as a variable potentially influencing team performance. Gladstein (1984) did not find support for the effect of "adequate skills" on performance of sales teams, however, Metley, Kaplan, Heisler, and Weiner (1991) did find that skills had a significant relationship with quality of group output. In an experimental research design, Bowen (1993) found that "knowledge-skills" was the most significant predictor of work group performance, however, the relationship was non-linear. There is no apparently no research which investigates specific skills needed for certain types of teams, in particular, cross-functional organizational design teams. Future research should investigate the relationship between the skill set and level of diversity in skill within a team on team effectiveness.

5.2.3. Teams With Charters Had Higher Clarity in Expectations

Next, the relationship between clarity in sponsor expectations and team performance is considered. The survey items part of the scale for clarity in sponsor expectations are shown below (Cronbach's alpha for this scale is 0.87, as shown in Appendix D).

1. We have a clear overall team purpose.
2. I am not sure what we are trying to accomplish as a team.
3. We coordinate with sponsors to get the information we need.
4. We know what our sponsors expect our team to accomplish.
5. We have enough guidance from sponsors on the scope of our effort.

What was unique about teams such that some had higher clarity in the sponsor's expectations as compared to other teams? A team charter was used by a number of the teams in the research sample as a tool to clearly define the team's purpose, scope, and other expectations of the sponsor. Based on interview data, teams were classified as to whether or not the team had a charter[6]. A one-way ANOVA with charter as a factor with two levels (1=no charter, 2=team had a charter) indicates that teams having a charter had significantly higher clarity in sponsor expectations as compared to teams that did not have a team charter (p=.05).

The reader should keep in mind two things in interpreting this result. First, only one team member was interviewed for each team (in most cases, the team leader or convener), so that the response to interview questions about whether the team had a charter represented one person's viewpoint, not the entire team's viewpoint. Second, the measurement of whether or not a team had a charter is subject to the researcher's interpretation of responses to interview questions. In spite of these potential problems with the operational measure, confidence is placed in this conclusion because of the fact that charter and clarity in purpose (or lack thereof) were also raised as an issue in qualitative data, discussed in the next section.

5.2.4. Qualitative Data Supported the Importance of Clear Expectations and Charter

Qualitative survey data supported the importance of a charter to provide direction and focus for a team. In the Direct Entry Team, which had a charter and had the highest reported clarity in sponsor expectations, half of the team members listed contributors to team effectiveness having to do with purpose, direction, and focus achieved from a charter:

- *"clear charter" (1106)*
- *"charter (kept us focused)" (1106)*
- *" understanding of goals for the team and buy-in by team members that those goals are worthwhile." (1106)*

[6] In earlier data analysis, teams did have a charter were further classified as to whether the team 1) developed its own charter or 2) whether the team reviewed and gave input to a charter developed outside the team. For the purpose of this post-hoc analysis, only two classifications are considered: having a charter or not.

On the other hand, in the team reporting the lowest clarity in sponsor expectations which did not have a charter, one-third of the team listed factors related to purpose and direction as obstacles to team effectiveness:

- *"not having clarity of our specific expectations" (1105)*
- *"not clear understanding of what or how" (1105)*
- *"no clarity in roles and responsibilities" (1105)*
- *"team objective not clearly defined or understood" (1105)*
- *"I believe that the major cause for poor/no results in this team was the lack of a clear vision... and a clear and concise charter for the team." (taken from last survey question on any additional information) (1105)*

Qualitative *interview* data with team members also provided support for the need to establish clear expectations from a team's sponsor on purpose and scope. The following quotes were extracted from interviews with team members:

> *"The [other] team had a much clearer charter, mainly because it was narrower. It's kind of do-able. It was a chunk you could fit in your mouth and one that everyone could understand intuitively." (2114)*
>
> *"... having a clear team charter with goals and objectives... making sure you can work closely with sponsor..." (2103)*
>
> *"... formalize the charter sooner.. more of what the sponsor really expected. We knew just because we knew what had to be done. It was kind of intuitive, but be more formal up front about what really were expectations, maybe try to negotiate various components of that. Could have negotiated, 'hey, do we have to do direct deposit at the same time we were doing this other thing." (2111)*

Based on the interview data, some of the most common activities used by teams to gain clarity in sponsors' expectations were: having the sponsor and/or team leader develop a draft of the team's charter (in particular, the team's purpose/mission, goals/objectives, and scope) before the team even had its first meeting, having the sponsor physically "sign off" on the team charter to demonstrate agreement and commitment to the charter, having meetings with the sponsor (particularly early in the team's life or when the team gets stuck), and keeping the sponsor informed about the team's progress (primarily through electronic mail and informal communication) so that the sponsor can intervene if necessary.

The impact of clarity in sponsor expectations can be compared to other research which included similar variables, for example, mission clarity and goal clarity. As reported in Chapter 1, Gladstein (1984) did not find that structuring of activities, which included role and goal clarity, had an effect on self-reported effectiveness for sales teams. Metley, Kaplan, Heisler, and Weiner (1991) found that goal clarity indirectly affected group performance through planning. George, Perkins, Sundstrom, and Myers (1990) found that goal clarity correlated positively with team performance. This last result is analogous to the bivariate correlation result between clarity in sponsor expectations and team performance. This research result supports what others have found for similar variables, however, none of the studies cited here examined whether clarity in sponsor expectations relates to team performance at the team level, which was found to be the case in this research.

Future research should explore the influence of a team charter and how it is developed on clarity in sponsor expectations and on team performance. Shea and Guzzo (1987) recommend using the presence of a charter as diagnostic question to use with teams. In addition, the role of sponsor should be explored. Team members at both Virginia Tech and National Grocers talked and wrote about the importance of having a clear purpose and expectations, and in particular Virginia Tech teams talked about the role of sponsor in chartering teams[7].

5.3. Team Self-Assessment Was Strongly Related to Team Satisfaction

As mentioned earlier, team self-assessment was shown to be strongly related to team satisfaction, as shown in Figure 5.2. Survey items part of the scale for team self-

[7] The term sponsor was widely used with Virginia Tech teams but was not widely used at National Grocers (based on survey and interview data). Many of the people who served on Virginia Tech teams went through team training provided by Cornelius and Associates, in which team roles, including sponsor, are defined.

assessment are shown below (Cronbach's alpha for this scale is 0.72, as shown in Appendix D).

1. We take the time as a team to examine areas in which we need more skill or experience.
2. *We rarely stop to consider how we can work better as a team.*
3. *We rarely follow through on our plans for improving the team.*
4. We have recently discussed what we did right or wrong on a particular project or job.

This conclusion was supported by the bivariate correlation between team self-assessment and satisfaction (section 4.4.1), Within and Between Analysis (section 4.4.2), partial correlation (section 4.4.3), and multiple regression (section 4.4.4). We can conclude that on average, members within teams shared a common perception about whether or not the team performed self-assessment and improvement. We can also conclude that teams in this research sample were significantly different on team self-assessment (based on WABA I results), and teams which reported higher levels of team self-assessment on average reported higher levels of team satisfaction. Table 5.3 summarizes the reported scores on team self-assessment for the four highest-performing teams and four lowest-performing teams as measured by TMPERF1.

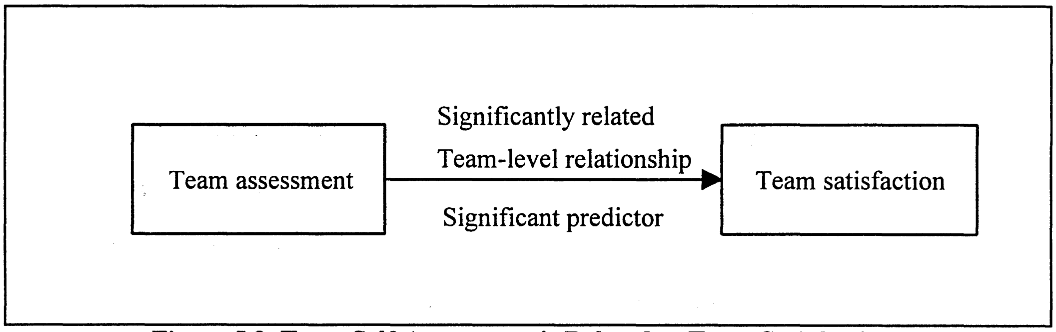

Figure 5.2. Team Self-Assessment is Related to Team Satisfaction.

Table 5.3. Group Means for Team Satisfaction and Team Self-Assessment

Team Name	Team Satisfaction (scale of 1 to 6)	Team Self-Assessment (scale of 1 to 6)
Highest-satisfaction teams:		
Staff Support Team	5.80	4.60
City Farms Leadership Team	5.70	4.78
Direct Entry Team	5.57	4.85
Surveyor Road Leadership Team	5.57	4.28
Lowest-satisfaction teams:		
Direct Lending Team	4.60	3.75
Peterborough Leadership Team	4.24	3.39
Time Entry/Leave Team	3.89	3.69
DSOTF DDT	3.89	3.11
Overall Mean	4.97	4.04
Standard Deviation	.63	.51

Unlike with team skills and clarity in sponsor expectations, there was no other specific variable measured in this research that could be examined in post-hoc analysis to further explore the relationship between team self-assessment and team satisfaction. No clear support for the relationship between team self-assessment and team satisfaction was evident from the qualitative data, although some team members referred to assessment activities. However, team members were not asked specifically about team assessment activities in either the open-ended survey questions or in the team member interviews. Based on qualitative interview data with teams, the types of assessment activities teams engaged in were primarily informal, such as short evaluations at the end of meetings about whether the meeting was productive. Some of the Virginia Tech teams had meetings with the team's sponsor at the completion of the team, and while the purpose was not assessment but instead presentation of the team's results, it is possible that issues related to assessing how the team performed and worked together were discussed.

To the researcher's knowledge, only one team (the Direct Entry Team) did a formal team self-assessment, near the end of the team's work. This assessment was prior to and completely separate from the team completing the Campbell-Hallam Team Development Survey which can be used as an assessment tool.

5.4. High Performing Teams Were Not Necessarily Satisfied Teams

In comparing results across the dependent variables (the two team performance measures and team satisfaction), one obvious conclusion should be stated explicitly: what was most related to team performance (skills and clear sponsor expectations) was not the same as what was most related to team satisfaction (team self-assessment). The teams that reported the highest levels of team performance were not the same teams that were most satisfied. A post-hoc Within and Between Analysis confirms this conclusion (see WABA calculations in Appendix G). The final induction drawn for the relationship between team satisfaction and team performance was "none." That is, we cannot conclude that teams reported higher levels of team performance on average reported higher levels of team satisfaction. This conclusion holds for both team performance measures.

Another related conclusion can be drawn from considering the partial correlations (section 4.4.4) for the two team performance measures. Not only are the predictors of team performance and team satisfaction different, but the most significant predictor of team satisfaction (team self-assessment) had a non-significant partial correlation with team performance when other variables were held constant. Specifically, when the variance that team skills and clarity in sponsor expectations explained in team performance-1 were partialed out, the correlation at the group level between team self-assessment and team performance was not significantly different than zero (as was shown in Table 4.78). Other variables also had a non-significant partial correlation with team performance-1 after controlling for team skills and clarity in sponsor expectations: defined design process, systemic design perspective, team commitment, team unity, team decision processes, commitment-building, and inter-organizational perspective.

The important inference here is that any additional time and energy a team could spend in team self-assessment, developing higher team unity, developing more effective decision processes, building commitment with stakeholders, etc., does *not* contribute significantly to team performance (after holding constant the effects of team skills and clarity in sponsor expectations), based on the results of this research. Yet teams which performed self-assessment activities were more satisfied.

Considering team performance-2, the conclusion is similar, except that two variables actually had a significant *negative* partial correlation with team performance-2 (commitment-building and defined design process) when team skills and clarity in sponsor expectations were held constant. In other words, after partialing out the effect of team skills and clarity in sponsor expectations, building commitment with stakeholders and having a defined design process was significantly negatively related to team performance-2.

Based on this research, there is apparently a balance necessary to address design features related to both team performance and satisfaction. In other words, in order for a team to be effective overall (both high-performing and satisfied), paying attention only to what is related to team performance or what is related to team satisfaction is not enough.

5.5. Research Results Support Sociotechnical Systems Theory

An interesting parallel between the conclusion in the previous section and sociotechnical systems theory can be drawn. The sociotechnical systems approach recognizes that every organization is a system, made up of people (the social system) using tools, materials, equipment, methods, and knowledge (the technical system) to produce products or services for customers who are part of the organization's external environment (Pasmore, 1988). Significant influence in sociotechnical systems theory comes from Trist, Emery, and Bamforth with their work at the Tavistock Institute, and more recently from Cherns (1976, 1987) and Pasmore (1988).

The technical system is defined as "tools, techniques, devices, artifacts, methods, configurations, procedures, and knowledge used by organizational members to acquire inputs, transform inputs into outputs and provide outputs or services to clients or customers" (Pasmore, p. 55). The social system is "comprised of the people who work in the organization and all that is human about their presence....individual attitudes and beliefs...relationships between groups, among group members..." (Pasmore, 1988, p. 25). An important outcome of the social system is "the opportunit[y] for satisfying to a substantial degree the needs and expectations of its members" (Davis, 1982, p. 2.1.14).

The primary aim of sociotechnical systems theory is to "design a work structure that is responsive to the task requirements of the technology and the social and psychological needs of employees" (Cummings, 1978, p. 261); this concept is called joint optimization. Any work design must consider both the technical and social system, and sociotechnical designers structure work such that variance is controlled *within* the work system rather than external to it.

Joint optimization is described by Davis (1982, p. 2.1.8) as follows: "maximizing the effectiveness of the organization requires joint optimization of the technical and social systems rather than maximizing the technical system and fitting the social system to it.... Joint optimization carries with it the prospect of degrading either the technical system or the social system in order to achieve a better joint outcome."

Consider a team as a sociotechnical system (similar to Goodman, 1986; and Kolodny & Kiggundu, 1980), which consists of a technical component (the team's task, outputs, and technology, or methods, for achieving objectives) and a social component (the people within the team, their attitudes, beliefs, etc.). The results from this research are consistent with the joint optimization principle of STS theory; that what is most related to team satisfaction (an important outcome of the social system) is the not the same as what is related to team performance (an outcome of the technical system), and that both must be considered to have a team that is effective overall (both high performance and high satisfaction).

This balance between team performance and team satisfaction has implications for how to design and manage cross-functional design teams. Conceivably, one could focus solely on team skills (selecting and developing a team with the right mix of skills) and clarity in sponsor expectations, while ignoring all other design features (including team self-assessment). For a team with these design features, we can predict based on this research, that the team's performance will be high (as measured by TMPERF1 and TMPERF2). However, we can also predict that the team will not have a high level of team satisfaction, because no time would be spent on team self-assessment. Given the current trend toward teams as the essential building blocks for transitioning to team-based organizations (Mohrman, Cohen, & Mohrman, 1995), people will be asked to serve on many teams of different types. If organizational members have served on teams where team performance is maximized, at the expense of team satisfaction, then the long-term viability of teams as an organizational strategy would be at risk. Members may be so antagonized by serving on teams where only the "technical system" and performance are considered important, and teams are not designed to be in any way a satisfying and developmental experience, people will be unwilling to continue to serve on cross-functional teams[8].

Consider the alternative situation, where a team spends a disproportionate amount of time on self-assessment. We can predict that such a team would have a high level of team satisfaction, however, design features that relate to team performance are ignored. This strategy would make it very difficult for a team to have a high level of team performance and produce improvements in business results. This defeats the underlying purpose for creating design teams: to improve business results in a given target system.

Another parallel between these research results and STS theory can be drawn using another principle, that of building redundancy into the work system to create capability and flexibility of the system. Cherns (1987) calls this the "multi-functional principle." This principal is often operationalized as creating redundancy in *skills* of people within a work system (e.g., multi-skilling in a self-managed team environment). Although diversity, or redundancy, of skills was not measured in this research, team skills did emerge as one of the two significant predictors of team performance. Future research

[8] Note that for a team where urgency for desired results is paramount, this strategy to optimize team performance may be appropriate.

should explore the extent to which STS theory can be used to frame and interpret research on design teams.

5.6. Results Support the Importance of Start-up in the Team Life Cycle

The conclusions in this chapter support the concept of the life cycle of a team. Blanchard and Fabrycky (1990) outline a system life cycle in which the outcomes of the system (in terms of cost and quality) can be largely predicted by the quality and intensity of start-up activities (for example, conceptual system design). Once again, consider a design team as a system, and assume a team's life cycle can be divided into three major stages: team start-up (designing the team, assembling team members, and orienting a team to its task), team functioning and development, and team transition and hand-off. Both team skills and clarity in sponsor expectations are most influenced in team start-up. Team are primarily defined in the team member selection. Clarity in sponsor expectations, which can be developed throughout the life of a team, is significantly influenced through creating a charter before a team even starts to meet.

Therefore, team start-up is a critical activity for teams, and more specifically, selecting team members that have the necessary skills for the team's task and developing clarity within the team about its purpose and scope, are the most important design features to manage in order to influence a team's performance. Another way to state this conclusion is the following. If all that is done to start-up and manage a team throughout its life cycle is to select members with the right skills and to develop within the team a very clear understanding of the sponsor's expectations on purpose and scope, we can predict that the team will have a high level of team performance. Anything else, any other design features, such as creating higher team unity or developing more effective decision processes, does not contribute significantly to the team's performance. In fact some design features, like commitment-building processes, actually may be detrimental to a team's performance. This conclusion can serve in a sense as a prioritization for where to focus energy and time in starting up and managing a design. This finding supports Cupello's (1995, p. 83) assertion that "the chartering process is the vital 20% that will lead to successful teams 80% of the time."

The previous discussion has focused on the "technical system" for a team, on what is most related to team performance. As concluded earlier, this emphasis must be balanced with what is most related to team satisfaction, i.e., team self-assessment. Therefore, teams with high skills and high clarity in sponsor expectations that in addition perform team self-assessment will have high levels of team performance and team satisfaction.

The importance of team member selection was emphasized by interviewees at Eastman:

> *"Any team has got to have the right skill profile to enable it to do what it has to do. And I think if the team is selected based on what's needed to achieve the objective, the team has a lot better shot at being effective." (23)*

This quote suggests that the skill profile of a team is one of the most important selection criteria. However, for some teams in the research sample, in particular the leadership teams in the Distribution Centres at National Grocers, team member selection appears to have been largely driven by representation, to ensure that multiple viewpoints were considered (based on interview data). However, given these research results, team skills is a much more important predictor of team performance than cross-functional representation. A more effective selection strategy would be to focus on selecting people with the skills necessary to accomplish the team's objective, while also considering representative viewpoints as of secondary importance. The problems associated with a focus on *representation* rather than *contribution* of members were described as follows:

> *"One of the very first things that invariably happens when you put together a design team is that people think they're on the team representing somebody. When they start out, 'well, I'm representing crew 2' or 'I'm representing this group over here' and until you get over that hump, you can't get anything accomplished." (23)*

> *"At the early stages when they first started in to this, I think it was some trust issues...between the management and the folks as well as some of the peer problems — 'if I'm on this team, I've got to make sure that my crew, my co-workers' viewpoints are heard as opposed to being there to design the system and work on the problems. I think you had to overcome 'I'm here to represent my group's point of view and make sure that nobody gets shafted'." (23)*

5.7. Qualitative Results Supported Quantitative Results But There Were Gaps

Qualitative data and analysis were not of *primary focus* in this research but instead were intended to supplement and illuminate quantitative findings. Quotes and comments which provided support to specific conclusions made throughout this chapter have been integrated where appropriate. However, this section differs from this purpose in order to provide a discussion about qualitative results overall, and how these results compared to quantitative findings.

To address Research Question 5 (what are the key learnings from organizations using design teams?), tables were presented in Chapter 4, section 4.5, which summarized two types of qualitative results: 1) themes about contributors and obstacles to team effectiveness for Virginia Tech and National Grocers teams and 2) key learnings from Eastman Chemical Company (Eastman) on their organization-wide strategy of utilizing design teams to support work redesign.

5.7.1. Qualitative Themes Supported Quantitative Results But Were Not Entirely Consistent

First consider the learnings on contributors to and obstacles to team effectiveness. As briefly mentioned in Chapter 4, the five themes which emerged as the most significant contributors to team effectiveness were: 1) commitment, attitude, willingness within team; 2) knowledge, skills, abilities, & experience of team members; 3) teamwork and ability to work as a team; 4) internal team leadership; and 5) communication and trust within the team. The emergence of communication and trust as an issue team members related to team effectiveness supports the similar finding by Gladstein (1984) who also obtained this finding using qualitative data.

The five themes which emerged as the most significant obstacles to team effectiveness were: 1) organizational context and culture; 2) making time for work on the team; 3) purpose, direction, scope of team; 4) commitment, attitude, willingness within team; 5) communication and trust within the team[9]. There are several conclusions relevant to these qualitative results:

1. The top-ranked themes support the quantitative results with regard to team skills and clarity in sponsor expectations.
2. Other qualitative themes (in addition to skills and clear expectations) were not supported in quantitative results.
3. Teams attributed what factors internal to the team as contributing to effectiveness and attributed factors external to the team as obstacles to effectiveness.

First, two of the themes that emerged as top-ranked contributors or obstacles to team effectiveness were supported in quantitative data analysis: knowledge/skills of team members (analogous to the variable team skills) and purpose, direction, scope (analogous to the variable clarity in sponsor expectations). Therefore, qualitative results provided support for the quantitative findings about what relates to team performance (namely, team skills and clarity in sponsor expectations).

Second, the remaining qualitative themes, which were related to many variables in the operational research model, were not supported by quantitative findings. For instance, variables from the operational research model which were very related to themes identified are: team commitment, clarity in sponsor expectations, team unity (similar to trust/communication), organizational support to team and individual, team leadership, and release time. None of these remaining themes were found to be significantly related to team performance or team satisfaction at the team level. Release time in particular was a very strong theme in the qualitative data (both as the second highest ranked obstacle to team effectiveness and in the interviews with team members, as shown in the quotes below). Release time, however, was not supported in the quantitative findings (the bivariate correlations between release time and team performance and satisfaction were not significant).

[9] The method used to rank these themes is discussed in Appendix F, but briefly, a criteria was used that takes into account both quantity/frequency of comments related to a theme and the number of teams over which comments are dispersed.

"Basically everyone on the team has to do this as an add-on. It's consistent of all the different teams that I'm aware of... Tech does not do a very effective job of committing resources to teams. They'll commit people but not give them release time." (2110)

"It was a matter of them having the time. Their job didn't go away. They did 100% plus this." (2114)

"In this company, the business does not release you from day to day job. The team needs large things accomplished between meetings, and the players can't see their way clear... to how to do "A" job and meet commitments. And leadership aren't holding me to "B" commitments but they sure are holding me to "A" commitments.... if I don't make ["B"] commitment here it's not a big deal, but on "A" job it's a big deal. And team leader has no position power over me." (2205)

The third conclusion to be drawn from the qualitative themes is that all five of the top-ranked contributors to team effectiveness focused on processes *within the team.* In other words, when asked what things contributed the most to team effectiveness, team members largely listed factors relating to internal team processes (commitment, leadership, communication, etc.). On the other hand, when asked what things were the biggest obstacles to team effectiveness, teams most frequently listed obstacles *outside the team.* The two top-ranked themes that emerged from obstacles listed were the existing organizational context and culture (e.g., "resistance to change," "support from senior management," and "old paradigms") and making the time for work on the team given current responsibilities ("conflicting demands on time," "daily work responsibilities outside the team," "difficulty in managing time commitments").

This result has an interesting parallel to the fundamental attribution error (Fiske & Taylor, 1984). In other words, teams may be attributing undesirable "behaviors" (the obstacles to team effectiveness) to factors outside of the team's control (the environment or context surrounding the time), and attributing desirable "behaviors" (the contributors to team effectiveness) to factors within the team's control (internal team processes and attributes).

5.7.2. Key Learnings from Eastman Chemical Company

Consider the learnings gained by Eastman in their overall strategy for utilizing work redesign teams (presented in Chapter 4). In comparing these learnings to the discussion in this chapter so far, the following conclusions can be made:

1. There is consistency across qualitative and quantitative results in the support for composition of teams and team start-up with the exception of demographic diversity.
2. Eastman's focus on transition and implementation processes were not reflected in results from Virginia Tech or National Grocers.
3. Organization-wide strategy issues and learnings from Eastman were not reflected in results from Virginia Tech or National Grocers.

First, there were a number of key learnings surrounding the composition of the team (Key Learnings #1-6) and the team start-up process (KLs #7-8). This emphasis on composition (in particular team skills) and team start-up (including chartering of teams) was very consistent with quantitative results in this research, with one exception. One of Eastman's key learnings was that demographic diversity on a team is very important for a team to be effective and to produce a high quality design (see Key Learning #3 and quotes below).

> *"I think there's got be a demographic profile because people see things in a different perspective." (23)*
>
> *"I'm convinced that diversity is in fact a strength for a team... there may be more conflicts in the team processes, but if that's managed well, if the team really comes together and develops good processes that diversity will invariably result in a better product." (23)*
>
> *"Diversity within the team, and demographics I think is important... getting different people's point of view from older folks that have been with the company for a long time to what's the needs of the younger employees — male, female point of view, minority point of view... I think all that is important to have good demographics and representation of the work force that you're going to be designing." (23)*

This assertion about demographic diversity, which is also found in the group effectiveness literature, was not supported in this research. None of the demographic variables were found to have a significant positive relationship with team effectiveness, and in fact, diversity in education level had a significant negative relationship with team performance and satisfaction. This lack of support for demographic heterogeneity was surprising, especially given the strong evidence in the literature for these types of creative tasks (see Jackson, 1992). This may be due to the relatively small sample of this research or to the use of subjective self-report measures of team performance vs. objective measures of team performance. This is a potential area for future research to explore.

Second, there were key learnings from Eastman surrounding the transition and implementation process that were not reflected in either the quantitative results or in the qualitative data from the other two organizations. For example, several of these key learnings were: the need to shift emphasis from the design process to implementation and transition processes (Key Learning #9); communication processes between the team and stakeholders (KL #10); and achieving commitment and "stake-building" through implementation and transition processes as opposed to in the design process (KL #12). Perhaps because the teams in the research sample were for the most part still intact and had not really reached full-scale implementation of a design (like the Ottawa Leadership Team) or were not intended to be implementation teams (like the Resource Allocation Team), this emphasis on "hand-off" and transition processes was not seen in National Grocers and Virginia Tech teams.

Third, there were several Eastman key learnings which were labeled "overall strategy for creating and managing design teams." For example, this category included designing into the total work system permanent structures for continually adjusting the work system design as well as structures for improving technical systems (Key Learning #13). A second learning in this category was the need to establish clear vision and strategy one level higher up than a design team's target system (KL #15). Although not seen in quantitative results, there was some reference to these issues in qualitative interview data from teams, National Grocers teams in particular. As an example, members of both the Finance Senior Management Team and the Information Services Division DDT referred to the need to integrate the formal organizational structured (called the "A" structure) with the improvement structure (called the "B" structure) into something that's being called the A' structure.

However, these types of organization-wide issues were more prevalent in Eastman learnings than in qualitative data from the other two organizations. Having used design teams for over eight years, Eastman has had to address these organization-wide and strategy-level issues. Using the analogy of skiing (where levels of expertise range from beginner, novice, intermediate, expert), Virginia Tech and National Grocers might be considered novice-level with respect to utilizing design teams to support large-scale change. Eastman might be considered intermediate level, perhaps approaching expert level, and therefore the Eastman learnings represent what organizations like National Grocers and Virginia Tech can expect to face in the next several years. So it is not surprising that the higher-level strategy issues about creating and managing design teams were emphasized more in qualitative data from Eastman than the other two organizations.

5.8. What Contribution Has This Research Made to the Body of Knowledge?

There are several important aspects of this research which make it unique as compared to other research in the area of group effectiveness. These are listed below and described in more detail in this section.

1. The focus on cross-functional organizational design teams is unique.
2. The use of methodology to examine relationships between variables at the group level of analysis is unique.
3. Boundary management processes were explored and relationships were tested with team effectiveness.
4. The research design utilized multiple methods for data collection and data analysis.
5. This research takes a sociotechnical systems approach to designing teams which are themselves performing redesign of a sociotechnical system.

First, this research is the first empirical study of which the researcher is aware that focuses specifically on cross-functional design teams. Goodman (1986) calls for group research on relatively homogeneous types of team to more fully understand what leads to team effectiveness for that type of team. Although there is some debate about how narrowly to define the type of team studied (McGrath, 1986), it seems at least plausible that there is a need for research focusing on teams that vary on the major dimensions described by Mohrman, Cohen, and Mohrman (1995) (improvement vs. core work, overlay vs. intact, and temporary vs. permanent). As Mohrman (1993) suggests, there is a need to understand the design and management requirements for at least these types of teams.

The second important way this research makes a unique contribution to the group effectiveness literature and theory has to do with methodological design. In a critique of group research over the past decades McGrath (1986) identified ten critical needs that group researchers should fulfill, one of which is research that attempts to understand what goes on at the group level of analysis (see below, p. 368):

> *"Closely related to the need to deal with groups as intact social systems is the need to do our group research at a group level of analysis. We need to get beyond the idea that a group is a forum for shaping members. It is that, but it is also much more than that. We also need to get beyond the idea that the group is to be construed as the simple sum of its members' behaviors. We need to ask, 'what goes on at the group level?'"*

The use of Within and Between Analysis to study relationships between design features (independent variables in the operational research model) and team effectiveness addresses precisely this issue. While other research has looked at this issue using other statistical techniques, few studies have used WABA to investigate group-level relationships. Little (1993) used WABA to study teams, but focused on manufacturing core work teams, a different type of team than studied here. As stated by Markham, Dansereau, Alutto, and Dumas (1983, p. 70) below:

> *"The WABA procedure itself has direct implications of measurement in organizational research. If a measure is believed to be a "group" construct, then empirical analyses must be viewed with concern when they do not indicate both that between-unit covariance for two variables is significant and that within-unit covariance is random."*

The tests and inferences using WABA that were reported in Chapter 4 allow the researcher to understand what variables are group (or team) level phenomenon (those for which a wholes inference was drawn). The final inductions for variables used in WABA were shown in Table 4.41 of Chapter 4.

Third, this research explored relationships between boundary management processes for cross-functional design teams and team effectiveness. Gladstein (1984) found that boundary management processes were viewed as distinct from intrateam processes but did not find significant relationships between these processes and team performance. She calls for further research to define and explore the influence of these types of processes that allow a team to interact with its environment. Given the types of teams in this research and the nature of their task, it was believed that boundary management processes would have a significant relationship with team effectiveness (clarity in sponsor expectations, keeping stakeholders informed, commitment-building with stakeholders, and inter-organizational perspective). Strong support was found for clarity in sponsor expectations. It may be argued that this variable is more related to the team's task and is not a boundary management process. However, for design teams, the manner in which clarity is achieved is through interacting with the team's sponsor, who is generally external to the team. This research has served to move forward in defining boundary management processes. Future research can more sharply define these constructs.

Fourth, this researched accomplished another need in the group effectiveness literature identified by McGrath (1986). He calls for research that relies on diverse research strategies:

> *"Not only do we need to employ a variety of measurement methods, we also need to bring a broader band of methodological strategies (for example, field studies, experiments, computer simulations, sample surveys, and so on) to our study of work groups in organizations. Furthermore, within each of the strategies that we might employ, we need a broadband approach to data collection. We need sets of data that are multivariate and that involve multiple types of measures from multiple sources for each of those variables." (p. 366)*

This research utilizes a variety of data collection techniques and a strategy for data analysis using multiple methods to identify key design features of teams. Other research reports correlations between independent variables and team effectiveness which do not provide as much information as the techniques used here. WABA provides information about the appropriate focus for the relationship between design features and team effectiveness, and the use of partial correlations and multiple regression examines the impact of variables on team effectiveness in the context of other variables. In addition, this research also employed a strategy to measure variables in multiple ways. For example, team performance was assessed using two operational measures, which were established to be strongly related. Also, qualitative data was used to supplement quantitative results. Although other research includes qualitative data as input to developing quantitative data collection instruments, it is less often that qualitative data is systematically analyzed or reported. In this research, content analysis was used to extract themes and key learnings from the organizations studied, and qualitative themes were ranked (described in Appendix F). So although qualitative results were not the primary focus of this research, they represented more than example quotes to support the quantitative results.

Lastly, this research has taken a sociotechnical systems perspective to understand what leads to team effectiveness and to understand the organizational context in which teams exist. The operational research model specified variables relating to the technical component of teams (its task and technologies used to create a redesign) and the social component of teams (e.g., team commitment, team unity, team roles, etc.). In addition, the common element of all teams in this research sample was the redesign of a sociotechnical system; teams had to address both the technology and social system of the work system. Examples of redesign initiatives were provided in Chapter 1 (section 1.9), Chapter 3 (section 3.1), and Chapter 4 (section 4.1).

5.9. Areas for Future Research

There are a number of areas in which this research can be extended and enhanced in future research:

1. Establish causal linkages between design features and team effectiveness through the use of quasi-experimental and/or experimental methods.

2. Increase generalizability of results by using a larger sample of cross-functional design teams, and a larger sample of organizations spanning different industries.
3. Include the use of objective measures of team performance for cross-functional design teams.
4. Define the skill profile required for design teams.
5. Study the impact of turnover on team effectiveness using a more precise measure of turnover.
6. Include perceived influence of team members as a composition variable.
7. Further explore the impact of boundary management processes on team effectiveness.
8. Further define characteristics of the design process used by teams.
9. Explore the impact of a team charter and how it is developed on team effectiveness.
10. Study the relationship between trust within the team and team effectiveness.

1. Future research should explore the use of quasi-experimental or experimental design strategies for studying the impact of design features on team effectiveness, so that causal linkages can be established. This research has clearly demonstrated a strong relationship between variables discussed earlier in this chapter, however, with correlational research, the researcher is not able to establish causality between independent variables and dependent variables. As described in Bryman and Cramer (1994), there are three criteria that must be met in order to determine a cause-and-effect relationship between two variables: the researcher must demonstrate a relationship between two variables, the researcher must demonstrate that the relationship is non-spurious, and the researcher must establish that the cause precedes the effect (the time order of the two related variables). In correlational research, variables are rarely manipulated (often because they are not capable of being manipulated) and often data about independent and dependent variables are collected at the same time. In such correlational designs, "the ability of the researcher to impute cause and effect is limited" (Bryman & Cramer, 1994, p. 14).
2. Future research should extend this dissertation by studying a larger sample of both organizations and teams to determine if these research results are found in other types of organizations, for example, in manufacturing organizations. A larger sample of teams would clearly need to draw from a larger number of organizations, because

teams designing large-scale systems tend to be limited in number within a single organization (unless it is very large). The research sample in this research included 130 people from fifteen teams across two organizations. This research was intended to develop a deeper understanding of the design features most related to team effectiveness for cross-functional design teams as a single type of team. The researcher's intention was not to conduct a large-scale study from which results could be generalized to all teams but rather, to focus on a relatively smaller set teams to allow for the blending of quantitative data and qualitative data. However, future research should aim to extend and replicate these results with a larger sample and different types of organizations to increase external generalizability of results.

3. A third area for future research is to study design teams using objective measures of team performance. Although McGrath (1986) calls for studies using objective data about teams, the use of self-report data is still relatively common (e.g., Gladstein, 1986). The two operational measures for team performance used in this research used self-reported perceptions of team members on general statements of team performance (using TMPERF1) and on performance dimensions specific to design teams (TMPERF2). When self-report measures are used, as in this research, the question can be raised of how much of the explained variance in relationships is common-method variance and how much is true variance.

Two strategies were used here to mitigate the consequences of self-report data about team performance. The first, which has been mentioned throughout this research, is that two operational measures (scales) were used to assess team performance and were established to be strongly related. One scale was a more general measure of team performance from the Campbell-Hallam Team Development Survey, written to apply to all types of teams (TMPERF1), while the second (TMPERF2) was developed by the researcher to relate specifically to design teams, and was adapted from an approach to measuring team effectiveness developed by Cohen, Mohrman, and Mohrman (1993). The second strategy was to obtain a "stakeholder" viewpoint on team performance (in the same performance dimensions teams assessed themselves on), to check this against the team's perception. As discussed earlier, there was alignment between teams' and stakeholders' viewpoint on team performance, and the correlations between design features and team performance-2 were very consistent with correlations between design features and the stakeholder viewpoint of team performance (as shown in Table 4.40).

One avenue to pursue on using objective team performance measures is to obtain stakeholder viewpoint on objective output measures for the team, such as percent of deliverables created on time or percent of goals accomplished by the team. Another option is use longitudinal research to track improvements in business results and attempt to attribute them to the design team's efforts. There are many environmental and other factors, however, which might explain improvements or lack of improvements in results other than the work of a design team.

4. The specific skills required for cross-functional design teams should be explored, given that team skills was found to be significantly related to team performance. Some exploratory post-hoc analysis was done in this area, however, it was not a focus of this research. An understanding of which skills are the most important for these types of teams will lead to education and training strategies for team members. In addition to identifying critical skills for a team, future research should investigate the relationship between diversity of skills within the team and team performance.
5. A more precise measure of turnover within a team can be used to determine the effect of turnover on team effectiveness. The measure used in this research was a categorical classification of whether a team had no, some, or a lot of turnover. One measure that might be used is the coefficient of variation (diversity) in team member tenure ("how long have you been a member of this team?"). With this operational measure, a team having new members joining the team over time would have a higher coefficient of variation of team member tenure than a team with no or a few members

joining the team. However, this measure does not account for members leaving the team, only members joining the team.

6. Future research should explore ways to operationalize the composition of a design team. Mohrman and Cummings (1989) suggest three criteria for design team member selection: skills, multiple perspectives, and influence of team members. The first criteria was included in this research ("team skills"), and the second was operationalized using the variables cross-functional representation and multi-level representation. However, these two operational measures appear to be simply a reflection of team size (they were significantly correlated with team size). Larger teams tended to have more functional areas and organizational levels represented on the team. Future research should develop a more effective way to operationalize "multiple perspectives." In addition, the third criteria suggested by Mohrman and Cummings, influence of team members, should be studied. Based on qualitative interview data, the lack of organizational influence among team members was a major factor in the decision to reform two of the teams in this research sample (the DSOTF DDT and the ISD DDT).
7. Future research should sharpen constructs for boundary management processes. The boundary management processes used in this research did not cluster as originally developed (described in Chapter 3), however, reliable scales were still formed for four boundary management processes. Future research should utilize qualitative survey and interview data collected from teams in this sample to identify key issues related to interacting with a design team's environment and stakeholders. These issues can be used to sharpen boundary management constructs. Although the boundary management processes of keeping stakeholders informed, commitment-building with stakeholders, and maintaining an inter-organizational perspective were not found to be significantly related to team effectiveness at the team level, the researcher believes that they are important for design teams, particularly when the team's work enters the implementation stage.

8. An additional area for future research is to explore the process used by teams for redesigning a target system. All teams in the sample followed a redesign/change process to improve a target system, whether a functional work system or business process. For example, teams commonly had steps for scoping out their team's task and defining the boundaries of what the team would do, analyzing and collecting data about the target system, redesigning the target system, and implementing and evaluating the design (although some teams were not charged with implementation). Future research should explore in more detail the similarities and differences between various design processes and methodologies used. Additionally, the researcher is interested in exploring the impact of how redesign work is accomplished; in other words, how much and what type of work is accomplished in team settings versus how much and what types of work is accomplished by individual team members, or sub-groups within the team, outside of team meetings. Based on qualitative interview data at Eastman, distribution of design work to individuals or sub-groups was more common with more recent design teams as compared to the earlier design teams which tended to do more work in an entire-team setting.
9. The impact of a team charter is another area for future research. A charter is a tool to help a team define its purpose and boundaries, and teams having a charter were found to be have higher levels of team performance (as reported in Chapter 4). Additionally, teams having a charter were found to have higher clarity in sponsor expectations (as reported in post-hoc analysis in Chapter 5). However, the processes by which a charter is developed, and the impact of elements of a charter were not included in this research.
10. Lastly, future research should investigate trust within the team. Trust emerged as one of the higher-ranked themes in the qualitative survey data. For these types of teams, which bring together people who often don't know each other and have never worked together, developing trust within the team seems important. In the qualitative interview data, trust and whether people knew each other prior to being on the team,

was referred to a number of times. Some teams had people that had worked together frequently and enjoyable prior to membership on the team. Other teams had members with adversarial relationships established in previous work experiences. Yet other brought together members who did not know other members at all. Parker (1995) refers to this phenomenon of cross-functional teams as having to work with allies, enemies, and other strangers. The construct of trust may capture these variations in members' perception of other team members.

5.10. Summary of this Dissertation

As described in Chapter 1, the purpose of this research was to develop a more complete understanding of the relationship between design features (also called attributes or characteristics) of cross-functional design teams that determine team effectiveness. Table 5.4 below is repeated from Chapter 4, with some modification, and shows the research questions used to achieve the overall purpose, the data analysis method used in the research, a brief summary of research results, and where in the dissertation document more detail can be found.

Based on the results summarized in Table 5.4 and presented in Chapter 4, the key conclusions drawn from this research are[10]:

1. Team skills and clarity in sponsor expectations were significant predictors of team performance (the same result was obtained for both team performance measures used in this research). Qualitative data supported the importance of team skills and clarity in sponsor expectations on team performance.
2. Team self-assessment was a significant predictor of team satisfaction. Qualitative data did not provide clear support for the importance of team self-assessment on team satisfaction.
3. The design features most related to team performance were NOT the same as design features related to team satisfaction.
4. The research findings support the main precepts of sociotechnical systems theory of joint optimization and redundancy in skill.

[10] This list of conclusions was presented earlier in Chapter 5 and were discussed in more detail throughout the chapter.

Table 5.4. Summary of Overall Research Questions, Data Analysis Method, and Results.

Research Question	Data Analysis Method	Summary of Research Results
Research Question 1: What are the team characteristics and attributes for design teams in this research?	Descriptive statistics on independent variables to describe design teams in the research sample.	Tables 4.2 and 4.3 in Chapter 4 summarize design features and summaries of each team are provided in Appendix F.
Research Question 2: Are there differences in team effectiveness for teams using different redesign methodologies?	Multivariate analysis of variance with three dependent variables and team methodology (TMMETH) as a factor having four levels.	There were significant differences between teams using different methodologies for redesign ($p< 0.001$ for all three dependent variables). More detail is provided in section 4.2 of Chapter 4.
Research Question 3: Which design features have the greatest variation between design teams?	One-way analysis of variance using team number as a factor with 15 levels (corresponding to 15 teams), treating the design features as dependent variables. The *eta*-between and *eta*-within are calculated for independent variable (design feature).	All independent variables have significantly more variation between teams than within teams ($p< 0.05$),with the exception of job tenure ($p= 0.09$), meeting attendance ($p= 0.64$), and release time ($p= 0.21$). Section 4.3. and Table 4.5 in Chapter 4 summarize these results.
Research Question 4: Which design features have a significant relationship with design team effectiveness?	1. Bivariate Pearson's correlation coefficients were calculated using weighted group means. 2. Within and Between Analysis (WABA) was used to identify only those relationships at the team level. 3. Partial bivariate Pearson's correlations were calculated for the remaining variables. 4. Remaining variables were analyzed using multiple regression.	Team skills and clarity in team sponsor expectations were significantly related to team performance at the team level ($r=.83$, $p< 0.005$, and $r=.89$, $p< 0.005$, respectively). These design features were the two most significant predictors of team performance ($p< 0.0005$ for both). Team self-assessment was significantly related to team satisfaction at the team level ($r=.84$, $p< 0.005$) and was the most significant predictor of team satisfaction ($p= 0.0001$). Conclusions are in sections 5.2-5.6 in Chapter 5.
Research Question 5: What are the key learnings from organizations using design teams?	Content analysis was used to extract key learnings from survey questionnaire and interview data.	Themes and key learnings about design team effectiveness are presented in Table 4.84 and 4.85 in Chapter 4. Conclusions are in section 5.7.

5. The research findings support the importance of team start-up (where team skill and clarity in expectations are primarily established) in influencing team performance.
6. In qualitative data, team members attributed factors internal to the team as contributing to team effectiveness while they attributed factors external to the team as obstacles to team effectiveness. This finding provides support for Gladstein's (1984) finding about members' attribution process uncovered in qualitative data.

This research has contributed to the group effectiveness body of knowledge by focusing on a single type of team as suggested by the literature to understand what leads to team effectiveness for cross-functional design teams and by studying what relationships between variables are operating at the team level of analysis. This research has also contributed to the organizational redesign body of knowledge by identifying design features which can be used to engineer more effective design teams responsible for large-scale change. In addition, this research addressed a need identified in the practitioner literature for documentation of design teams to provide benchmark data.

As recommended earlier in this chapter, there are a number of areas for future research which can extend and replicate the results of this research in order to increase generalizability.

The following chapter represents a departure from the traditional "dissertation model," which generally ends after conclusions and areas for future research. The purpose of this research was to develop a better understanding of what leads to effective design teams, while the more ultimate aim was to help organizations improve the effectiveness of cross-functional design teams. To contribute to this aim, the researcher has identified practical implications and recommendations for creating and managing design teams based on applying the results and conclusions from this research. The intended audience for the following chapter is academicians interested in "reduction to practice" of research findings and practitioners involved with cross-functional design teams.

Chapter 6 Practical Implications of This Research

The purpose of Chapter 6 is to convert the conclusions and interpretations from Chapter 5 into practical applications, or "reduction to practice," which can be used by practitioners. This chapter describes a recommended process for installing and managing design teams based on these research results. These recommendations, however, are not intended to be generalizable to all types of teams, or even all design teams in any type of organization. Because this was a correlational research study with a limited sample size, generalization to a wide audience is not possible.

However, all teams in this research shared the common task of organizational redesign of a sociotechnical work system, whether a distribution warehouse, knowledge-work support division, or administrative process. Teams had to address technology redesign as well as redesign of the social system. Examples of redesign initiatives included redesign of: information technology, performance measurement system, facility (warehouse and store) layout, safety management processes, education and training, and distribution processes. So although the research results are not widely generalizable to all types of teams or even all design teams in organizations, it is expected that the results will be applicable to design teams performing organizational redesign involving these types of initiatives.

6.1. A Team Can Be Viewed as a Life Cycle

Based on the results and conclusions of this research, key processes and activities in various stages of a design team's life cycle are highlighted in Table 6.1. The team's life cycle is divided into:

- team start-up
- team functioning and development
- team transition and hand-off[1]

[1] These stages are related to but are not intended as an alternative model to Tuckman's (1955) commonly-used model of the stages of group development (forming, storming, norming, and performing). Rather, these life cycle stages relate to the chronological progression of key activities for a design team. Tuckman's model refers more to the

The last stage is labeled "hand-off" because for most design teams, their work will be handed off to an implementation team or to a leadership team of the target system (depending on whether the design team executes implementation as well as design). The table specifies for each major stage of a team's life cycle, the key process or activity that relates to team performance or satisfaction, and the desired outcome of that process or activity. The key processes/activities and the desired outcomes for each, are based on the results of this research and represent the levers having the strongest relationship with team effectiveness. Recommendations for each stage of the team's life cycle are discussed in the next section.

Table 6.1. Key Processes/Activities in the Stages of a Design Team's Life Cycle.

Stage of Team Life Cycle	Key Process/Activity	Desired Outcome	Related Design Feature (Variable) in this Research
Team Start-up[2]	Team member selection	Appropriate team skills profile	Team skills
	Chartering process	Clear purpose, boundaries, and expectations for results	Clarity in sponsor expectations
Team Functioning and Development	Ongoing interaction with sponsors	Clear purpose, boundaries, etc.	Clarity in sponsor expectations
	Team self-assessment activity	Team self-assessment and improvement	Team self-assessment
	Inter-team interaction and coordination	Coordination with other teams and stakeholders of the design effort	Boundary management processes
Team Hand-off and Transition	Transition and implementation planning	Clear roles for different teams involved	none

interpersonal dynamics that occur within a group, and a group may cycle through these stages repeatedly if it undergoes significant change.

[2] The key processes listed in team start-up are not intended to be discrete or sequential in the order listed; in other words, some of the work in the chartering process (defining team purpose and objectives) is necessary before team members having the right mix of skills can be selected.

6.2. Recommendations for Managing the Design Team Life Cycle

The team's life cycle, as shown in the previous table, is divided into team start-up, team functioning and development, and team transition and hand-off. Recommendations around these key processes/activities to start-up (install) and manage a design team over the life cycle are provided in this section.

6.2.1. Member Selection and Chartering are Critical Start-up Activities

The two processes that are critical in team start-up are team member selection and the chartering process. These activities overlap to some extent. Based on the results of this research, a common problem for design teams is that teams are often left to charter themselves (the quote below was from an interview with the team leader of a Virginia Tech team):

> *"We're in effect chartering ourselves, we're trying to go out and get sponsors. They ought to define the need, then get the team." (2114)*

The sponsor is an important role in design team start-up, in providing external resources and guidance to the team. The sponsor must be involved with chartering the team and creating a draft charter, or ensuring that one is completed, before the team has even had its first meeting or team members are selected. In team start-up, key activities must occur (initiate the chartering process and select team members) before the first team meeting and activities that must occur at the first meeting or soon after (complete the chartering process). Therefore, the recommendations below are divided into these two time frames.

Before the team has been selected and convened for the first team, there is some need defined, or a problem defined, for which a design/redesign effort is appropriate. The "unit of improvement" to be redesigned may be a functional work system or a business process. The need for a design effort may have been defined by higher-level leadership, by customer feedback, by the formal leader of the target system or process owner for the business process, or by some other mechanism. After an initial need and problem has been defined, the individual or team that will act as a sponsor of the design effort must be identified. A sponsor may be a team or an individual. At Eastman, sponsors were most often teams (the steering team or leadership team for a functional work system), and at Virginia Tech and National Grocers, the role of sponsor was generally performed by an individual or several individuals rather than a team[3]. The role of sponsor is one that Virginia Tech struggled with defining, and one that National Grocers had not yet adopted on a wide-spread basis. Some National Grocers teams used the term "sponsor" but it was not consistent across all the teams studied in this research.

Once the sponsor has been identified and accepts responsibility for sponsorship, he or she should draft a charter for the team. At this point, the sponsor may have selected someone to be a team leader and involve him or her in creating the draft charter (this was done with several Virginia Tech teams), or the sponsor may draft a charter alone. Although this was not formally tested as a hypothesis in this research, the researcher believes that the sponsor should draft the elements of the charter that define *what* the team will accomplish (mission, boundaries, deliverables, etc.), while the team should have the autonomy to define *how* the team will accomplish its mission. A template for design team charters and example charters are provided later in this chapter.

After the team's mission and objectives are defined in the draft charter, the sponsor (and possibly others, for example, a team leader or other stakeholders of the design effort), should select team members. As described earlier, the team mission and objectives (defined in the draft charter) should drive the team member selection strategy, which should be on the basis of skills and ability to contribute to the team. This is a different selection strategy than practiced in some cases, where the selection is driven by representation. Based on this research, the selection strategy should be driven by

[3] However, because the term sponsor is not consistently used at National Grocers among teams, it is difficult to describe how the role was operationalized in the organization since not all teams used this role.

identifying who can bring the necessary skills and knowledge to contribute to the team given the team's mission? Of secondary importance should be representation issues. Note that these two selection strategies need not conflict; that is, a key knowledge/skill area identified for the team may be broad and detailed knowledge of the target system. It may be that this knowledge/skill can only be obtained by selecting members from different functional areas or levels within the organization. The specific manner in which potential team members are selected may vary. For some teams in this research, the sponsor approached formal leaders in various parts of the organization and requested people from their area who had certain skills and knowledge. For other teams, specific individuals were directly approached and asked to be on the team.

Once the charter is drafted and team members have been identified, the team should be convened. At the first meeting, the sponsor should attend to "kick-off" the team and communicate the mission and goals of the team (as defined in the team's charter). The first meeting should be devoted to reviewing the draft charter, developing a clear understanding within the team about the elements in the charter, renegotiating any requirements or expectations that seem infeasible to the team at that point in time, and completing as many of the remaining elements of the charter as possible. Finalizing the charter may not be possible at the first meeting; if not, it should be finalized within the first several team interactions. Also, any renegotiation that is necessary with the sponsor on expectations or time lines should occur within the first several team interactions as well.

With teams of this cross-functional nature, members typically come from many parts of the organization, and so when members come together at the first meeting, they may be facing "allies, enemies, or strangers" as described by Parker (1995). This characteristic was observed in the teams in this research: members of some teams had worked together extensively prior to the team (people were "allies), many people didn't know each other before being on the team ("strangers"), and in some teams people had worked together previously and developed an antagonistic relationship ("enemies").

Unless a team is comprised of only allies and everyone on the team knows each other well (which is not very common), an activity should be done at an early team meeting, preferably the first, to allow members to get to know each other. One exercise to accomplish this would be to have each team member give a brief summary of their background, skill areas, their past experience with working on teams in general, and what their goals are for being on the team. This exercise, in addition to allowing members to learn each others' skills and perspectives about teams, may also surface any paradigms about team experiences and/or confusion about why someone is even on the team.

There may be other important team start-up activities, for example, education and training for team members. This start-up activity was not emphasized here because there was a great deal of variation in these types of activities in the teams studied, and no conclusion was reached about the importance of these educational activities relative to team effectiveness. As with the team profile and member selection, form should follow function. That is, the specific content and intensity of the educational activities should depend on the team's specific redesign task and objectives.

According to the practitioner literature on organizational redesign, design teams need a period of education and learning as a team involving reading, benchmarking visits to other organizations, and perhaps external conferences and workshops. The teams in this research sample did not tend to have a definable educational period on topics related to the team's work. Most National Grocers teams went through a "bootcamp" experience which combines educational activities with interpersonal relationship-building, however, not all teams had this experience at the start of the team or altogether as a team. For some types of design efforts, like those involved with sociotechnical systems work redesign, the educational process may be extensive (site visits, learning the sociotechnical systems design process, etc.) while for others it may be less intense. Based on interviews with team members, the skill areas which team members felt were lacking most were: team process and development, meeting management, and orientation to the design process the team is using, for members to develop a clear roadmap of how the team will create its result (design).

6.2.2. Boundary Management and Self-Assessment are Critical Team Development Processes

An activity in the team functioning and development stage which continues to clarify expectations, purpose, and scope is ongoing interaction with the sponsor. This interaction may occur in the form of joint meetings with the sponsor, informal communication between the team leader and sponsor, and/or regular progress updates to the sponsor through reports or electronic mail. All of these types of activities occurred with National Grocers and Virginia Tech teams, however, they were not systematic, and team members, particularly at Virginia Tech, expressed a frustration that not only was the sponsor role not well-understood, but that certain leaders within Virginia Tech were unwilling to commit the necessary time to being a sponsor (the following quotes were from three different teams):

> *"We can't get any sponsors to devote the right amount of attention to the team." (2114)*

> *"One thing would be solidifying what the sponsor role is and building a much stronger link between the sponsor and the [team]... making sure linkages are there and on a very regular basis." (2110)*

> *"Our sponsors need help in understanding what it means to be a sponsor, in how you communicate, what do you expect from a team, what should they expect from you....the higher the level of sponsorship, the more you need sponsor training." (2106)*

> *"...the idea of the relationship between sponsor and the team is not being met here, on this team or any teams that I see...[sponsors] just didn't participate much..." (2114)*

Another process/activity in the team functioning and development stage which is important for team effectiveness is team self-assessment. As discussed in Chapter 5, team self-assessment was strongly related to team satisfaction, yet was not strongly related to team performance. To achieve a balance and optimize both the technical work system of the team (team performance) and the social system of the team (team satisfaction), team self-assessment activities should be designed in to the team development process. To keep these activities linked to the design features found to be most related to team performance, assessment/improvement should be focused on how the team can improve its collective skill and knowledge level and understanding of purpose, scope, and expectations. In other words, team self-assessment activities and planning sessions should be focused on team skills and clarity in sponsor expectations. In this sense, the assessment activity is creating joint optimization by linking these three design features that together predicted team performance and satisfaction.

The Campbell-Hallam Team Development Survey was used in this research. The TDS is a useful tool for team self-assessment that is recommended for teams at least three months old (Campbell, 1995). It is not specifically focused on team skills and clear expectations/purpose, however, the team feedback session to review survey results can be structured around these areas, in addition to any other areas that members feel are important and unique to the team. The TDS requires approximately ten minutes to complete and can be reviewed in a team meeting lasting one and a half hours, or longer if necessary. Therefore, the requirements of this assessment activity as an example would take little time away from a team's task-related work. A team can also use other mini-evaluations or assessments if it is a fairly short-term team for which even one meeting away from task-related work would be detrimental.

The third process/activity in team functioning and development listed in Table 6.1 is inter-team interaction and coordination; these were called "boundary management" processes in this research. Boundary management processes included keeping stakeholders informed of the team's plans and progress, building commitment from stakeholders for the team's work, and maintaining an inter-organizational perspective by coordinating activities with other improvement teams in the organization. As cited earlier in this dissertation, Parker (1994, p. 45) states the importance for a team to manage external boundaries: "my own work with cross-functional teams tells me that the teams need to develop strong relationships with senior management, build bridges to functional department managers, fashion positive interfaces with key support groups, and successfully involve customers and suppliers."

Although not found to be significant in this research, the researcher believes boundary management is critical to cross-functional design teams, particularly during implementation of the design or design. In a sense, these boundary management processes to gain input, share information, and build commitment represent the learning curve that stakeholders outside the team (customers, employees, management, etc.) experience. A design team leader at Eastman stated the design team's obligation with stakeholders' learning in the following way:

> *"The design team's got two responsibilities: not only do they have to design the work system, they've got to communicate with co-workers what's happening. There's going to be two learning curves that takes place during this process. Everybody starts at ground zero. The design team is on the fairly sharp curve and then it gets steeper with their learning. Where everybody else is on the learning curve also and the bigger that gap is between the design team and everybody else when you start rolling out, the longer the more difficult the transition's going to be." (23)*

6.2.3. Transition and Implementation Planning Ensures Successful Hand-off

There were no specific variables in this research that lead to the identification of transition and implementation as a key process/activity in team hand-off. However, this represented a theme in the learnings from Eastman, having experienced dozens of design efforts and transitions. Whether or not the design team is charged with design only, or design and implementation, the transition and implementation process is critical. National Grocers struggled with this issue of how to define the role of various teams (design teams, leadership teams, implementation teams) in the organizational infrastructure and how to define the transition process between various teams.

The charter for the team should define the products/deliverables the team will create (such as a design document, implementation plan, etc.). Rather than "throwing this design over the wall" to an implementation team or a leadership team to implement, the design team needs to carefully plan how the design will be implemented. Eastman specifically uses the term "transition planning" for this activity, which refers to how the implementation process will be managed during the transition period from using the old work system design to implementing the new work system design. This is an important concept even if there is not a clear distinction between the "old design" and the "new design." The transition plan addresses how things should be sequenced, who should be involved in implementing what aspects of the design, where will focused ad-hoc implementation teams be needed, and what resources will be required for implementation. Even if the design team does not remain intact through implementation[4], they should be responsible for developing this transition plan. If a team is used for implementation, there should be sufficient overlap in the membership of the design and implementation teams to ensure integrity of the original design yet allow for necessary adjustment to the design.

6.3. A Clear Organizational Strategy for Design Teams is Necessary

This section includes practical implications from this research and recommendations on creating and documenting an organizational strategy for the role of design teams in large-scale improvement efforts. This recommendation for an organizational strategy is intended to address a number of the key learnings, particularly from Eastman Chemical Company.

First, the organization should define the strategy for using teams to support improvement. The strategy should identify what types of teams will be used for what purposes, and clear roles should be defined between teams. In a sense, this strategy document represents the "charter" for the organization as a system of teams, and should specify the purpose, role, and boundaries of different types of teams. The strategy should serve to concretize the role of teams in improvement, not to be used rigidly as a set of rules, but rather as a set of flexible guidelines, or principles, to guide decisions about forming and disbanding different types of teams. The strategy will be important for

[4] Mohrman and Cummings (1989) recommend that the design team remain intact through implementation even if another team has ownership for implementation and the design team acts as an advisory group.

people on various teams to see their team's role in the context of larger systems, and how their team needs to interact with other teams.

As mentioned earlier, the issue of role clarity between teams was present at National Grocers. Clarity and differentiation between teams created for different purposes, for different horizontal functional systems, and at different organizational levels is needed[5]. The role of design and development teams in both the Finance and the Information Services Division became less clear over time, and led the vice president of ISD to disband the DDT because it was no longer adding value to organizational improvement. Disbanding the team was not in and of itself a problem; on the contrary this is what is generally supposed to happen for design teams. However, members of ISD experienced a level of frustration and confusion because of the lack of role clarity between improvement-focused teams. An organizational strategy will provide important guidance as lines between the formal organizational structure and the parallel structure become blurred.

Second, to improve the effectiveness and efficiency of design team start-up (or any team for that matter), the chartering process for teams should be standardized. This is not to say that all team charters should look exactly alike, but instead, that all team charters should follow a similar structure and contain the key pieces of information about what a team will do and how. Eastman identified the standardization of the charter document and chartering process as one factor that enabled the company to reduce the cycle time for design efforts from about 18 months to about 4 months (there were a number of other factors as well, as described in Chapter 4).

A template for a design team charter is shown in Table 6.2. This template is intended to be a guide to sponsors and to teams on important information to document in the charter about what a team will do and how. Not all teams may need to use all the elements listed but may tailor to their specific needs. An example of an actual charter is shown in Table 6.3, which was created by a sponsor of a design effort at National Grocers

[5] Based on interview of a National Grocers executive vice president.

with external feedback from consultants. The charter was given to the team, and the team had the opportunity to review and complete the charter (note the elements recommended for the team to complete). Another example, a generic design team charter, is shown in Table 6.4, which was taken from Pasmore (1988).

To some, a charter may seem to overly constrain a team or stifle team creativity by bounding a team's work. However, Cornelius (1995) in a recent presentation to Virginia Tech leadership, drew a parallel to recent psychological research with small children. When playing in an unconstrained play area, children tended to cluster and play together in a relatively small area. When playing in a bounded area, however, children tended to play at the boundaries. In the absence of boundaries, children as a group remained within an area, creating an artificial boundary that was smaller than the real boundary in the other scenario. Drawing the parallel to a team, a charter can serve to focus and channel, not stifle, a team's energy and creativity.

Third, the role of sponsor needs to be clearly defined and consistently used. The role of sponsor, and what it entails, was raised frequently as an issue by teams in this research. Even if a team has a clear understanding of who their sponsor is, the sponsor (whether individual or a group) may not understand what this role means. Cornelius (1994) provides some guidelines about what a sponsor should do (see Table 6.5); this "sponsor job description" is intended to apply to a sponsor for any type of team (core work team, improvement team, etc.).

A last recommendation relates more generally to managing design teams and keeping focused on the end they are intended to achieve. A team must keep focused on its purpose and scope and focused on business results. The BPR Planning Team provides an example of a team that handled well the temptation to broaden scope. In the course of data collection, the BPR Planning Team came across a set of issues and problems that needed to be addressed but didn't really fit within the domain of this team's mission as defined in the team's charter (these issues were not part of human resource systems). The BPR team developed a short problem statement for each issue, and went out to the larger university system and found sponsors for each problem, rather than trying to tackle any of these issues as a team. When coming across a related problem that needs to be addressed, it can be tempting for a team to include that in their scope. As found at Eastman, design teams often made the mistake of trying to solve all problems and create the perfect design. The BPR Planning team was able to stay focused on the team's task, while also finding a way to address issues identified by the team but outside its scope.

Table 6.2. Design Team Charter Template.

Charter Elements	Definition of Charter Elements
Purpose/Mission (provides direction to the team)	What is the team's essential purpose or mission? (e.g., redesign the payroll process). What specific goals or objectives must be accomplished as part of this mission?
Sponsor (provides accountability to the team)	Who is the chartering team or individual? To whom is the team accountable for its results?
Boundaries (defines the scope of work for the team)	What is the target system, or unit of improvement, the team will focus on (e.g., Division, department, distribution centre, core business process)? What constraints, boundaries, or limits must the team work within (e.g., do not change the pay system)? At what point does the team's work end (e.g., up to implementation, including implementation, etc.)?
Deliverables or Products: (defines what products the team is expected to produce)	What plans, reports, or documents, does the sponsor expect the team to create?
Timeline (defines time constraints for the team)	Within what time frame must the team accomplish its mission and/or objectives?

Table 6.2 (cont'd). Design Team Charter Template.

Measures of Effectiveness: (defines success for the team)	What key measures of effectiveness will be used to assess whether the team has been successful (process measures such as percent of deliverables on-time and results measures such as cycle time reduction in the target system)? Who will assess the success of the team and when? What goals or expectations do sponsors have for improving business results in the target system?
Team to Team Interactions (defines interactions, communication with other teams)	With what other teams or groups must the team interact and coordinate with (e.g., improvement teams, leadership teams, other stakeholder groups)? In what ways will the team coordinate and communicate with these teams?
Resources to the Team (defines the resources the team has available)	What resources can the team call upon if necessary for help (e.g., in technical content areas, for group process and facilitation, etc.)?
Membership of the Team (defines who is on the team)	What viewpoints are needed on the team? Who specifically is a member of the team? Who are ad-hoc or temporary members?
Team Redesign Process (defines the team's methodology for redesign):	At a macro level, what process will the team use to redesign/improve the target system?
Team Roles and Responsibilities (clarifies roles within the team)	What formal team roles will the team use to distribute workload (team leader, convener, facilitator, recorder, etc.)? What are the responsibilities of each role?
Ground Rules (defines the team's norms for acceptable member behavior)	What rules does the team want to live by?
Intrateam processes (defines how the team will function in meetings)	How often and where will the team meet? How will teams make decisions in a group setting? What principles will be used in making decisions?
Team self-assessment (defines improvement process for the team)	How and when will the team assess its performance and review the charter?

Table 6.3. Example Charter for National Grocers Team

NG Distribution 1996
Performance Evaluation Program of the Future—PEP96
Program Design Team Charter

Team Purpose
To redesign the PEP Program, implement the new design, and evaluate the new design throughout 1996

Sponsors
Mike S., Andy F., Dave P.

Deliverables and Time Frame
Complete PEP96 program design by October 25-26, 1995
Complete PEP96 program implementation plan by October 25-26, 1995
Provide monthly progress updates to SrLT starting October 25, 1995
Fully implement PEP96 program by January 1, 1996
Evaluate PEP96 program quarterly through 1996 to plan enhancements for 1997
Provide quarterly evaluations to SrLT in March, June, and September, 1996

Measurement of Team Effectiveness
On-time completion of all milestone agreements made with Sponsors

Boundaries
PEP96 program must be based on and aligned with the VMS in each branch and the Total Distribution System VMS
PEP96 program must include the 10 DSOTF Great Performances
PEP96 program must align with 13 DSOTF Expectations
PEP96 program must align with NG Values and Operating Principles: Learning, Serving, Excellence, and Integrity
PEP96 program to be created in-house, using outside resources as required

Membership
Kevin W., John C., Hank S., and Matt D.

Resources
George B., Stacey S., SrLT, Altyn C., Others as needed

Table 6.3 (cont'd). Example Charter for National Grocers Team

Recommended Steps in Redesign Process Obtain program design specifications from: Dave, Andy, Mike; the Distribution Senior Leadership Team; Distribution Managers; and other relevant stakeholders. Clearly identify in writing the purpose(s) of the new program Design the program, integrating it with VMS Prepare detailed implementation plan with what to do, who's accountable, when it will be done Present program purpose, recommended program design, and implementation plan to SrLT on Oct 25-26 Revise purpose, design, and plan as needed Execute formal approval process with Mike, Andy, Dave Implement the program Evaluate program implementation and impact
Reporting Frequency Monthly at Distribution Senior Leadership Team meetings until implementation is complete Quarterly program evaluation reports/meetings with SrLT throughout 1996
Program Design Specifications Program must motivate and reinforce behaviors consistent with the process of continuous improvement Program must foster cooperation, not competition, between warehouses; e.g., no one "wins" the program at the end of the year Program must enhance morale of the Distribution workforce Program must be clearly understandable by entire Distribution workforce Program must emphasize within-branch improvement rate on high-priority KPI great performance targets negotiated with Distribution Senior Leadership Team Program must emphasize accomplishment of 10 DSOTF Great Performance KPIs
Relevant Readings NG Motivation Task Force Bootcamp Report of Output from September 27-29, 1993 NG Motivation Task Force prework for November 4-5, 1993 NG Motivation Task Force Report of Output from November 4-5, 1993
Charter Elements the Team Should Complete Who is the one Accountable Agent for the Team? Team Roles: which roles to use? rotated or permanent? Meeting Mechanisms: how often? where? how long? Ground Rules

Table 6.4. Sample Design Team Charter.
(taken from Pasmore, 1988)

Design Team's Role

Meet the requirements of the charter and function within its parameters; work *with* the steering committee; represent the entire organization--not just your individual views--in the technical and social considerations; be responsible to ensure that a more optimal work structure is created through communication with and participation of the entire organization; recognize the importance of your role; learn sociotechnical systems and be able to sell its outcomes; be a positive model to the organization; self-appraise and critique both quality and progress; constantly communicate with the organization; steward progress and problems to the steering committee; work to make the acceptance of the design easy; assist in implementation; work hard, our collective future depends on it.

Expected Outcomes

Improved product quality; higher work satisfaction; increased sense of responsibility; increased flexibility; legitimate employment security; pay and rewards consistent with company and individual objectives; improved productivity; increased technical competence; adoption of change as a natural part of doing business; innovation.

Desirable Outcomes (Human)

One class of employee, eliminating arbitrary boundaries between members; a place where one comes to work for more than just the dollars; a place where jobs are challenging, fun and envied by others divisions; individual control over work assignments; everyone has the chance to experience the pleasure of individual achievement; a place that fosters team effort and spirit; a place embracing lifelong learning; a place that encourages creativity and risk taking in the development of ideas and eliminates the fear of expressing them.

Desirable Outcomes (Organizational)

Delegation to its lowest and most effective level; a flexible workforce that by itself moves easily to where the work needs to be done; fewer job classifications; fewer levels of management; working safely is a part of the culture; an organization that can evolve its design and practices with little turmoil so that it will always stay ahead of the competition.

Desirable Outcomes (Business)

Being the industrial equivalent of a world champion sports team; make product introductions in half the time and with higher quality; develop the ability to plan ahead and avoid problems instead of reacting to them; hire and develop people with tomorrow in mind; increase communication of business information for all; develop a rapid grievance procedure or eliminate the need; productivity that is double today's by 1990; be able to handle increased productivity and product variety while maintaining quality; establish a "no defects" philosophy; establish and maintain 95% + yields in processing; implement the future technology agenda; lower costs.

Constraints

Must use the sociotechnical systems process; must satisfy the "expected" outcomes; discretion allowed only on "desirable" outcomes; proposed changes and final design will require approval by the steering committee; must be compatible with stated corporate philosophy; must fit with new corporate compensation program; cannot disrupt production; must maintain safe working conditions during and after change; company benefits are non-negotiable; must enhance equal opportunity and embrace human differences; design team must operate within budget; must follow and meet redesign schedule; must respect employee seniority but not be restricted by it. The design team should not make the mistake of assuming there are other constraints without thoroughly testing them.

Table 6.4 (cont'd). Sample Design Team Charter.

Steering Team's Charge to the Design Team

Design Team's Charge

1. *Learn* about innovative and high performing work designs through workshops and visits to other companies and plants where such systems are being used.
2. Develop a *statement of philosophy or vision statement* specifying the principles which are to govern the new work organization and your work as a design team.
3. Conduct an *environmental analysis* of the manufacturing system to determine the complete set of expectations which others will impose on this organization.
4. Analyze the *social system* within which the new manufacturing system will operate.
5. Analyze the *technical system* which has been proposed and suggest modifications as appropriate to achieve the best fit between technology, the people who will operate it, and the environment.
6. Make specific *recommendations* to the steering committee on (a) the design of jobs; (b) the work flow; (c) the work organization, including supply, support and management functions.
7. By October 1, a pilot manufacturing process is to be in place.
8. Maintain *communications* with both the steering team and the remainder of the division while you are working.

Constraints and Limitations on Design Team's Recommendations

1. Your recommendations must meet (a) customer requirements; (b) delivery schedules; (c) costs; (d) quality; (e) reliability; and (f) product specifications.
2. Any plant environmental recommendation must be in keeping with the vision. Avoid cosmetic changes.
3. Any changes must meet contract provisions in effect at the time.
4. Your recommendations must be compatible with current programs and systems, such as the new quality control program.
5. All changes must meet the tests of practicality and economic limitations.
6. Since serving on the design team and making recommendations for improvement is your full time job, you will not be eligible for suggestion awards.

Concerns of the Steering Team

1. The recommendations of the design team will not be supported by others.
2. The remainder of the division will view the design team as elitist.
3. The magnitude and complexity of the design team's assignment.
4. The design team may not think systemically enough, and may overlook important parts of any work system such as the reward system, selection, supply, management structure, etc.
5. The design team needs to share information widely and educate others at the same time you are doing your design work.
6. There may be unproductive conflict within the design team.

Hopes and Aspirations for the Design Team

The steering team hopes for creative and successful work by the design team, which will suggest changes in the technology, the contract, and division/corporate policies, wherever changes are needed to produce the most effective work organization.

Table 6.5. Sponsor Job Description.
(taken from Cornelius and Associates, 1994)

Job Summary
The management person who is responsible for officially starting (or "chartering") a particular team. The sponsor provides resources, removes roadblocks, and is the management "champion" for the efforts of the team. The sponsor also determines when to disband the team.

Principal Duties
1. Determines the need to "sanction" officially the creation of a team to accomplish a business purpose.
2. Provides guidance, insures that the team has clear direction, and either writes or approves the team's written charter.
3. Provides (or allocates) organizational resources needed for the team to accomplish its goals.
4. Actively monitors the performance of the team against its goals by reviewing team minutes, holding periodic meetings with the team leader, and occasionally attending team meetings.
5. Determines when to formally disband the team, either because the team has accomplished its goals, or is unable to accomplish its goals.
6. If the team is multi-disciplinary and cross-functional (i.e., members of the team have supervisors other than the team sponsor), the sponsor works wit relevant other management personnel to insure that the team members have the time to work on team goals. Also, the sponsor works to resolve conflicting demands on team members that are made by other management personnel.
7. Represents the interests of the team in discussions with upper management and other management personnel in the organization.
8. Responds to requests for help from the team, provides encouragement, and works to remove barriers to team success.
9. Insures that team successes are documented and publicized.

Requirements:
The team sponsor must be high enough in the management hierarchy to provide or acquire the resources needed by the team to accomplish its goals.

6.4. Summary of Practical Implications

This chapter has converted the results and conclusions (discussed in Chapters 4 and 5) into practical implications and recommendations for a practitioner audience. The application of these results is presented in the form of a design team life cycle with key processes to install and manage design teams and recommendations for developing an overall organizational strategy for utilizing cross-functional design teams. Specifically, the variables found to be most significantly related to team effectiveness were highlighted in this life cycle process and in the recommendations for the organizational strategy.

The conclusions in the previous chapter and the reduction-to-practice application outlined in this chapter are grounded in theory (the group effectiveness literature) and based on empirical data from teams in their organizational context. As cross-functional design teams become increasingly popular in organizations, the need to understand what leads to effectiveness grows. The purpose, or objective, of this research has been to develop a deeper and more complete understanding of what leads to team effectiveness, while the aim has been to contribute to the body of knowledge (both the scholarly group literature and the practitioner body of knowledge). It is hoped that the dissemination of these research findings to both an academic and practitioner audience will ultimately positively influence the successful design and management of cross-functional design teams to support organizational improvement.

The last section of this chapter represents a departure from the traditional dissertation in that the researcher's personal learnings in the research process are documented. The purpose of including this section in the dissertation is to share these learnings with other students who, it is hoped, will benefit from these experiences.

6.5. Lessons Learned in the Research Process

The purpose of this section is to share lessons learned throughout the research process used to conduct this dissertation[6]. The intended audience for this chapter is primarily

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[6] Because this section reflects the researcher's personal learnings, the first person is used throughout the section.

other graduate students engaged in the research process. This chapter documents the lessons that I have learned along the way, in the hope that other students may benefit from my experiences.

I had a committee that was interested in my research topic, willing to spend the time with me individually, and worked well together as a group. The reason for these characteristics of my committee is partially a result of good fortune and partially a result of hard work on my part to manage and build my relationship with my committee. It seems that the norm for many graduate students is to only interact with their committee as a group once, at their final defense, and to rarely or never meet with committee members other than their advisor on a one-on-one basis. I believe this is a tremendous lost opportunity. Because the process used by my two co-advisors includes four formal meetings of the committee for a Ph.D. student (pre-proposal review meeting, preliminary exam defense meeting, proposal review meeting, and final dissertation defense), I benefited from the synergy of my committee members as a group in four occasions rather than just one. I also proactively scheduled time one-on-one with members of my committee throughout my Ph.D. program, sometimes more frequently depending on what kind of guidance I needed and how much. The purpose of these meetings was often to get specific help, but it was also often simply to update them on my progress and keep them connected to my research. I am convinced that these interactions had an impact on creating more ownership and involvement with my committee, and made the review and defense meetings smoother.

My committee was unusual from many in that I had two chairmen, or co-advisors. This strategy worked well for me and provided the guidance and resources that I needed. I would not change this decision in hindsight because the value in having two advisors and what I learned from each as an advisor outweighed the costs (the "inefficiency" in clarifying and meeting requirements from two advisors). I would not, however, recommend it as a general strategy for other students. My second co-advisor joined my committee relatively later in my Ph.D. program (several months before my proposal defense). This member gave me a great deal of help that I needed at the time (and throughout the rest of the research process), for example, in survey development, refining the scope of the research, acquiring contacts for additional research sites, and defining the research in the context of industrial engineering. If I had had two co-advisors throughout the entire research process, the difficulties of managing and meeting the requirements of two advisors in defining the overall scope of the research topic in addition to defining methodology and executing the research might have been much more difficult..

I also had a third committee member, who particularly near the end of my dissertation process, acted as a research methodology advisor. While this compounded the multiple "customer" and efficiency issues at times, I feel that it substantially improved the quality of the dissertation as a product.

Another aspect of this research that in hindsight I would not change was studying real teams in organizations and doing field research with one of the organizations. This opportunity was possible because of the work of my advisors with members of industry (National Grocers and Eastman Chemical Company). I had anticipated, but did not experience, difficulty in obtaining agreement from teams and individuals to take the time to participate in this research. The willingness of individuals to give their time was surprising, particularly given the workload most people had. I believe this was partly due to the fact that people saw value in the research topic itself. I believe it was also partly due to the way I designed the survey process. The choice of the Campbell-Hallam Team Development Survey, which gave feedback to each team, was helpful in "selling" teams to participate in the research..

To every student, I highly recommend building a network of colleagues for support and advice related to your research, even if they are not located at your university. There were a number of other students and individuals, here at Virginia Tech and elsewhere around the country, with whom I interacted frequently to talk about research ideas, share articles, talk about methodology, and so on. Being a part of the Center for Organizational Performance Improvement made this easier, but on a number of occasions, I created these opportunities myself with students outside the Center and with people doing related research around the country.

In addition to those factors outlined so far, there are a number of aspects of the research process where I experienced difficulty. Throughout this research effort, I struggled to get the right balance of trying to create high quality research (tools and processes) with the need to move forward and make progress. I often erred on the side of spending too much time in each step of the way, trying to make sure it was "perfect." Research, like many things in life, has equifinality. There are many paths that can be taken to achieve an end, few of which are absolutely right or wrong. I learned the hard way the importance of balancing efficiency (time) with quality.

I learned some value lessons about following up with research participants to return my surveys. Although I obtained a 96% response rate and people were willing to complete the survey, it was not a high priority for them (understandably). I spent a lot of time and effort to follow up with late returns. And often, when I finally did contact people directly, I found that some had lost their copy or didn't realize that I was still waiting on their survey or didn't realize its importance to me. I allowed initial follow-up to occur with team leaders, who were typically busy and, understandably, did not place a high priority on my surveys. I was overly sensitive to busy schedules vs. "pushing back" to ask people to return surveys in a more timely fashion.

Another issue that I struggled with was learning research methods used in this dissertation to analyze data. In hindsight, my learning in this area would have been smoother and less "painful" if I had taken a graduate course in Management on Research Methods to learn some of the statistical techniques that are not included in the typical statistics classes that engineers take, for example, factor analysis and multivariate analysis of variance. Instead, I learned through reading on my own and through the patient teaching of one committee member by auditing his graduate class. I also received the help of the Statistical Consulting Center here at Virginia Tech. My learning in these areas was piecemeal and inefficient. All the things I did to learn on my own were valuable, and I am not suggesting they are not necessary; often you must learn specific statistical techniques for a given research effort independently. However, I could have learned more and more quickly, if these independent learning activities had been coupled with (or preceded by) a formal course to lay the foundation and provide a framework for more specific techniques.

I struggled with not being disciplined enough to protect time for my dissertation. I have done many things in my graduate career, and have made some wise decisions about trade-offs on time in order to gain learning and experiential opportunities. I have also made some unwise ones, and in hindsight, distinguishing between the two is much more clear now than it was at the time.

In summary, in spite of the intense pace of the last several months, it's been enjoyable; more so than I thought it would. Uncovering the story that my data had to tell was exciting. My advice to other graduate students would be to protect and to enjoy this time at the end of the research process and not let yourself be rushed to meet deadlines (as much as I have). Interpreting your results and writing your dissertation really represent the culmination of all the hard work throughout this learning and research process.

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Appendix A What is Research

An important step for a novice researcher to go through before conducting research is learning about research: what it is, different types of research, and ways of doing research. The purpose of this chapter is to document the researcher's knowledge base on research. As learning occurs through reading, thinking, and dialogue, this chapter knowledge base will be updated.

A.1. Defining Research

Leedy (1985) defines research as "the manner in which we attempt to solve problems in a systematic effort to push back the frontiers of human ignorance or to confirm the validity of the solutions to problems others have presumably resolved." An interesting definition of research can be found in Webster's dictionary — research is "studious inquiry...critical and exhaustive investigation or experimentation having for its aim...the revision of accepted conclusions...in the light of newly discovered facts." Based on these and other ideas of what research is, the following concept of research is offered:

> *Research is the focused and systematic acquisition and transfer of knowledge; research always takes as its foundation the existing knowledge base and either: 1) confirms existing knowledge, 2) adds new knowledge to existing knowledge bases or 3) significantly challenges or redirects a knowledge base.*

Based on definitions of research provided here and others in the literature, common elements of research can be extracted. Research:

- has a purpose or aim and is focused — purpose puts boundaries around the problem and defines the scope;
- acquires knowledge through collection and analysis of data;
- is systematic and uses a structured method to do the research (research methodology); and
- disseminates knowledge among colleagues.

The next sections take the first three elements of research listed above and expound upon them. The last element, disseminating knowledge, is important and merits a brief explanation, but does not require further detailed discussion. Disseminating knowledge is included in this list of elements of research because the author believes that good and complete research does not exist until the results are disseminated and accepted among peers in the field of study. Knowledge dissemination does not necessarily imply a formal publication in a journal or at a conference, but may be as informal as discussing research results with respected colleagues.

A.2. The Broad Purpose Defines the Type of Research

In a sense, there are two research purposes in any study. The content-specific purpose, or focus, serves to put boundaries around a research problem and define its scope. This can be termed and expressed as a research purpose, research problem statement, and/or research objective(s). A research study can use all or any of these to look at the research from different angles. There is also a broad research purpose which explains the overall reason for conducting the research in the first place. The broad purpose of the research will then determine the type of research to be conducted. Different types of research, each with a different broad purpose, are defined below and are portrayed in Figure A.1 along a continuum from theory to practice.

Basic research has as its primary purpose to gain knowledge and understanding of a particular phenomenon, and not for a practical application with specific commercial objectives (National Science Foundation, 1982; Patton, 1990).

Applied Research contributes knowledge and understanding of a phenomenon so that a specific and recognized need may be met through the generation of potential solutions (National Science Foundation, 1982; Patton, 1990).

Evaluation Research is, broadly, any effort to increase human effectiveness through systematic data-based inquiry. *Summative evaluation* is research directed toward determining effectiveness of human interventions and actions. *Formative evaluation* is directed toward improving an intervention (Patton, 1990).

Action Research has as its purpose to solve problems in a program, organization, or community through active research involvement in the subject under study (Patton, 1990). The focus is on knowledge acquisition, while also solving a recognized problem.

Design and Development is "systematic use of the knowledge or understanding gained from research directed toward the production or useful materials, devices, systems, or methods, including design and development of prototypes and processes." (National Science Foundation, 1982).

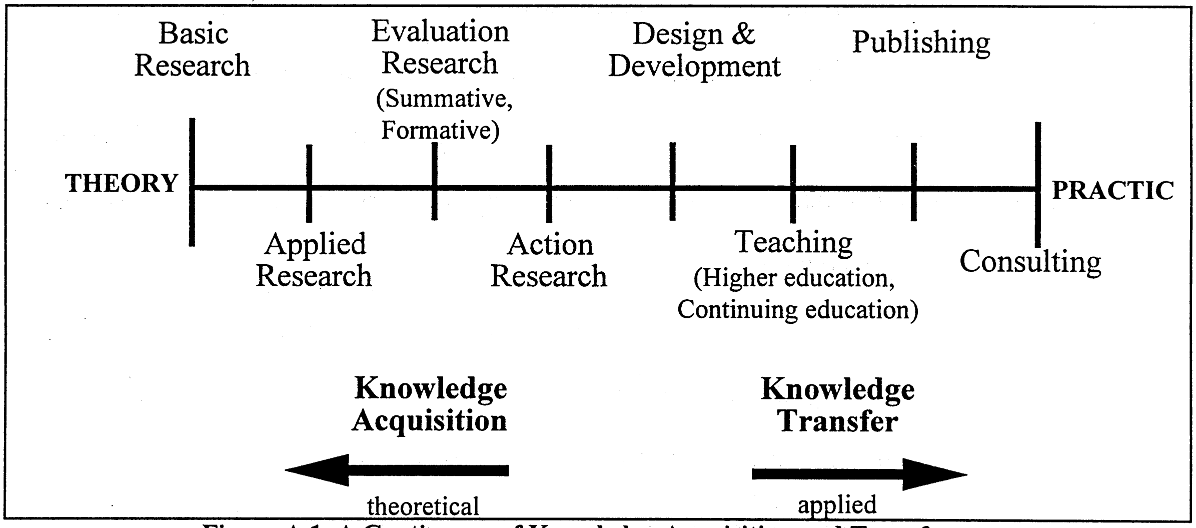

Figure A.1. A Continuum of Knowledge Acquisition and Transfer.

The left side of the continuum in Figure A.1 is concerned with the acquisition of knowledge through research, and the five types of research described above are portrayed from the more theoretical to the more applied types of research, from left to right. In addition to types of research, Figure A.1 portrays knowledge transfer through teaching, publishing, and consulting, along the same continuum.

A.3. The Output of Research Is Knowledge

As identified in the definition provided earlier, research can accomplish three things: confirm existing knowledge, add to the existing knowledge base, and change or redirect the existing knowledge base. An example of confirming existing knowledge would be to take an existing theory or theories of a particular field of study and test them, either through an experimental method or in an organization through case and field study. For example, suppose the existing knowledge base and theory suggests that males have different patterns of cooperative versus competitive behavior than females. An experiment could be perform by enlisting subjects and test this hypothesis using a game in a laboratory and observing cooperative and competitive behavior in both males and females. A field or case study could also be performed by entering an organization to collect data on cooperative and competitive behavior in both males and females in team situations. If the research results support the hypothesis, then existing theory is confirmed.

Creating new knowledge and new theory can add to existing knowledge bases, within accepted structures of knowledge, or it can be ground-breaking research, in which existing paradigms about the phenomenon under study are challenged or proven obsolete. As an example of these two situations, consider 16th century astronomy. In the beginning of this century, most scientists, or philosophers as they were then called, believed that the planets revolved around the Earth. Scientists performed a multitude of calculations, constructing tables of planetary orbits. This research, which was new knowledge, fit within the existing paradigm that the planets revolved around the Earth. Other researchers of that century, namely Copernicus and Galileo, believed that the planets in fact revolved around the sun. This research and new knowledge was revolutionary, controversial, and was not accepted initially by most philosophers nor by the Church. It is an example of research which created a new paradigm and made the existing paradigm obsolete. It would seem likely that most research creating new knowledge will fit into existing paradigms and knowledge bases, and only infrequently will we see the leaps forward in knowledge that create new paradigms of the world.

A.4. A Research Methodology is a Map for Conducting the Research

Those who conduct and write about research seem to agree on the distinctions of different types of research. However, there is rigorous debate on *how* to do research, which is the third element of research identified earlier, that is, a systematic and structured method.

A.4.1. Two Competing Research Paradigms

A paradigm is a worldview, a general perspective and way of breaking down the complexity of the real world. Paradigms filter out all the unimportant, unreasonable data encountered (Barker, 1987), allowing individuals to interpret data and make action possible (Patton, 1990). The negative effect of paradigms is that they filter out data which does not match current paradigms, and individuals may be unable to interpret data inconsistent with these paradigms (Barker, 1987). There exist two primary paradigms about how to do research, and the debate centers around which is best and whether they can be combined in one research study.

Logical-positivism uses quantitative and experimental methods to test hypothetico-deductive generalizations. This paradigm is also called the hypothetico-deductive paradigm, as well as the quantitative paradigm (Patton, 1990). The choice of this paradigm implies use of quantitative methods. Phenomenological inquiry uses qualitative and naturalistic approaches to inductively and holistically understand human experience in context-specific settings (Patton, 1990). This paradigm is called the holistic-inductive or the qualitative paradigm. The choice of this paradigm implies the use of qualitative methods.

There are three views on combining these two research paradigms (Rossman and Wilson, 1985): purist, situationalist, and pragmatist. The purist view argues that the quantitative and qualitative paradigms are based on inherently contradictory and mutually exclusive assumptions about the nature of research and society; further, purists argue that a synthesis of the two cannot be done (Rossman and Wilson, 1985). Supporters of this view either strongly argue for the hypothetico-deductive paradigm or the holistic-inductive paradigm. The situationalist view argues that both paradigms have strengths and weaknesses, and there are specific situations where each paradigm is most appropriate. Situationalist are not proponents of only one research paradigm or the other. They believe that each has value in certain situations, but that they should not be combined in one research study. The pragmatist view supports integration of hypothetico-deductive and holistic-inductive (and hence, quantitative and qualitative methods) within a research study. In a study on anthropological methods, Pelto and Pelto (1978) concluded that examining cultural behavior with a variety of different approaches greatly enhanced the credibility of their research results.

The view upheld in this research is that of the pragmatist, in combining both paradigms of how to conduct research. The research design described in Chapter 3 reflects this view in that both quantitative and qualitative data and analysis methods are utilized.

A.4.2. The "Wallace Wheel" As Another Perspective on Research Paradigms

Another way to compare competing research paradigms is to view them within the scientific (research) process (see Figure A.2). The "Wallace wheel" (Wallace, 1971) portrays both research paradigms as part of the research process. The right half of the wheel represents the application of theory and knowing what to observe, using deductive methods. The left half of the wheel represents constructing theory and understanding what is observed using inductive methods. These two halves are another way of looking at the hypothetico-deductive and holistic-inductive research paradigms. The top half of Figure A.2 represents theorizing using logic methods, while the bottom half represents doing empirical research using research methods.

Once the type of research and views on research paradigms are defined, a researcher must design the research methodology, which maps out the specific activities.

A.4.3. Research Design As A Process of Making Choices

Table A.1 lists a series of design issues and choices in constructing a research methodology. The first few of the issues listed have already been discussed elsewhere in this document (the broad research purpose as either basic research, applied research, evaluation research). This table was constructed based on Patton (1990) but other resources were used as well (Yin, 1989; Eisenhardt, 1989; Miles and Huberman, 1994).

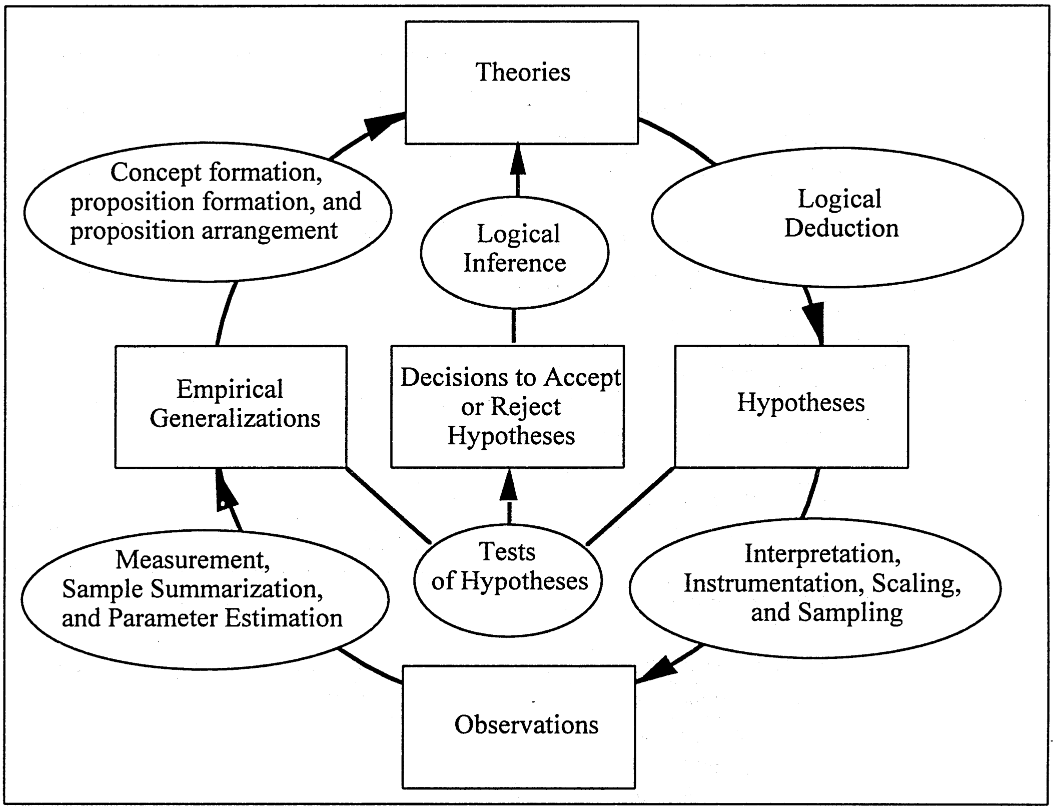

Figure A.2. The Scientific Process.
(taken from Wallace)

Table A.1. Research Design Issues and Options.
(adapted from Patton, 1990, p. 197)

Issues	*Sample Options and Considerations*
1. What type of research was this?	
1a. What was the broad purpose of the study?	Basic research, applied research, summative evaluat formative evaluation, action research, development
1b. What was the focus (nature) of the study?	Exploratory, descriptive, explanatory, predictive
1c. Did the research confirm or create theory (knowledge)?	Confirming theory, Theory-building (Eisenhardt, 1989)
2. What were the units of analysis?	Individuals, groups, program components, whole programs, organizations, communities, critica incidents, time periods, and so on
3. What were the sampling strategies for case sites?	Purposeful sampling, probability sampling; variatio in sample size from a single case study to a generalizable sample
4. What people, settings, events, and social processe were sampled (Miles and Huberman, 1984)?	Purposefully or randomly select key people, settings events and social processes
5. What type of research paradigm was used?	
5a. What inquiry paradigm was used?	Hypothetico-deductive, naturalistic inquiry, or both
5b. What analytical approach was used?	Inductive, deductive, or both
5c. What types of data were collected?	Qualitative, quantitative or both
6. What was the source of data?	Documentation, archival records, artifacts, interview direct observations, participant-observation, survey, experiment, etc. (Yin, 1989)
7. What research method was used?	Case study method, experimental method, historical method, etc.
8. How were validity of and confidence in the findings addressed?	Construct validity, internal validity, external validity and reliability (Triangulation options, multiple data sources, multiple methods, multiple perspectives, and multiple investigators)
9. Time issues: When did the study occur? How was the study be sequenced or phased?	Long-term fieldwork, rapid reconnaissance, explorat phase to confirmatory phase, fixed times versus open time lines
10. How were logistics and practicalities handled?	Gaining entry to the setting, access to people and records, contracts, and so on
11 How were ethical issues and matters of confidentiality handled?	Informed consent, protection of human subjects, reactivity, and so on
12. What resources were available? What did the study cost?	Personnel, supplies, data collection, materials, analysis time and costs, reporting/publishi costs

The list of design choices in Table A.1. can be used to aid research design to ensure that all important design issues are considered.

A.4.4. Different Research Methods

One of the design issues listed in Table A.1 is the choice of a research method. There are a variety of research methods available to a researcher. Table A.2 lists alternative research methods, as well as their characteristics and/or goals (Leedy, 1985). This table is not meant to be an exhaustive list, rather representative of the various methods available. The choice of a particular research method can depend on several things. Yin (1989) suggests using three criteria: the form of the research question(s), the degree of control over behavioral events of subject(s) under study, and whether the focus is on contemporary events or not.

Eisenhardt (1989) and Rossman and Wilson (1985) suggest that a researcher can use more than one research method within a research study. For example, a research study can be conducted using the case study method and have an experiment or a survey (both quantitative methods with quantitative data) as part of the research design, along with interviews and observations. In fact, Rossman and Wilson (1985) strongly argue for combining methods using both quantitative and qualitative data in one study, called triangulation. Triangulation allows researchers to improve accuracy of conclusions by relying on data from more than one data collection method and/or source (Leedy, 1993). Rossman and Wilson (1985) provide examples of how qualitative data enriches quantitative data within a study, and vice versa.

Table A.2. Research Methods.
(taken from Leedy, 1993)

Method	*Characteristics of the Method and the Research Goals*
Action Research	The approach in action research is to do something to see if it works. Will playing video games improve eye-hand coordination in typing? Method: Get a bank of computers, a group of typists; set up a training session. See if typing skills improve.
Case and Field Study Research	A type of descriptive research in which data is directly gathered from individuals (individual cases) or social or community groups in their natural environment for the purpose of studying interactions, attitudes, or characteristics of individuals or groups. A case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used" (Yin, 1989). A case study is a research strategy which focuses on understanding the dynamics present within single settings (Eisenhardt, 1989).
Descriptive (or Normative) Survey	The descriptive survey method, also called the normative survey method, is employed to process the data that come to the researcher through observation. This method looks with intense accuracy at the phenomena of the moment and then describes precisely what the researcher sees.
Developmental	This type of research is an observational-descriptive genre of investigation that usually stretches over a period of time and is frequently called "the longitudinal study." Trend studies and projections of future trends are sometimes considered as developmental research projects.
Historical	The historical method attempts to solve certain problems arising out of a historical context through a gathering and examination of relevant data.
Experimental Method	The experimental method attempts to control the entire research situation, except for certain input variables which then become suspect as the cause of whatever change has taken place within the investigative design.
True Experimental Method	The true experiment evinces a greater degree of control and refinement and a greater insurance of both internal and external validity.
Quasi-Experimental Method	Quasi-experimental designs are used in situations where random selection and assignment are not possible. The researcher must be aware of the specific variables the design fails to control and take these into account in the interpretation of data.
Ex Post Facto	This method observes existing conditions and searches back through the data for plausible causal factors. It is the "detective method" in which the situation of the crime is discovered and then the search for the cause or motivation for the crime is sought.

A.5. Summary

This appendix has outlined the body of knowledge review conducted by the author on research paradigms, research design, and research methods. The specific design for this research and the specific methods used to analyze data were described in Chapter 3.

Appendix B Data Collection Instruments

This appendix contains all data collection instruments used to collect both quantitative and qualitative data from members of design teams at National Grocers and Virginia Tech, and from team leaders, internal consultants, and strategy designers of design teams at Tennessee Eastman Company. For the purpose of saving space, a font size of 10 is used in this appendix, however, a larger font size was used when sending team members these surveys and letters. This appendix contains:

- introductory letter, survey instructions, and informed consent form used in this research (the introductory letter and survey instructions were used with members of teams studied at National Grocers and Virginia Tech; the informed consent form was used with all participants of this research);
- a copy of the Campbell-Hallam Team Development Survey[1], completed by teams at National Grocers and Virginia Tech;
- a "generic" version of the Design and Leadership Team Survey developed by the researcher, completed by teams at National Grocers and Virginia Tech;
- a generic version of thank you letters sent to members of teams at National Grocers and Virginia Tech;
- the interview guide used to interview one member of each team at National Grocers and Virginia Tech;
- the interview guide used with the strategy designer of work redesign teams at Tennessee Eastman;
- the interview guide used to interview team leaders and internal team consultants at Tennessee Eastman;
- the focus group guide used to interview a group of team leaders and internal team consultants at Tennessee Eastman; and
- the thank you letter sent to all participants at Tennessee Eastman.

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[1] The Campbell-Hallam Team Development Survey is reproduced in this appendix with the permission of Dr. David Campbell.

Introductory Letter Sent to Team Members at National Grocers and Virginia Tech

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Department of Industrial and Systems Engineering
College of Engineering
302 Whittemore Hall, Blacksburg, V
(703) 231-6656 FAX (703) 231-332

Date

Dear team name member,

You and your team have learned a lot about what makes design teams and leadership teams successful. Research sponsor name want to capitalize on your team's experiences. To do this, we want to collect lessons learned from recent teams across organization name and analyze them for common issues/themes. The learnings will guide current and future teams like yours, which are critical to continued success.

Besides being an important part of this effort to document your team's learnings, your participation will provide your team with some valuable summary information that can help you assess team process and effectiveness if desired.

To get the information we need, I am asking you to complete two surveys (enclosed) by date. Both surveys together should take about an hour to complete. The survey instructions on the next page will tell you what to do.

Everyone on the team name who returns the surveys to me will have a chance to receive a prize; I'll select one team member randomly from the team to receive a Virginia Tech T-shirt.

Answering the questions in the surveys honestly is critical if the information is to be valuable. Therefore, the survey is confidential and the privacy of your responses will be protected. I am asking for your names on both surveys only so that I can keep track of who has completed the surveys. No one at organization name will see what you have written. Before and during the time you complete the surveys, please do not discuss your responses to questions with any other team members; this is important so that your responses reflect your individual experiences on the team.

Thank you, in advance, for your participation in this important effort.

Eileen Van Aken
The Performance Center

Survey Instructions

If anything in these instructions is unclear or if you are missing any of the pieces described below, please call Eileen Van Aken at Virginia Tech at 540-231-2723.

As you complete the two surveys, keep in mind:

- Your responses should be based on your experiences with the BPR team and not on other teams you may be a member of.
- The Campbell-Hallam Team Development Survey asks questions about your team leader; for the purposes of this survey, the **team leader for the team name** is **team leader name**. **Other team members are:** (list other team members).
- The "target system" your team is focusing on for change/improvement is target system.
- Please answer **ALL** questions in both surveys.
- Eileen needs your name on the surveys only to keep track of who on your team has returned their surveys. Your responses will be kept strictly confidential.
- Until you've finished both surveys, please do not discuss your responses to questions with any other team members.
- If any item in either survey is unclear to you, please call Eileen for clarification.

Step 1
Read and sign the Informed Consent Form. Return the first page to me and keep the second page for your reference in case you have questions or concerns.

Step 2
Open the Campbell-Hallam Team Development Survey (CHTDS) booklet and verify that the information about your team in the shaded gray box is correct. Read and follow the brief Directions to complete the survey (reminder: use a pencil to complete this survey - one is enclosed for you to use and keep).

Step 3
Turn to the Design and Leadership Team Survey and verify that the team name on the first page is correct. Complete the survey in either pencil or pen.

Step 4
Once you've finished, please put both surveys and your signed Informed Consent Form in the return envelope provided. Please return your envelope to me by date.

Once Eileen receives your surveys:

- She will record the information from your surveys for analysis at Virginia Tech and will then mail your CHTDS to NCS Assessments in Minnesota for scoring.
- You will receive a sealed *Team Member Report* compiled by NCS that summarizes your responses to the CHTDS. No one else, including Eileen, will see your individual Team Member Report.
- Your team will also receive a *Team Report* that summarizes the responses of all team members grouped together (in this report, only summary information is shown - not individual responses).
- Your team can review and discuss the Team Report in a team meeting and use the information as a way to acknowledge team strengths and identify ways to improve.

Informed Consent for Participants of Investigative Projects

Title of Project:	An Applied Research Study on the Effectiveness of Teams Leading Large-Scale Change Efforts
Research Investigator:	Eileen Van Aken

I. Purpose of This Research

You are invited to participate in a study about teams leading change and improvement efforts within organizations. This study involves members of teams leading redesign efforts, in addition to individuals who initiate or interact with teams.

II. Procedures

The procedures to be used in this research are interviews and survey questionnaires.

Interviews

Interviews will be conducted with team members of National Grocers and Virginia Tech teams, and interviews will be conducted with individuals who interact with teams (sponsors of teams, internal consultants to teams, strategy developers, etc.). Interviews will require about one hour.

Survey Questionnaires

For each team at National Grocers and Virginia Tech participating in the research, members are asked to complete two surveys: the Campbell-Hallam Team Development Survey and the Design and Leadership Team Survey, which together require about one hour. Stakeholders (sponsors, customers, managers, etc.) of teams are asked to complete a Stakeholder Survey which will require about 15 minutes.

III. Benefits of This Research

For each team participating in this research, the following information will be provided that may be helpful to the team: Team Member Report summarizing responses for each team member and a Team Report summarizing the team's responses overall. Both of these reports are provided by NCS Assessments, the supplier of the Campbell-Hallam Team Development Survey.

You may also receive a summary of this research project when complete. If you would like a summary, please give your name and address to the researcher or the survey administrator.

IV. Extent of Anonymity and Confidentiality

The results of this study will be kept strictly confidential. Only the research investigator will have access to individual survey responses and audio tapes of interviews, and research results will be summarized only at the team level. Only a subject number will identify you during analyses.

With participants' permission, interviews will be taped. These tapes will only be reviewed by the researcher and research assistants to transcribe tapes at Virginia Tech and will be erased after one year.

V. Freedom to Withdraw

You are free to withdraw from this study at any time.

VI. Approval of Research

This research project has been approved, as required, by the Institutional Review Board for projects involving human subjects at Virginia Polytechnic Institute and State University and by the Department of Industrial and Systems Engineering.

VII. Participant's Responsibilities

I know of no reason I cannot participate in this study.

____

Participant's Signature

KEEP THIS PAGE FOR YOUR REFERENCE

VIII. Participant's Permission

I have read and understand the informed consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project.

If I participate, I may withdraw at any time without penalty. I agree to abide by the rules of this project.

Should I have any questions about this research or its conduct, I will contact:

Eileen Van Aken 540-231-2723, e-mail: evanaken@perform.vt.edu
Research Investigator

Dr. Brian Kleiner 540-231-4926, e-mail: bkleiner@vt.edu
Faculty Advisor

Dr. Ernest Stout 540-231-6077
Chair, Institutional Review Board, Research Division

TDS™

Campbell-Hallam
Team Development
Survey™

Member

NCS™

Product Number
05368

DIRECTIONS:

This survey is designed to help you find ways to improve your team. You will receive extensive feedback based on your responses. Your personal responses will remain confidential and will be combined with the results of the other team members to form a team average.

Please note the name of your team and team leader, which should appear in the shaded box at the right.

To receive a personal report of your results, you need to fill in the other information requested on this page. Use a soft black lead pencil only and make a heavy, dark mark when filling in the circles. Begin by printing your name in the boxes below. Print your last name first, as many letters as possible. Do the same for your first name and middle initial. Blacken the circle below each box that corresponds to the letter in the box. In a similar way, complete the boxes for today's date, your gender, race, birth date, team role, level of education, and length of time on team. If you make a mistake or change your mind, please erase the mark fully and then fill in your new choice.

SURVEY ADMINISTRATOR:
Please complete this information about the team.

Team Name: ______________________

Team Leader: ______________________

ORG.	TEAM	SPECIAL CODES
0–9	0–9	0–9

LAST NAME	FIRST	MI
A–Z	A–Z	A–Z

TODAY'S DATE

MONTH	DAY	YEAR

GENDER
1 Male
2 Female

RACE
1 African American
2 Asian American
3 Hispanic
4 Native American
5 White
6 Other

BIRTH DATE

MONTH	DAY	YEAR

What is your role on the team?
1 Team leader
2 Team member
3 Other

How long have you been on this team?

YEARS	MONTHS

What is your level of education?
1 Some high school
2 High school graduate
3 Some college
4 Vocational training
5 College graduate
6 Master's level degree
7 Doctoral level degree

By David Campbell, PhD, and Glenn Hallam, PhD
Center for Creative Leadership
Colorado Springs, Colorado 80906

21475
PLEASE DO NOT WRITE IN THIS AREA

Please read each statement below and indicate how much you agree with it, using the following scale:

- Ⓐ **STRONGLY AGREE**
- Ⓐ Agree
- ⓐ slightly agree
- ⓓ slightly disagree
- Ⓓ Disagree
- Ⓓ **STRONGLY DISAGREE**

Fill in only one circle for each statement.

Some of the statements may seem quite similar. The purpose of this repetition is to gather better information. Your answers to two similar statements provide more reliable results than either answer taken alone.

Please mark your responses carefully, using only a soft black lead pencil. Do not make any stray marks, and do not fold or wrinkle the sheet.

1. Our team works hard. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
2. Reports on our performance are favorable. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
3. Our team meetings are well organized. . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
4. We take the time as a team to examine areas in which we need more skill or experience. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
5. Our team members are skilled and competent. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
6. I like being part of this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
7. My work requires frequent interaction with the other team members. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
8. I have challenging goals for my performance on this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
9. We have a difficult time reaching decisions. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
10. I am burdened by other responsibilities that reduce my ability to contribute to this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
11. I am never sure how well I am performing on this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
12. We are committed to superior team performance. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
13. Our organization fully supports this team and its mission. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
14. This team often laughs together. . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
15. I often do not know what I am supposed to be doing on this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
16. We clearly think of ourselves as a team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
17. We are meeting our team objectives. . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
18. I am valued for my contribution to this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
19. We usually have access to the information we need. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
20. I am not sure just who is on this team. . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
21. We all accept personal responsibility for the success of this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
22. We have a clear overall team purpose. . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
23. We are open to trying new and different approaches to our work. . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
24. I know what I want to achieve on this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
25. The team leader is skilled and experienced. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
26. We have enough time and people to perform well. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
27. We need a better space where our team can meet or work. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
28. When we disagree, we usually work out our differences in an honest, healthy way. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
29. We often do not know who is responsible for important tasks. . . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
30. We often receive reports on our performance, such as sales figures or customer comments. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
31. The team leader has a clear vision of where we are going as a team. . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
32. I am proud to be part of this team. . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
33. We rarely stop to consider how we can work better as a team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
34. I would be more effective if I had a certain tool, resource, or piece of equipment. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
35. The team leader gives members the freedom to make their own decisions. . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
36. Our team has a reputation for being innovative. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
37. We need a better way to get news or plans from people outside the team. . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
38. I am not sure what we are trying to accomplish as a team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ

Please continue on the next page.

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PLEASE DO NOT WRITE IN THIS AREA

Ⓐ **STRONGLY AGREE**
Ⓐ Agree
ⓐ slightly agree
ⓓ slightly disagree
Ⓓ Disagree
Ⓓ **STRONGLY DISAGREE**

39. This team suffers from a lack of training or experience. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
40. Our work is high quality. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
41. We are overwhelmed with things to do. . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
42. The team leader often says things that discourage members from performing well . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
43. We rarely follow through on our plans for improving the team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
44. We have enough money and other material resources to do our work. . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
45. Team members anticipate what they will need from me and tell me so I can plan ahead . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
46. Team members offer help when I need it. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
47. The team leader praises or rewards members when they perform well. . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
48. Our team members have many new and creative ideas. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
49. Our team members always agree with each other. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
50. We often receive critical information too late. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
51. We have a time schedule for achieving our team goals. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
52. I am unhappy on this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
53. Team members strive to develop skills that can benefit the team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
54. We have a good method of tracking our team's performance. . . . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
55. I receive few rewards for performing well on this team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
56. There are team members who have the skill or knowledge to back me up if necessary. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
57. Team members put their personal interests before the interests of the team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
58. We have recently discussed what we did right or wrong on a particular project or job. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
59. The team leader encourages members with different opinions to express their ideas. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
60. The people who evaluate our team performance are happy with our results. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
61. We hesitate to try something new, even if the change would be a clear improvement. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
62. I often find it difficult to get answers to important questions about my work. . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
63. We need to focus on fewer activities. . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
64. Team members have been carefully selected to create the right mix of skills. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
65. Voicing disagreement on this team is risky. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
66. We have easy access to the equipment we need. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
67. The team leader gives members valuable feedback to help them improve. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
68. Team members compete with each other rather than cooperate. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
69. We have the opportunity to develop new skills. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
70. We need to meet more often as a team. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
71. I work under unpleasant conditions, such as crowding, dirt, noise, or poor lighting. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
72. So far, our team has been a great success. . . . . Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ

SUPPLEMENTAL ITEMS

Your survey administrator may have provided you with a separate page of supplemental items. If so, please refer to the statements on that page and use the space below to record your responses. If you did not receive supplemental items, please leave this part blank.

A. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
B. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
C. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
D. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
E. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
F. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
G. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
H. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
I. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
J. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
K. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
L. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
M. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
N. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ
O. Ⓐ Ⓐ ⓐ ⓓ Ⓓ Ⓓ

NCS Assessments 06/96 MM104451:321

Design and Leadership Team Survey

Team Name: Team name ______________ Team Leader: Team leader name ______

Your Full Name: ______________________ Today's Date: ______________________

SECTION I Below are some questions about your experience within organization.

1. When did you first come to work for organization? _______, 19____
month year

2. When did you start your present job? _______, 19____
month year

3. If you have taken the Myers-Briggs Type Indicator and you know your type, please indicate below. If you have **NOT** taken the MBTI, please **SKIP** this question.

Extrovert/**I**ntrovert	(circle one)	**IN**tuitive/**S**ensing	(circle one)
Thinking/**F**eeling	(circle one)	**J**udging/**P**erceptive	(circle one)

4. What is your highest education level? (Circle the highest completed)

1	Some elementary school
2	Completed elementary school
3	Some high school
4	Graduated from high school or high school equivalency
5	Some vocational or technical training beyond high school
6	Graduated from vocational school
7	Some college/university education
8	Graduated from college/university
9	Some graduate school
10	Completed graduate degree

SECTION II The questions in this section ask about how your team functions over the time you have been a member.

5. How often do you communicate on average with at least one other team member outside of regular team meetings? Please use a **specific number** for how often you communicate; e.g., 2 times per day, 3 times per week, 2 times a month, 1 time a month, etc. If you do not communicate with other team members outside of team meetings, please **SKIP** this question.

   On average, I communicate with other team members outside of team meetings:

   _________ times per _____________

6. Over the time you have been a member, what percentage of team meetings have you attended?

   I have attended ___________% of team meetings

7. Are you able to communicate with other team name members using electronic mail? (Circle the number of your response)

(1)	(2)	(3)	(4)
No, with NONE of my team members	Yes, with SOME of my team members	Yes, with MOST of my team members	Yes, with ALL of my team members

8. Please rank the following ways you communicate with **members of the team name** in order of importance as a source of information for you to perform your work on the team. Rank each of the following, with **1 being most important**, **2 being next most important**, and so on.

   _______Regular team name meetings (face-to-face meetings)

   _______Telephone (interactive) conversation

   _______Electronic mail

   _______Voice or phone mail

   _______Informal face-to-face communication

   _______Written memo or report (paper, not sent through e-mail)

   _______Other (please specify___________________)

9. Please rank the following ways you communicate with **anyone outside the team name** in order of importance as a source of information for you to perform your work on the team. Rank each of the following, with **1 being most important, 2 being next most important**, and so on.

________Meetings of other teams (face-to-face meetings)

________Telephone (interactive) conversation

________Electronic mail

________Voice or phone mail

________Informal face-to-face communication

________Written memo or report (paper, not sent through e-mail)

________Other (please specify____________________)

10. Over the time you've been a member of the team name:

a. how many new members have joined the team? ________ members
b. how many members have left the team? ________ members

11. What formal roles are presently used in your team? Please also identify if roles are permanent or rotated.

Roles	Does your team use this role? (Circle one)		If yes, is it permanent or rotated? (Circle one)	Rotated how often?
Team leader	No	Yes	Permanent	Rotated, every ________
Convener	No	Yes	Permanent	Rotated, every ________
Recorder	No	Yes	Permanent	Rotated, every ________
Facilitator	No	Yes	Permanent	Rotated, every ________
Reporter	No	Yes	Permanent	Rotated, every ________
Others:				
________________			Permanent	Rotated, every ________
________________			Permanent	Rotated, every ________
________________			Permanent	Rotated, every ________

12. Are you currently performing any formal team roles? If so, which one?

1 NO, I do not currently perform any formal role other than team member

2 YES, I currently perform the role of:____________________

13. For each of the following knowledge/skill areas, please circle your level of skill that you bring to the team.

Please use the following scale:

E	=	Expert: I have excellent knowledge/skills in this area
G	=	Good: I have well-developed knowledge/skills in this area
sa	=	Slightly above average: I have average, or a touch above, knowledge/skills
sb	=	Slightly below average: I have average, or a touch below, knowledge/skills
P	=	Poor: I am not very knowledgeable/skilled in this area
N	=	None: I have no knowledge/skills in this area

		Expert	Good	Slightly Above Average	Slightly Below Average	Poor	None
A.	Problem solving and decision making	E	G	sa	sb	P	N
B.	Meeting management	E	G	sa	sb	P	N
C.	Group process and facilitation	E	G	sa	sb	P	N
D.	Computer skills (word processing, spreadsheets, electronic mail)	E	G	sa	sb	P	N
E.	Communication and listening	E	G	sa	sb	P	N
F.	Making presentations	E	G	sa	sb	P	N
G.	Systems thinking and perspective	E	G	sa	sb	P	N
H.	Organizational redesign	E	G	sa	sb	P	N
I.	Large-scale organizational change	E	G	sa	sb	P	N
J.	Writing reports and plans	E	G	sa	sb	P	N
K.	Managing change	E	G	sa	sb	P	N
L.	Leading groups or teams	E	G	sa	sb	P	N
M.	Self-managing/self-directed work teams	E	G	sa	sb	P	N
N.	Personality style (e.g., Myers-Briggs)	E	G	sa	sb	P	N
O.	Technical, job-related skills in my area	E	G	sa	sb	P	N
P.	Knowledge about the <u>target system</u> (outputs/ products, customers, work processes, etc.)	E	G	sa	sb	P	N
Q.	Improvement methodologies (Continuous Process Improvement, Business Process Redesign, etc.)	E	G	sa	sb	P	N
R.	Quality Tools (flowchart, cause-and-effect, Pareto, etc.)	E	G	sa	sb	P	N
S.	Measurement and data collection	E	G	sa	sb	P	N

Others (Please specify)

______________________________	E	G	sa	sb	P	N
______________________________	E	G	sa	sb	P	N
______________________________	E	G	sa	sb	P	N
______________________________	E	G	sa	sb	P	N

SECTION III The questions in this section ask about any education and training that you have received in the past 12 months to develop and increase your knowledge and skills.

14. For each of the following knowledge/skill areas, circle whether or not you have received education/training **in the past 12 months**. Also, for each knowledge/skill area, circle whether or not you got the education/training **because** you are on the team name.

	Did you get education/ training in this area in the past 12 months? (Circle YES or NO)	Was it **because** you are on the team name? (Circle YES or NO)
Example: Dribbling a basketball	YES or NO	YES or NO
A. Problem solving and decision making	YES or NO	YES or NO
B. Meeting management	YES or NO	YES or NO
C. Group process and facilitation	YES or NO	YES or NO
D. Computer skills (word processing, spreadsheets, electronic mail)	YES or NO	YES or NO
E. Communication and listening	YES or NO	YES or NO
F. Making presentations	YES or NO	YES or NO
G. Systems thinking and perspective	YES or NO	YES or NO
H. Organizational redesign	YES or NO	YES or NO
I. Large-scale change	YES or NO	YES or NO
J. Writing reports and plans	YES or NO	YES or NO
K. Managing change	YES or NO	YES or NO
L. Leading groups and teams	YES or NO	YES or NO
M. Self-managing/self-directed work teams	YES or NO	YES or NO
N. Personality style (e.g., Myers-Briggs)	YES or NO	YES or NO
O. Technical, job-related training in my area	YES or NO	YES or NO
P. Training in the target system (outputs/products, customers, work processes, etc.)	YES or NO	YES or NO
Q. Improvement methodologies (Continuous Process Improvement, Business Process Redesign, etc.)	YES or NO	YES or NO

	Did you get education/ training in this area in the past 12 months? (Circle YES or NO)	Was it **because** you are on the <u>team name</u>? (Circle YES or NO)
R. Quality Tools (flowcharting, cause-and-effect diagram, Pareto chart, etc.)	YES or NO	YES or NO
S. Measurement and data collection	YES or NO	YES or NO
Others (Please specify)		
______________________________		YES or NO
______________________________		YES or NO
______________________________		YES or NO
______________________________		YES or NO

15. What education/training activities have you participated in over the past 12 months to develop your knowledge and skills? (Circle **ALL** that apply)

1 Site visits to learn from and benchmark other organizations

2 Training workshops or seminars within <u>organization name</u>

3 Training workshops, seminars, or conferences outside <u>organization name</u>

4 Reading books, articles, or case studies

5 Discussing books, articles, or case studies with others

6 Other (please specify:)______________________________

____

____

16. Please estimate the amount of time in days that you have spent in formal education/ training activities in the past 12 months.

I have spent: _____________days in education/training in the past 12 months.

17. Please list any content areas for which you think your team needs education/training.

18. Over the time you have been a member, what percentage of your working time do you devote **ON AVERAGE** to the team name, including team meetings and work outside of meetings?

___________ % of my time (Please give your best estimate on a **specific percentage of time** rather than a range)

19. Please estimate the percentage of time that the team name as a whole has spent SO FAR in each of the following areas:

Your percentages should add up to 100%.

	Percentage of team's time:
Scoping the team's task	________%
Education/training to develop team's knowledge/skills	________%
Analyzing and collecting data on the target system	________%
Redesigning or planning changes to the target system	________%
Implementing the team's design or plan for change	________%
Evaluating/assessing the implemented design or changes	________%
Other (please specify:________________________________)	________%

SECTION IV Please circle the appropriate letter to indicate how much you agree with the following statements about the team name's process and interactions with other groups and individuals.

The following terms are used in several of the questions in this section and are defined below:

SPONSOR(S) - The individual or group that chartered (initiated) the team name and/or to whom the team is accountable for its progress and results.

CUSTOMER(S) - The people who work in the target system that are directly impacted by your team's redesign/changes; they are the "end-users" of your team's work.

KEY STAKEHOLDERS- Anyone OTHER THAN customers or sponsors who is directly impacted in any way by the team's redesign/changes.

Please use the following scale:
A **STRONGLY AGREE**
A Agree
a slightly agree
d slightly disagree
D Disagree
D **STRONGLY DISAGREE**

20.	My team uses clearly defined formal roles within the team.	**A**	A	a	d	D	**D**
21.	We are effective at building ***customer*** commitment to what we are doing.	**A**	A	a	d	D	**D**
22.	We are effective at building ***key stakeholder*** commitment to what we are doing.	**A**	A	a	d	D	**D**
23.	We are effective at building ***sponsor*** commitment to what we are doing.	**A**	A	a	d	D	**D**
24.	Formal team roles help us clarify responsibilities within the team.	**A**	A	a	d	D	**D**
25.	We follow well-defined and systematic decision-making processes.	**A**	A	a	d	D	**D**
26.	We coordinate with sponsors to get the information we need.	**A**	A	a	d	D	**D**
27.	Everyone on the team participates in decision processes.	**A**	A	a	d	D	**D**
28.	We are not clear about where the team is headed next in our overall process for change/redesign.	**A**	A	a	d	D	**D**
29.	We communicate regularly to keep ***sponsors*** informed of our plans and progress.	**A**	A	a	d	D	**D**
30.	We communicate regularly to keep ***customers*** informed of our plans and progress.	**A**	A	a	d	D	**D**
31.	We communicate regularly to keep ***key stakeholders*** informed of our plans and progress.	**A**	A	a	d	D	**D**
32.	We use relevant data to support decisions.	**A**	A	a	d	D	**D**
33.	We know what our sponsors expect our team to accomplish.	**A**	A	a	d	D	**D**
34.	We consider the impact of what we're doing on other parts of the organization **outside** the target system.	**A**	A	a	d	D	**D**
35.	We implement decisions in a timely manner.	**A**	A	a	d	D	**D**

A	**STRONGLY AGREE**
A	Agree
a	slightly agree
d	slightly disagree
D	Disagree
D	**STRONGLY DISAGREE**

36.	The team is effective at getting customer input.	**A**	A	a	d	D	**D**
37.	We have enough guidance from sponsors on the scope of our effort.	**A**	A	a	d	D	**D**
38.	We are not clear on what decisions we can make.	**A**	A	a	d	D	**D**
39.	The process we use to redesign/change the <u>target system</u> has well-defined steps planned in advance.	**A**	A	a	d	D	**D**
40.	We get what we need from leadership of <u>organization</u>.	**A**	A	a	d	D	**D**
41.	Team members perform informal team roles as needed (e.g., information seeker, information giver, elaborator).	**A**	A	a	d	D	**D**
42.	We share lessons learned with other teams at <u>organization</u> that are like ours.	**A**	A	a	d	D	**D**
43.	The formal roles we use help to distribute workload within the team.	**A**	A	a	d	D	**D**
44.	We coordinate with other improvement teams that may be impacted by our work.	**A**	A	a	d	D	**D**
45.	We are able to clearly identify the decisions that need our attention.	**A**	A	a	d	D	**D**
46.	We have tools and techniques to support our team's redesign/change process.	**A**	A	a	d	D	**D**
47.	We anticipate issues and concerns from key stakeholders.	**A**	A	a	d	D	**D**
48.	We are well-informed about other improvement teams that might impact what we're doing.	**A**	A	a	d	D	**D**

SECTION V Please indicate **how much you agree** with each statement in this section about whether your team considers how what you're doing impacts various subsystems or subcomponents within the target system. Definitions for each subsystem (in bold) are shown immediately below each statement. **PLEASE READ THESE DEFINITIONS BEFORE YOU ANSWER EACH QUESTION.**

Please use the following scale:
A **STRONGLY AGREE**
A Agree
a slightly agree
d slightly disagree
D Disagree
D **STRONGLY DISAGREE**

49. We consider how what we're doing impacts the **TECHNOLOGY** of the target system. .... **A** A a d D **D**

Technology - The equipment, materials, work methods, and physical environment (arrangement of physical equipment and facilities) that people working in the target system use to deliver products/services to customers.

50. We consider how what we're doing impacts **DECISION-MAKING** in the target system. .... **A** A a d D **D**

Decision-making System - The decision rules and decision processes in the target system, including how decisions are made and who makes what types of decisions.

51. We consider how what we're doing impacts **INFORMATION-SHARING AND COMMUNICATION** in the target system. .... **A** A a d D **D**

Information and Communication Systems - The information provided to people working in the target system **AND** the mechanisms used to convey this information.

52. We consider how what we're doing impacts **EDUCATION AND TRAINING** in the target system. .... **A** A a d D **D**

Education and Training System - The planning and coordination of education/training provided to increase the skill and knowledge base of people working in the target system.

53. We consider how what we're doing impacts **PERFORMANCE MEASUREMENT AND APPRAISAL** in the target system. .... **A** A a d D **D**

Performance Measurement and Appraisal System - How the performance of people, groups, and the entire target system is measured and evaluated.

A	**STRONGLY AGREE**
A	Agree
a	slightly agree
d	slightly disagree
D	Disagree
D	**STRONGLY DISAGREE**

54. We consider how what we're doing impacts **REWARDS AND RECOGNITION** in the target system. .... **A** A a d D **D**

Reward and Recognition System - How people working in the target system are rewarded, including financial and non-financial, formal and informal, individual and group rewards.

55. We consider how what we're doing impacts the **ORGANIZATIONAL STRUCTURE** of the target system .... **A** A a d D **D**

Organizational Structure - The formal organizational structure, including how people working in the target system are grouped into teams and departments, hierarchical relationships, and span of control; and the parallel structure created to support improvement efforts, including process improvement teams, committees, and task forces.

56. We consider how what we're doing impacts **STRATEGY AND PLANNING** in the target system. .... **A** A a d D **D**

Strategy and Planning - The different kinds of plans for the target system and how they are developed, such as business plans, marketing plans, and improvement plans, which include mission and vision, long-term and short-term goals, and objectives for the target system.

SECTION VI Please answer the following regarding your team's effectiveness. Compared to what you think is possible, or 100%, how effective is the team in each of the following areas? (Fill in the percentage, for example, 80% = eighty percent of what you think is possible.)

57. Quality of team decisions and solutions ________%
58. Quality of team deliverables (plans, reports, etc.) ________%
59. Timeliness of team deliverables, e.g., meeting deadlines ________%
60. Managing costs, e.g., staying within budget ________%
61. Utilization of key skills of team members ________%
62. Customer and stakeholder satisfaction -internal or external ________%
63. Improving business results in the target system ________%
64. Overall performance of the team ________%

65. Who is the sponsor that chartered (initiated) your team?
This "sponsor" may be an individual (director, vice-president, manager, etc.) ***OR*** *a group (e.g., leadership team, management team). If an individual, please give their name and job title; if a group, please give the group/team name.*

66. What deliverables or products do sponsor(s) expect your team to produce?
Examples might be: a design/plan to improve the target system, an implementation plan, a skills matrix for people working in the target system, and/or progress updates to the sponsor.

67. What, if any, expectations do sponsor(s) have for your team to improve business results in the target system?
Examples might be: improve quality by 30%, reduce cycle time, improve customer satisfaction, and so on.

68. What results has your team achieved so far?

69. What are the biggest things **CONTRIBUTING** to the team's effectiveness?

70. What are the biggest **OBSTACLES** to the team's effectiveness?

71. Is there anything else you would like to share regarding your team's task, process, activities, results?

SECTION VII Lastly, please answer the following questions about the survey itself.

72. How long did it take you to complete **THIS** survey? ____________minutes

73. How difficult were the two surveys to complete? (Circle the number of your answer.)

	NOT AT ALL DIFFICULT	SOMEWHAT DIFFICULT	MODERATELY DIFFICULT	VERY DIFFICULT
Campbell-Hallam TDS	1	2	3	4
Design and Leadership Team Survey	1	2	3	4

THANK YOU for your time! If you would like to see the results of this research, please contact Eileen Van Aken, Performance Center, 1900 Kraft Dr. Suite 200, Blacksburg, VA 24060; 540-231-2723.

Thank You Letter Sent to Team Members at National Grocers and Virginia Tech

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Department of Industrial and Systems Engineering
College of Engineering
302 Whittemore Hall, Blacksburg, VA
(703) 231-6656 FAX (703) 231-3322

To:	Members of the team name
From:	Eileen Van Aken
Date:	Date
Subject:	Surveys for the team name

Thank you very much for taking the time to complete the two surveys about the team name. The information you shared is an important part of learning about what makes teams like yours successful. I'll send contact person the feedback and summary information from the surveys as soon as I have it.

If you want to tell me anything else about the survey process or content of the surveys, you can contact me by phone, fax, e-mail, or regular mail. I'd be very interested in any feedback on, for example, how hard it was to make the time to do it, did the question items seem like valuable information to capture about the team, was the wording clear and understandable, etc.

If you don't have specific feedback or the time to share it, there's no need to respond.

Thank you for allowing me the opportunity to learn about your team, and for contributing your time to this effort.

By the way -- the winner of the Virginia Tech T-shirt was team member name. Congratulations!

Phone:	540-231-2723
Fax:	540-231-3538
E-mail:	evanaken@perform.vt.edu
Mail:	Eileen Van Aken, The Performance Center, 1900 Kraft Dr. Suite 200, Blacksburg, VA 24060

Interview Guide for Team Members at National Grocers and Virginia Tech

Team Name:
Team Member:
Date:
Start Time:
End Time:

(47 questions)

Introductory Comments
Thank you for making the time to talk with me.
I'd like to ask you some questions about the team name to supplement the information you shared in the written survey. Just as with the survey, your responses are confidential and will only be used for research purposes. No one else at organization will know what you specifically have said about the team. If you have any questions or if there is anything you'd like to add after we talk, you can give me a call.
Some of these questions may sound kind of formal - it's only because I need to be careful to ask the questions in the same way to everyone on different teams that I talk with.
As you respond to questions, I'll be typing your answers in to a computer.

I. Background on the Team
First, I'd like to start out with some background information about the team.

1. When was the team initially formed?

2. Were you a member when the team initially started up? If so, could you describe how and why the team was formed? (prompts: who decided a team was needed, who was on the team, when it would meet, why the team was needed, etc.)

3. Does the team have a charter? If so, how was it developed?

4. What is the team's essential purpose or mission?

5. Are there any *specific* goals or objectives the team has to support that mission?

6. Who are the team's customers and stakeholders? (redundant with survey)

7. Meeting schedule:
   a. How often does the team currently meet?
   b. Has that meeting schedule changed since you've been a member? If so, how and why?

8. Over the time you've been a member, has there been any change in team membership? If so, why were changes made?

9. My understanding is that the team consists of (list team member names).
   a. How many different functional areas or units within target system do team members represent?
   b. How many different organizational levels within target system do team members represent?

10. Is everyone on the team physically located in the same general work area or building? If not, how many different locations are team members spread across? (list each team member and have interviewee specify location).

11. Did the team as a whole go through any education or training to prepare people for the team?
(13 questions)

II. Current Team Activities and Functioning

Next, I'd like to ask you about some of the team's current activities and functioning.

1. Is there a usual agenda-building and meeting process the team uses? if so, could you describe it?

2. What are some topics of discussion from recent team meetings?

3. How would you describe the usual atmosphere of team meetings in terms of trust, communication, and participation?

4. Does the team have an overall process or method its using to improve the <u>target system</u>? If so, could you describe it at a big-picture level?

5. I'd like to get your viewpoint about the amount of decision-making influence and control the team has over certain decisions affecting the team. I'll give you a list of decisions, and for each one please tell me how you would classify this decision for the team: **(decision-making domain)**

The choices are:

NO influence: the team has no input or influence over this decision - someone else outside the team makes the decision

SOME influence: the team can provide input to the decision-maker, outside the team.

A LOT of influence: the team can make a recommended decision but must get outside approval.

COMPLETE influence: the team has the freedom to make this decision with no outside approval.

How much decision-making influence does the team have on _: (please answer NO, SOME, A LOT or COMPLETE)

a defining the overall mission or purpose of the team
b setting goals and objectives for the team
c choosing the overall process or method for changing/redesigning the <u>target system</u>
d deciding how much working time team members can spend on team activities
e choosing the specific problems, issues, and improvements the team focuses on
f setting deadlines or time frame for achieving the team's goals/objectives
g changing the membership of the team (adding or removing team members if necessary)
h acquiring education and training resources for team members if necessary
i deciding when and how often the team will meet
j deciding how to run meetings
k deciding which formal roles to use within the team
l deciding how work to be done outside of meetings is divided up among team members
m implementing the team's decisions and improvements in the <u>target system</u>
n deciding how and when the team will be evaluated
o providing rewards and recognition to members for their work on the team

6. I'd like to ask you about critical incidents that have occurred over the time you've been a member of the team. A critical incident may be a key event, decision, activity, or milestone that has had a significant impact on the team's development, whether that impact is positive or negative. What

critical incidents have you observed or experienced as a member of the team? How did they impact the team?

(20 questions)

III. Interaction Outside the Team

Next, I'd like to find out about your team's interaction with people outside the team. In this set of questions, I'll use the term "stakeholders" to refer to anyone who has a stake in the team's activities and results, including sponsors, customers, or any others.

1. How does the team communicate with stakeholders to keep them informed? How often?

2. For the next three questions, I'd like you to answer on a scale of 1-10, with 10 being very **effective** and 1 being very **ineffective**:
   a. how effective would you say the team is in getting the input and guidance it needs from stakeholders, particularly sponsors? Could you elaborate on why you give the team a __?
   b. how effective would you say the team is in keeping stakeholders informed about the team's plans and progress? Could you elaborate on why you give the team a ______?
   c. how effective is the team in building commitment and buy-in for its plans and decisions from stakeholders? Could you elaborate on why you give the team a __?

(4 questions)

IV. Assessment of the Team

Lastly, I'd like to get your opinion on the team's effectiveness.

1. What objective measures of effectiveness do you think should or could be used to assess whether the team is successful or not?

2. Out of all the goals or objectives the team has ever set for itself, what percentage of its them would you say the team has successfully accomplished so far?

3. In what ways could the team improve? (prompts: in what areas, what are the biggest obstacles, etc.)

4. Right mix of people:
   a. Do you think the team has the right mix of people with the necessary skills?
   b. Do you think the team has the right mix of people with the necessary viewpoints or perspectives from the target system represented?
   c. Do you think your team has the right mix of people with the necessary influence?

5. Based on your experience so far, do you think the team is a success? Why or why not?

6. Do you enjoy being a part of this team? Why or why not?

7. Think back over your experiences with this team. If you were advising a new team like yours just being formed, what are the key lessons learned that you take away from your experience that you would pass on as advice to a new team?

8. Is there anything else you think I should know about the team that I haven't asked in order to get a complete picture?

(10 questions)

Thank you for your time.

Interview Guide for Strategy Designer at Eastman Chemical Company

Introductory Comments
Thank you for making the time to meet with me.

The questions I'd like to ask you today are based on your experiences with teams supporting work redesign. Your responses to questions in this interview are confidential and will only be used for research purposes. If you have any questions after this interview or if there is anything you would like to add, you can contact me by phone or by e-mail (give business card).

I would like to tape record our conversation so that I don't miss anything you say. Do you have any objections?

As part of the research protocol for Virginia Tech, I need to ask you to read this Informed Consent Form and sign it if you decide to participate in this research.

History and Background of Work Redesign Teams:
1. As a generic label for the types of teams (design teams, renewal teams, work system effectiveness teams), I have been using "work redesign teams" - so when I use that, I'm including all types. Is that all right with you?

2. Could you describe the evolution of Eastman's approach to using teams to support work redesign?

More specific questions to cover as part of the above question:
- Who or what group has ownership for the strategy and process of using work redesign teams? For example, who has ownership for changing the approach or strategy if necessary?
- Verify that Eastman has used three different types of teams: design teams, renewal teams, work system effectiveness teams.
- When was the first design team created? In what department?
- What kind of results did the team achieve?
- When and how did the idea for renewal teams result?
- What led to the idea of using work system effectiveness teams? Was there a specific event or incident that led to that decision? Do they replace the need for renewal teams?
- Could you describe the characteristics of each type of team Eastman has used to support work redesign:
  - design team?
  - renewal team?
  - work system effectiveness team?
- Could you describe how the design and management requirements differ for each type of team?

Installing Teams
3. Would you describe the process of starting up a work redesign team? (who charters, what information is given to the team, etc.)

4. What are the most important factors to pay attention to, or manage, when setting up a team and getting a team started?

5. What principles or criteria are used when selecting people to be on work redesign teams?

Key Learnings Over Time

6. Think back over the years Eastman has utilized teams to support work redesign. What have been critical incidents - events, key decisions, etc. - that have had a major influence on Eastman's strategy using work redesign teams?

7. Think back over the years Eastman has used teams to support work redesign. What are the key learnings you take away from how and where teams have been utilized?

8. If you could keep the key learnings you have right now, but could start all over again with work redesign teams, what would you do differently?

9. How have learnings from key individuals involved with work redesign teams (consultants, team leaders, etc.) been transferred and disseminated within the company and others involved with teams? Probe for above question:
   - Have there been any sort of internal workshops or meetings to discuss learnings and overall strategy?
   - What other mechanisms are used to transfer learnings?

10. How are the design and management requirements for work redesign teams different from other improvement-focused teams (for example, PECI teams, other task forces)?

Measuring Team Effectiveness

11. How do you define team effectiveness? How do you define whether a team was successful?

12. What measures are used to assess whether a team was effective? Output measures? Outcome measures?

Factors Leading to Effectiveness:

13. Think about the teams you have knowledge of that were the most effective in accomplishing their task: based on your experience with those teams, what factors contributed the most to their effectiveness?

14. Think about instances where a team was ineffective or struggling. Based on your experience, what factors prevented the team from being effective?

(Hand interviewee list of Factors That May Influence Team Effectiveness) and ask:

15. Please review this list. Based on your experience with teams, what factors, if any, are missing from this list that may have a significant influence on a team's effectiveness?

Interview Guide for Team Leaders and Consultants at Eastman Chemical Company

Introductory Comments
Thank you for making the time to meet with me. The reason you were contacted to participate in this research is because of your experiences with design teams and/or renewal teams, and I'd like to ask you questions about those experiences. My research focus is on what leads to an effective team for teams supporting work redesign and large-scale change efforts.

Your responses to questions in this interview are confidential and will only be used for research purposes. If you have any questions after this interview or if there is anything you would like to add, you can contact me by phone or by e-mail (give business card).

I would like to tape record our conversation so that I don't miss anything you say. Do you have any objections?

As part of the research protocol for Virginia Tech, I need to ask you to read this Informed Consent Form and sign it if you decide to participate in this research.

Participant's Role with Teams
1. As a generic label for the different types of teams used (design teams, renewal teams, work system effectiveness teams), I have been using "work redesign teams" - so when I use that, I'm including all types. Is that all right with you?

2. Could you describe your role in the formal organizational hierarchy? (department or functional area)?

3. Could you describe the teams you have been involved with? For each team:
   - team name and type
   - work system the team focused on
   - length of existence
   - products or outputs the team created
   - outcomes in the target system the team created

4. What does the role of consultant/team leader involve?

Installing Teams
5. Would you describe in general the process of how teams are set up? (who charters, what information is given to the team, etc.)

6. What are the most important factors to pay attention to, or manage, when setting up a team and getting a team started?

7. What principles or criteria are used when selecting people to be on work redesign teams?

Key Learnings Over Time
8. Think back over the time you have been involved with work redesign teams at Eastman. What have been critical incidents - events, key decisions, etc. - that have had a major influence on Eastman's strategy using work redesign teams?

9. Think back over the years Eastman has used teams to support work redesign. What are the key learnings you take away from how and where teams have been utilized?

10. If you could keep the key learnings you have right now, but could start all over again with work redesign teams, what would you do differently?

11. How have learnings that people like you have gained through your experience with teams been transferred and disseminated within the company?

Probe for above question:

- Have there been any sort of internal workshops or meetings to discuss learnings and overall strategy?
- What other mechanisms are used to transfer learnings?

12. As team leader/consultant, what were the skills or behaviors that were the most critical in helping the team to be effective?

13. Could you give a specific example of how a team you were involved with was ineffective, and what did you do about it?

14. How are the design and management requirements for work redesign teams different from other improvement-focused teams (for example, PECI teams, other task forces)?

Measuring Team Effectiveness

15. How do you define team effectiveness? How do you define whether a team was successful?

16. What measures are used to assess whether a team was effective? Output measures? Outcome measures?

Factors Leading to Effectiveness:

17. Think about the teams you have been involved with that were effective in accomplishing their task and goals: based on your experience with those teams, what factors contributed the most to their effectiveness?

18. Think about instances where a team was ineffective or struggled. Based on your experience, what factors prevented the team from being effective?

(Hand interviewee list of Factors That May Influence Team Effectiveness, below) and ask:

19. Please review this list, if you would. Based on your experience with teams, what factors, if any, are missing from this list that may have a significant influence on a team's effectiveness?

Factors That May Influence Team Effectiveness

Composition of Team
- diversity of team with respect to demographics (age, gender, race, organization tenure)
- skills the team collectively has
- diversity of team with respect to functional areas and organizational levels of work system
- turnover of team members

Team Task
- systemic nature of redesign process - to what extent are all key components of the work system considered (pay, information, decision-making, education and training, etc.)
- comprehensiveness of redesign process - to what extent does team devote time to: learning, planning or designing, implementing, assessing/monitoring changes.

Team Structure
- size
- clear and well-defined charter - mission, products, goals/outcomes
- frequency of team meetings
- team members co-located - team members are in the same geographic location or facility
- clearly defined team roles

Resources
- percent of time team members devote to team
- educational activities for team learning
- team has access to necessary information
- leadership within the team

Organization Context
- feedback on team performance
- rewards for team efforts
- support from organization

Internal Team Processes
- members are committed to the team
- inter-organizational communication
  - the team effectively coordinates with other individuals and groups to **obtain necessary information, input, approval, and commitment** from key stakeholders
  - the team effectively **shares** information on plans, decisions, and activities with key stakeholders
- problem-solving effectiveness of the team
- the team's ability to communicate internally - quality, frequency, and mechanisms used

Focus Group Guide

Group: Team leaders and internal team consultants
Moderator: Eileen Van Aken
Recorder: Stephen Van Aken
Date: 3/16/95
No. of participants: 9

Moderator Script for Introductory Comments

Brief Introduction

"I'd like to thank you for taking the time to come to this focus group session today.

"My name is Eileen Van Aken, I'm a Ph.D. student in ISE at Virginia Tech. Research sponsor had initially contacted each of you about being interviewed by me. Because so many people responded that they were willing to be interviewed, I thought it would be valuable to gather a group, in addition to some one-on-one interviews, to have a dialogue about what leads to team effectiveness for work redesign teams.

"This is Steve Van Aken, who will record notes. He is also a Ph.D. student in ISE and his research area is team effectiveness.

Purpose of Meeting:

"The **purpose** of this group session is so that I can **capture some of your experiences and learnings about work redesign teams.** When I use the term "work redesign teams" I am including the different types of teams used at Eastman to support work system redesign: design teams, renewal teams, transition teams, and work system effectiveness teams (also called business effectiveness teams).

"I am interested in your perspective on what factors lead to effective and successful teams, and in your perspective on the overall work redesign process and strategy used at Eastman.

How Information Will be Used:

"I will use the information you share today in addition to information from individual interviews with team leaders and consultants to summarize overall findings about work redesign efforts at Eastman. What you say today is confidential - none of the responses from this focus group will be attributed back to individuals by name.

How Long Will the Session Last?

"I expect the session to last no longer than 1:30, and I believe that all or most of you said you could stay until then. If anyone needs to leave earlier, that's fine.

Ground Rules and Moderator's Role

"Let me briefly share some ground rules I'd like to have us use:

- It's okay for us to get "off-track - I'll be raising questions I'd like to have the group explore. At any point, **we can go back to an earlier question**. And, **you can bring up your own issue to discuss**, even if it seems unrelated to what we've already talked about. It's okay if we get off on other topics, but if we seem to get off track too far or for too long, I'll bring us back to our topic.
- Be open and honest - Nothing you say will be attributed back to you; I would like everyone to feel comfortable sharing both positive and negative comments.
- Dialogue - I would like to create a **dialogue** where you all **talk with each other about the issues, rather than talking to me as the moderator**. Also, I encourage you to share your point of view, even if it differs from what someone else has said.
- Lastly, it's helpful if only **one person talks at a time** so that we can capture what you say).

"Does anyone have any objections at all to us audio taping this session?

"As part of the research protocol for Virginia Tech, I need to ask you to read this Informed Consent Form. After reading it, please sign at the bottom to indicate your agreement to participate in the research. The paragraph about survey questionnaires does not relate to you - only the information about interviews does. The second page is for you to keep in case you have questions or concerns about the research, so please tear that off.

Opening Question

1. For my benefit and for anyone who doesn't know everyone here, please take less than a minute, and tell us your name, what teams you have worked with, and what your role has been with work redesign teams (team member, team leader, consultant, etc.).

Introductory and Transition Questions

2. Based on your experience, how successful has the overall strategy for work system redesign been in achieving improvements in business results?

3. Based on your experience with teams, what are the most significant reasons that a good design might not lead to improvements in business results?
   If brought up, then integrate: If not, ask as a separate question
   a. What is the typical "lag or delay time" between a team completing a design or plan, and actual improvements appearing in business results?

Key Questions

4. Think back on the teams that were the most effective in accomplishing their task: based on your experience with those teams, what factors contributed the most to their success? *(probe for examples - could you give an example of that? could you elaborate on that?)*

5. Think back on the teams that were less successful or really struggled: based on your experience, what factors held the team back? *(probe for examples - could you give an example of that? could you elaborate on that?)*

6. How should a work redesign team be measured or assessed to determine whether the team was successful in accomplishing its task?

7. Considering all the teams you've worked with, think back on the overall process used to design these teams, start-up the teams, and manage teams.
   a. What about that process has worked well?
   b. What hasn't worked?
   c. What changes would you make today in this overall process to make work redesign teams even more successful?

8. To what extent do you think key learnings from work redesign teams in manufacturing applicable to other types of teams in the company that are doing design-related work? (for example, BPR teams, restructuring)

9. When you look ahead the next 3-7 years, what changes do you see in the process or *strategy for work redesign and using teams to support work redesign?*
   Probes:
   a. What do you think the role of work redesign within the company will be, in manufacturing and in non-manufacturing?
   b. How will teams support that work redesign function, if at all?

c. If there is a role for work redesign teams in the future, do you think they will look or function much differently than today?

Ending Questions

10. Assume that today's session is an attempt to document all the key learnings that you've accumulated about work redesign teams **and** about the overall process that's been used to implement work system redesign. Is there anything else you would like to share or anything that I've missed in order for our recorder's notes to reflect your key learnings and all the key issues?

Wrap-Up

- Thank you very much for your time. If there is anything that occurs to you after today that you think I need to know, or that you forgot to say, please e-mail me or call me. (hand out business cards).

Additional Questions if Time Permits:

11. Are the issues or problems that earlier work redesign teams struggled with the same as for more recent teams? What are the differences?

12. How are key learnings from manufacturing work system redesign being transferred within the company?

Thank You Letter to Eastman Participants

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

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(703) 231-6656 FAX (703) 231-3322

To: Interviewees for Eileen Van Aken's Research
From: Eileen Van Aken
Date: 3/22/95

I would like to thank each of you for participating in the recent interviews to capture learnings about what leads to effective work redesign teams. The information you shared was an important contribution to this research, which I believe will benefit any organization utilizing design teams to support large-scale change efforts.

If you think of anything else you'd like to share about what contributes to a team's success or what holds a team back from being successful, would you please call or e-mail me (if you have access to internet)? Or, if you know anyone else who has been involved with work redesign teams and has learnings to share, please encourage them to contact me. My phone and e-mail address are:

Phone: 540-231-2723
E-mail: evanaken@perform.vt.edu

Once again, thank you.

Appendix C Pilot Study Results

The two teams who participated in the pilot study were the Research and Development Team at the Center for Organizational Performance Improvement at Virginia Tech, and the On-Campus Interviewing Team in Career Services at Virginia Tech.

For both of these teams, the surveys were administered in a group setting, and the researcher read the survey instructions. The survey was revised after each administration, as summarized in Tables C.1 and C.2. In addition to pilot testing the survey instruments with two teams, the researcher obtained feedback from several committee members and an expert practitioner (who was a member of the first pilot team and had extensive industrial experience with design teams), who suggested changes. The majority of the changes made after the two pilot teams completed the survey were formatting changes and re-wording items to improve the overall readability and "user-friendliness" of the survey.

The internal consistency of each scale using Cronbach's alpha (Cronbach & Meehl, 1955) after each pilot administration and for the overall research sample is shown in Table C.3. Some of the scales from the Design and Leadership Team Survey (the survey developed for this research) were revised to improve the scale after pilot tests. The Campbell-Hallam Team Development Survey (TDS) could not be revised due to copyright.

The reliability for most of the scales based on the total research sample was above 0.70, the generally-accepted criteria for alpha (Nunnally, 1978). However, as applied in Tamimi, Gershon, and Currall (1995), Nunnally suggests allowing a lower threshold for exploratory work developing new scales, for example, 0.60 or even 0.50. The scales having alpha values lower than 0.70 are defined design process (alpha=0.63, a new scale developed in the Design and Leadership Team Survey), time (alpha=0.67), information (alpha=0.64), feedback (alpha=0.42), and rewards (alpha=0.49). All of these except the first one are scales from the TDS. Three of these scales have alpha values above 0.60, but the alpha value for the feedback and rewards scales is unacceptably low. Factor analysis was used to investigate how survey items in these lower-reliability scales (and other scales as well) clustered together (perhaps in different ways than suggested by the TDS authors) before deciding to exclude them from further analysis or before deciding to use a single survey item from a scale in data analysis. Results from factor analysis were described in Chapter 3.

Table C.1. Revisions Made After First Pilot Team.

Revisions After First Pilot Team	Justification
Further operationalized construct of "inter-organizational communication" into five scales: sponsor management, customer management, stakeholder management, improvement team coordination, and inter-organizational impact	Based on further reflection and on expert practitioner input from one of the pilot team members.
Team roles scale: deleted two items and reworded two items	Based on content feedback from team members, determined that questions were not getting the information desired; changed the scale (even though reliability was fair) by deleting two items, and rewording two items.
Decision Processes scale: deleted one item	To improve reliability based on reliability analysis.
Changed how "comprehensive design process" was operationalized from a perceptual scale to objective data on time spent in each stage of the change/redesign process.	Feedback that the scale as written was confusing.
Simplified the questions relating to education, training, and development activities.	Content feedback from pilot team suggested that questions were confusing, difficult to answer.
Added several skills to the skills checklist which is used in two questions.	Suggestions from pilot team.
Changed wording on the stem for questions part of the "systemic perspective" scale to clarify.	Content feedback from pilot team; it was not very clear what these questions were asking.
Deleted several questions that were not part of the central focus of this research.	To reduce the time to complete the survey
Deleted several questions that could easily be obtained through interviews with team members, such as how often the team meets and team size.	To reduce the time to complete the survey.
Added open-ended question "What results has your team accomplished so far?"	Suggested by pilot team.
Substituted the actual team name and name of the target system throughout the survey.	To improve the readability of the survey.
Made many formatting changes.	To improve the readability of the survey.

Table C.2. Revisions Made After Second Pilot Team.

Revisions after Second Pilot Team	Justification
Changed questions on measuring content of ETD activities of the team. For each ETD content area, ask whether ETD was received in last 12 months, and if so, was it because person is on this team?	To improve readability and clarity of questions.
Changed response categories on knowledge/skill areas that each team member brings to the team; from yes/no to a six-point scale assessing level of knowledge/skill in each area.	To improve the precision of the scale.
Added one more skill area to the checklist of skills.	Suggested by pilot team member.
Added question on the ability of team members to communicate through electronic mail.	Suggested by dissertation committee member.
Improved questions on which team roles are used and whether roles are permanent or rotated.	To improve readability of questions.
Added scale "defined design process."	Based on practitioner input.
Revised wording of several questions.	Suggested by pilot team, these items were not as clear.
Changed unit of time on amount of training received from hours to days.	Suggested by dissertation committee member, to make question easier to answer.
Made additional formatting changes and spaced questions out more.	To improve readability of survey.

Table C.3. Scale Reliabilities Before and After Pilot Study.

Scale	Reported Reliabilities from Hallam & Campbell (1994)[1]	Scale and Reliability from Pilot Team 1[2]	Scale and Reliability from Both Pilot Teams[3]	Scale and Reliability from Research Sample
Team Skills	IC .71 TR .88	.70/.74 (10) k=5[4]	.61/.67 (16) k=5	.77/.78 (127) k=5
Individual Goals	IC .61 TR .81	.42/.38 (10) k=3	.47/.47 (16) k=3	.72/.74 (129) k=3
Defined Design Process	n/a	was added after first pilot team	-2.9/-1.83 (6)[5] k=3	.63/.63 (126)
Systemic Perspective	n/a	.90/.90 (10) k=8	.91/.91 (16) k=8	.87/.88 (129) k=8
Comprehensive Change Process	n/a	.42 (10) k=5 measurement was changed after pilot 1	n/a	n/a
Mission Clarity*	IC .81 TR .80	.64/.65 (10) k=3	.77/.80 (16) k=3	.79/.79 (129) k=3
Team Commitment*	IC .66 TR .78	.53/.54 (10) k=4	.66/.69 (16) k=4	.80/.81 (129) k=4
Team Unity*	IC .77 TR .86	-.30/-.33 (10) k=5	.34/.32 (16) k=5	.82/.82 (129) k=5
Team Self-Assessment	IC .69 TR .72	.28/.32 (10) k=4	.41/.43 (16) k=4	.72/.72 (129) k=4
Team Decision Processes*	n/a	.82/.78 (10) k=6	.84/.81 (16) k=6	.83/.84 (124)
Team Roles*	n/a	.71 (10) k=6 completely changed scale after pilot 1	.05/.19 (6) k=4	.70/.68 (128) k=4

[1] The reported reliabilities for each scale (dimension) from the Campbell-Hallam Team Development Survey are the internal consistency (IC) using Cronbach's alpha and the test-retest reliability (TR). For scales developed in the Design and Leadership Team survey, this column is left blank.

[2] Numbers in parentheses represent the sample size used to calculate Cronbach's alpha. There were ten team members in the first pilot team, six in the second pilot team, and 130 in the research sample. Both alpha and standardized alpha values from SPSS are reported (e.g., .80/.85)

[3] If a scale was changed between the first and second pilot team, the reliability reported in this column only reflects responses from the second pilot team, not both teams combined. See Table I.1. for revisions made between administering surveys to pilot team 1 and 2.

[4] k refers to the number of items in the scale.

[5] After reviewing the data for this 3-item scale, it appears that the reliability is significantly influenced by one response (out of 6 people in the second pilot team) to one question item. The relatively small sample size of the pilot study also appears to significantly influence alpha values for other scales as well: team unity, rewards, organizational support, and stakeholder management.

Table C.3 (cont'd). Scale Reliabilities Before and After Pilot Study.

Scale	Reported Reliabilities from Hallam & Campbell (1994)[6]	Scale and Reliability from Pilot Team 1[7]	Scale and Reliability from Both Pilot Teams[8]	Scale and Reliability from Research Sample
Team Leadership	IC .85 TR .75	.71/.73 (10) k=6	.75/.76 (16) k=6	.86/.86 (126) k=6
Team Coordination*	IC .69 TR .80	.66/.65 (10) k=4	.60/.62 (16) k=4	.69/.70 (127) k=4
Time*	IC .68 TR .76	.78/.80 (10) k=4	.83/.84 (16) k=4	.67/.68 (127) k=4
Information*	IC .67 TR .75	.75/.75 (10) k=4	.66/.66 (16) k=4	.64/.64 (129) k=4
Feedback*	IC .68 TR .86	.35/.38(10) k=3	.63/.64 (15) k=3	.42/.42 (129) k=3
Rewards*	IC .69 TR .79	-.88/-1.09 (10) k=2	-.46/-.57 (16) k=2	.47/.49 (129) k=2
Organizational Support*	IC .62 TR .60	-.38/-.40 (10) k=2 added 1 item from DLTS	.59/.57 (6) k=3	.70/.71 (129) k=3
Sponsor Management*	n/a	n/a	.73/.63 (6) k=5	.86/.87 (128) k=5
Customer Management*	n/a	n/a	.64/.64 (6) k=3	.70/.71 (125) k=3
Stakeholder Management*	n/a	n/a	-.72/-.36 (6) k=3	.71/.71 (128) k=3
Improvement Team Coordination*	n/a	n/a	.00/.34 (6) k=3	.74/.74 (129) k=3
Team Performance-1	IC .85 TR .84	.74/.66 (10) k=5	.77/.72 (16) k=5	.92/.92 (127) k=5
Team Performance-2*	n/a	.96/.97 (10) k=8	.96/.97 (16) k=8	.93/.93 (110) k=8
Team Satisfaction	IC .85 TR .81	.81/.84 (10) k=3	.76/.77 (16) k=3	.88/.89 (128) k=3

*These scales were revised after factor analysis: either by combining multiple scales into one scale, or by re-clustering question items differently than clustered into scales here.

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[6] The reported reliabilities for each scale (dimension) from the Campbell-Hallam Team Development Survey are the internal consistency (IC) using Cronbach's alpha and the test-retest reliability (TR). For scales developed in the Design and Leadership Team survey, this column is left blank.

[7] Numbers in parentheses represent the sample size used to calculate Cronbach's alpha. There were ten team members in the first pilot team, six in the second pilot team, and 130 in the research sample. Both alpha and standardized alpha values from SPSS are reported (e.g., .80/.85)

[8] If a scale was changed between the first and second pilot team, the reliability reported in this column only reflects responses from the second pilot team, not both teams combined. See Table I.1. for revisions made between administering surveys to pilot team 1 and 2.

Appendix D Scale Reliability Analysis and Histograms

This Appendix provides supporting information about the reliability and distributions of the scales used in this research. While Chapter 3 contains information about construct measurement and the coefficient alphas for each scale, this Appendix contains the output from SPSS for reliability analysis as well as the histograms generated in SPSS for each scale. For each scale (consisting of more than one survey item), there are two histograms: the histogram based on all individual level data (n=130 individuals) and the histogram based on group means (n=15 teams). The second histogram is included because of the data analysis performed using group means.

In addition, following the scale information, histograms for the single-item variables are presented. Again, two histograms are included: one based on all n=130 individuals and one based on n=15 group means. For demographic variables, only the histogram based on group means are shown because the variable was operationalized either using the coefficient of variation or standard deviation of the variable within a team (e.g., age, education level, etc.). Therefore, only histograms for group-level data on these demographic variables are meaningful.

Team Skills (TMSKLS)

1.	CQ05	Tm Skills:	Our team members are skilled and competent.
2.	CQ39R	Tm Skills:	*This team suffers from a lack of training or experience.*
3.	CQ53	Tm Skills:	Team members strive to develop skills that can benefit the team.
4.	CQ56	Tm Skills:	There are team members who have the skill or knowledge to back me if up necessary.
5.	CQ64	Tm Skills:	Team members have been carefully selected to create the right mix of skills.

	Mean	Std Dev	Cases
1. CQ05	4.6614	1.0252	127.0
2. CQ39R	3.8110	1.4624	127.0
3. CQ53	4.1417	1.1528	127.0
4. CQ56	4.7402	.9695	127.0
5. CQ64	4.0630	1.4516	127.0

Correlation Matrix

	CQ05	CQ39R	CQ53	CQ56	CQ64
CQ05	1.0000				
CQ39R	.4757	1.0000			
CQ53	.4841	.4680	1.0000		
CQ56	.3579	.1834	.5445	1.0000	
CQ64	.5157	.3945	.4262	.2768	1.0000

N of Cases = 127.0

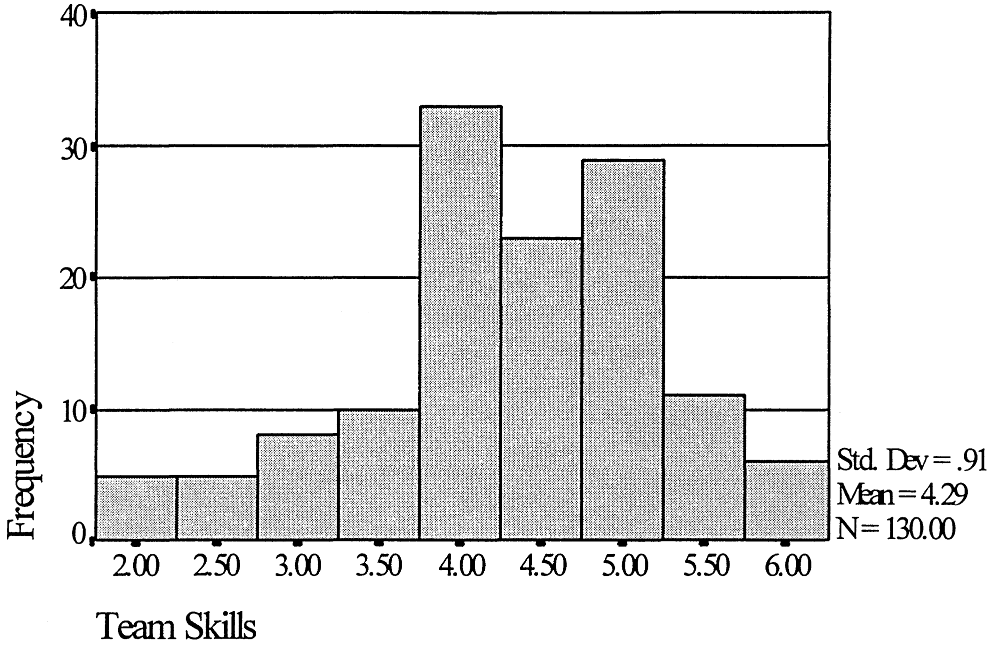
Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	21.4173	19.5784	4.4248	5

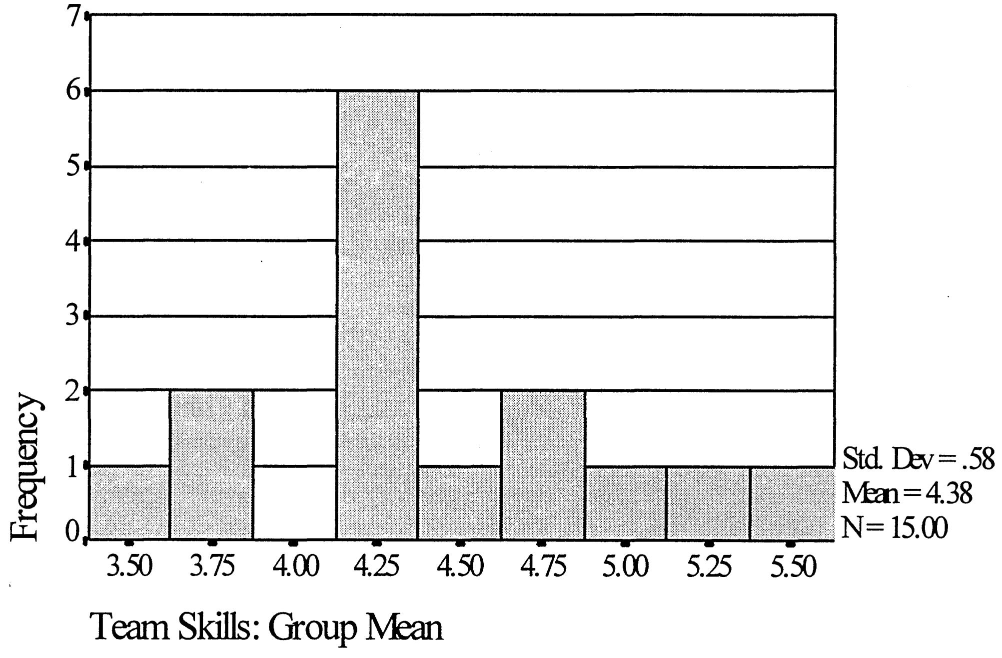
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.2835	3.8110	4.7402	.9291	1.2438	.1608

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ05	16.7559	13.7098	.6345	.4069	.6998
CQ39R	17.6063	12.2406	.5081	.3283	.7422
CQ53	17.2756	12.8838	.6484	.4745	.6879
CQ56	16.6772	15.4108	.4240	.3236	.7601
CQ64	17.3543	12.0560	.5372	.3200	.7296

Reliability Coefficients 5 items
Alpha = .7670 Standardized item alpha = .7784


40
30
20
10
0
Frequency
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Std. Dev = .91
Mean = 4.29
N = 130.00
Team Skills


7
6
5
4
3
2
1
0
Frequency
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
Std. Dev = .58
Mean = 4.38
N = 15.00
Team Skills: Group Mean

Individual Goals (INDGLS)

1. CQ08 Ind Goals: I have challenging goals for my performance on this team.
2. CQ15R Ind Goals: I often do not know what I am supposed to be doing on this team.
3. CQ24 Ind Goals: I know what I want to achieve on this team.

		Mean	Std Dev	Cases
1.	CQ08	4.8372	1.1096	129.0
2.	CQ15R	4.3798	1.3122	129.0
3.	CQ24	4.7984	1.0184	129.0

Correlation Matrix

	CQ08	CQ15R	CQ24
CQ08	1.0000		
CQ15R	.3701	1.0000	
CQ24	.5584	.5079	1.0000

N of Cases = 129.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	14.0155	7.6873	2.7726	3

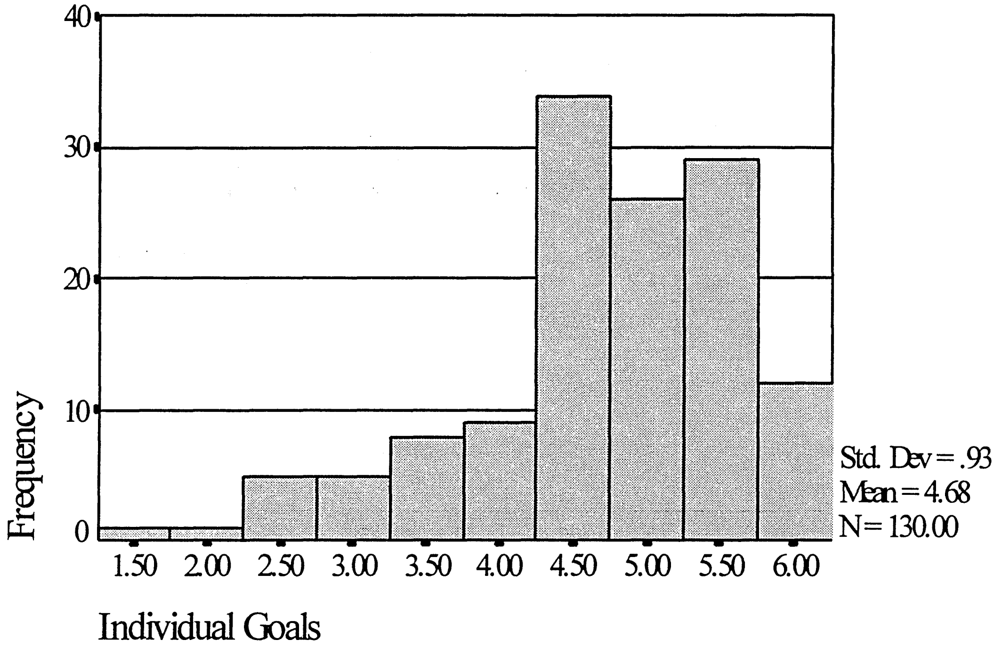
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.6718	4.3798	4.8372	.4574	1.1044	.0643

Item-total Statistics

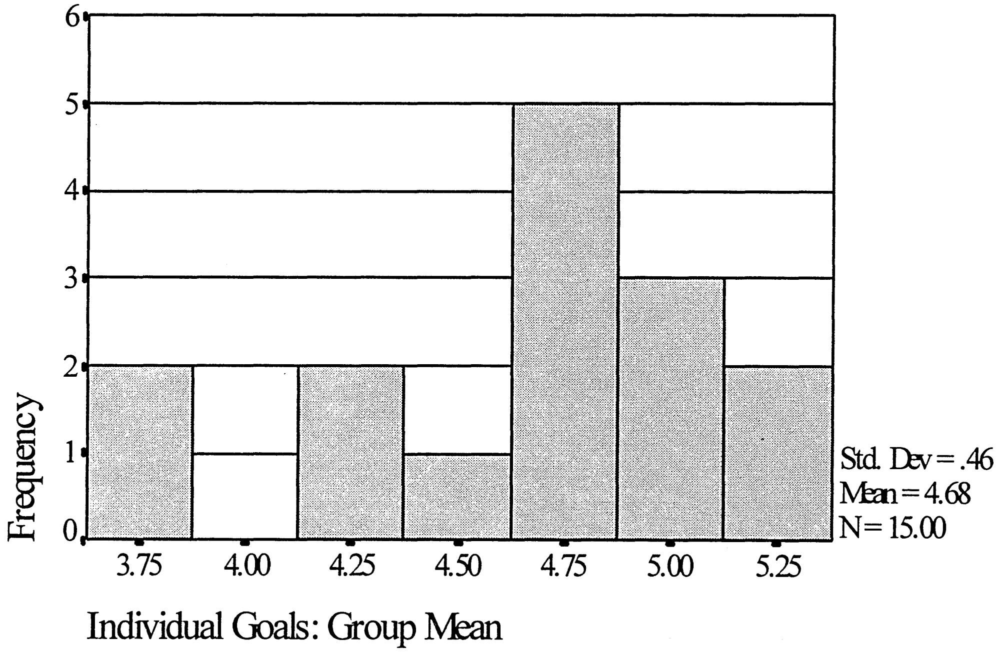
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ08	9.1783	4.1164	.5197	.3219	.6595
CQ15R	9.6357	3.5303	.4939	.2688	.7150
CQ24	9.2171	4.0306	.6406	.4169	.5348

Reliability Coefficients 3 items

Alpha = .7214 Standardized item alpha = .7338



40
30
20
10
0
Frequency
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Individual Goals
Std. Dev = .93
Mean = 4.68
N = 130.00



6
5
4
3
2
1
0
Frequency
3.75
4.00
4.25
4.50
4.75
5.00
5.25
Individual Goals: Group Mean
Std. Dev = .46
Mean = 4.68
N = 15.00

Systemic Perspective (SYSPERS)

1. DT49 SysPers: We consider how what we're doing impacts the **technology** of the target system.
2. DT50 SysPers: We consider how what we're doing impacts **decision making** in the target system
3. DT51 SysPers: We consider how what we're doing impacts **information sharing and communication** in the target system
4. DT52 SysPers: We consider how what we're doing impacts **education and training** in the target system
5. DT53 SysPers: We consider how what we're doing impacts **performance measurement and appraisal** in the target system
6. DT54 SysPers: We consider how what we're doing impacts **rewards and recognition** in the target system
7. DT55 SysPers: We consider how what we're doing impacts the **organizational structure** of the target system
8. DT56 SysPers: We consider how what we're doing impacts **strategy and planning** in the target system

Note: specific names of target systems were inserted into each team's survey.

		Mean	Std Dev	Cases
1.	DT49	4.7519	.9440	129.0
2.	DT50	4.6434	.9666	129.0
3.	DT51	4.7752	.8408	129.0
4.	DT52	4.6279	.9106	129.0
5.	DT53	3.7132	1.1538	129.0
6.	DT54	4.5349	.9358	129.0
7.	DT55	4.5891	.8625	129.0
8.	DT56	4.5891	.8625	129.0

Correlation Matrix

	DT49	DT50	DT51	DT52	DT53	DT54	DT55	DT56
DT49	1.0000							
DT50	.5444	1.0000						
DT51	.3131	.5543	1.0000					
DT52	.3553	.3984	.4613	1.0000				
DT53	.1135	.2368	.2713	.3587	1.0000			
DT54	.4255	.5752	.5016	.5563	.4399	1.0000		
DT55	.4592	.5632	.4965	.5101	.4538	.6325	1.0000	
DT56	.4592	.5632	.4965	.5101	.4538	.6325	1.0000	1.0000

N of Cases = 129.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	36.2248	29.7538	5.4547	8

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.5281	3.7132	4.7752	1.0620	1.2860	.1151

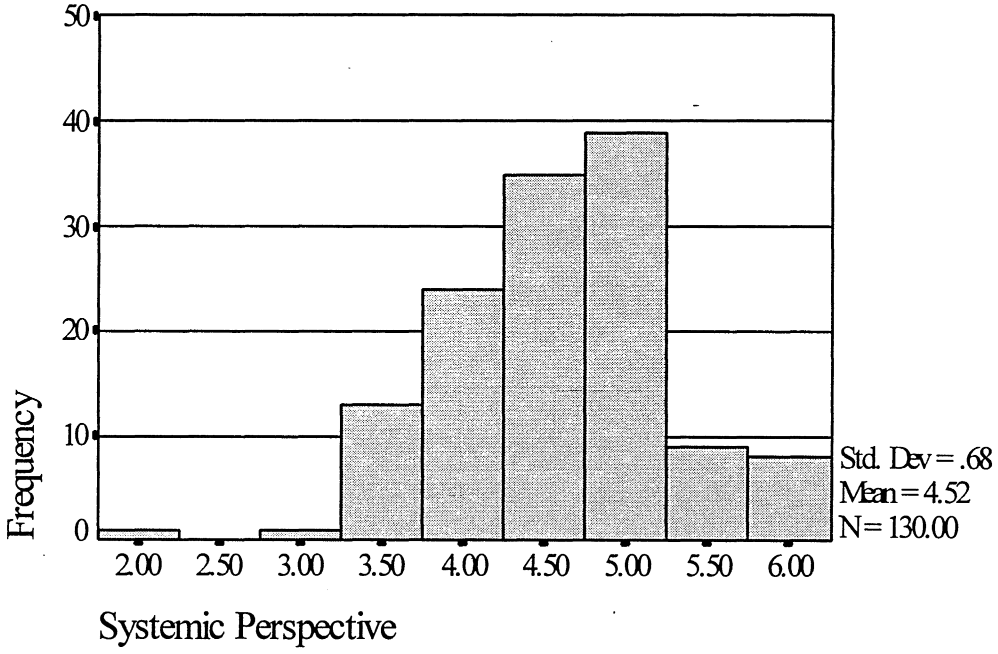
Systemic Perspective (SYSPERS) cont'd

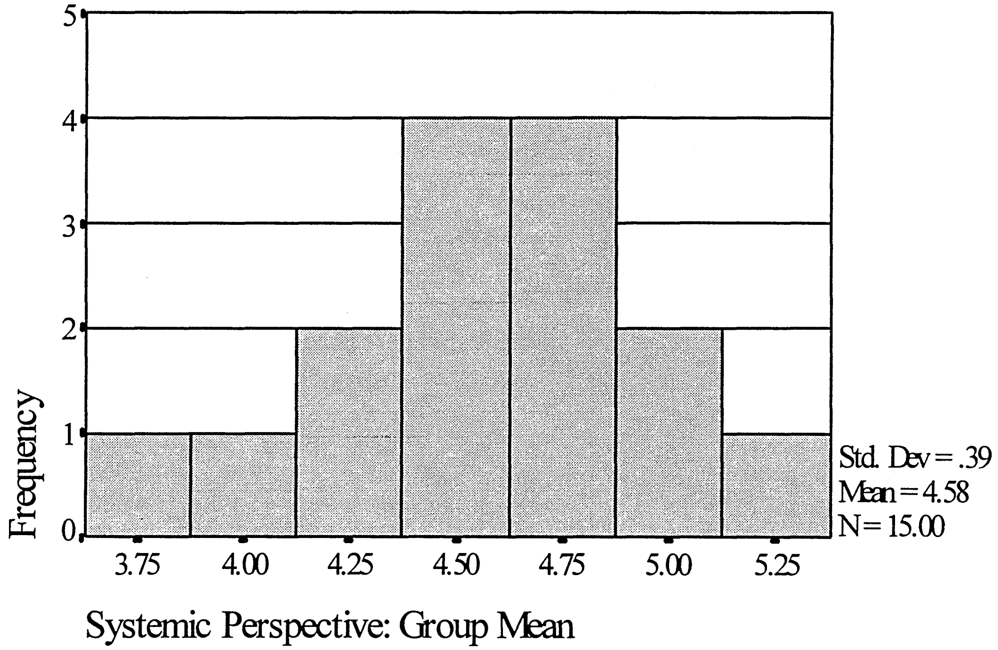
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
DT49	31.4729	24.2668	.4942	.	.8703
DT50	31.5814	22.7765	.6550	.	.8531
DT51	31.4496	24.1869	.5877	.	.8604
DT52	31.5969	23.6019	.6016	.	.8589
DT53	32.5116	23.6112	.4291	.	.8838
DT54	31.6899	22.3562	.7370	.	.8441
DT55	31.6357	22.3897	.8110	.	.8377
DT56	31.6357	22.3897	.8110	.	.8377

Reliability Coefficients 8 items

Alpha = .8718 Standardized item alpha = .8792





5
4
3
2
1
0
Frequency
Std. Dev = .39
Mean = 4.58
N = 15.00
3.75
4.00
4.25
4.50
4.75
5.00
5.25
Systemic Perspective: Group Mean

Team Commitment (TMCMT)

1. CQ01 Tm Comt: Our team works hard.
2. CQ12 Tm Comt: We are committed to superior team performance.
3. CQ21 Tm Comt: We all accept personal responsibility for the success of this team.
4. CQ46 Tm Comt: Team members offer help when I need it.

		Mean	Std Dev	Cases
1.	CQ01	4.9297	.9490	128.0
2.	CQ12	4.5547	1.0485	128.0
3.	CQ21	4.3672	1.3854	128.0
4.	CQ46	4.5938	1.0382	128.0

Correlation Matrix

	CQ01	CQ12	CQ21	CQ46
CQ01	1.0000			
CQ12	.5935	1.0000		
CQ21	.4211	.5634	1.0000	
CQ46	.4663	.4618	.5973	1.0000

N of Cases = 128.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	18.4453	12.5639	3.5446	4

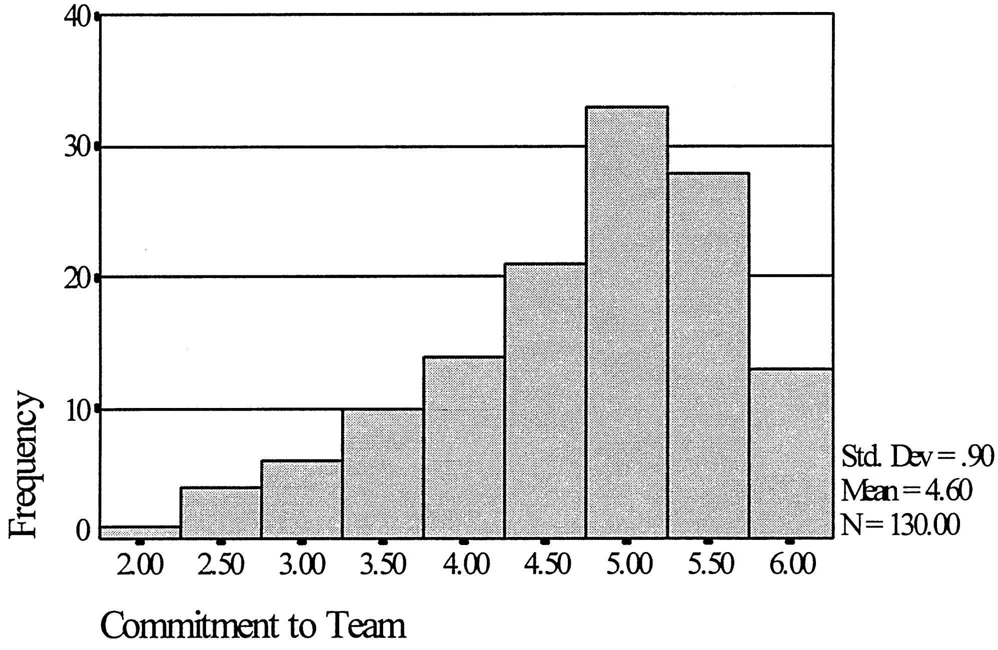
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.6113	4.3672	4.9297	.5625	1.1288	.0548

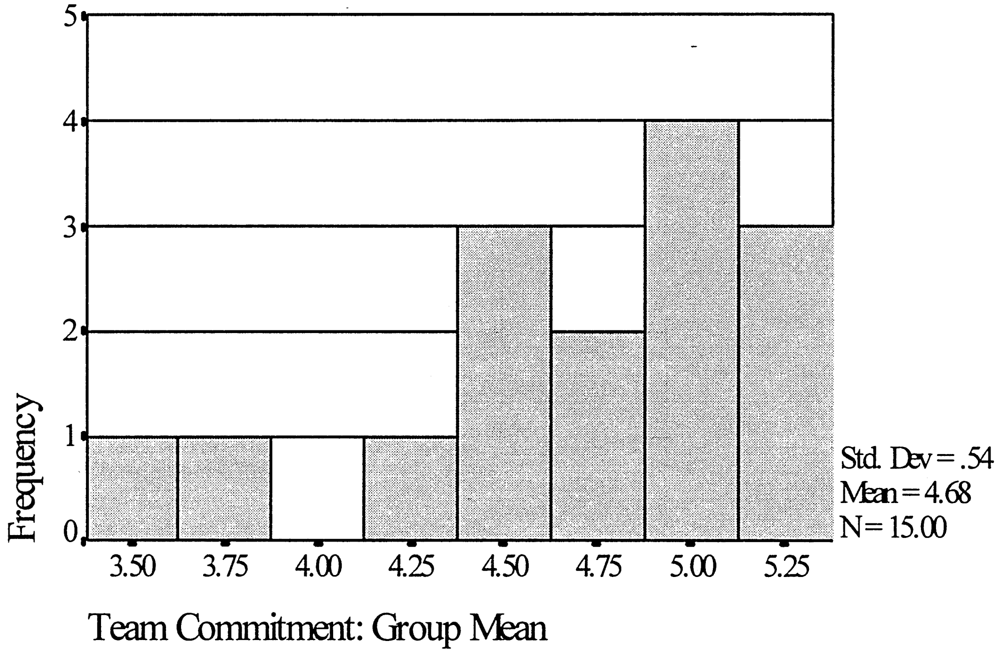
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ01	13.5156	8.4564	.5811	.3992	.7734
CQ12	13.8906	7.6415	.6595	.4734	.7349
CQ21	14.0781	6.1828	.6476	.4619	.7533
CQ46	13.8516	7.8439	.6263	.4148	.7505

Reliability Coefficients 4 items

Alpha = 8030 Standardized item alpha = .8108


40
30
20
10
0
Frequency
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Commitment to Team
Std. Dev = .90
Mean = 4.60
N = 130.00


5
4
3
2
1
0
Frequency
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
Team Commitment: Group Mean
Std. Dev = .54
Mean = 4.68
N = 15.00

Team Unity (TMUNTY)

1. CQ14 Tm Unity: This team often laughs together.
2. CQ28 Tm Unity: When we disagree, we usually work out our differences in an honest, healthy way.
3. CQ65R Tm Unity: *Voicing disagreement on this team is risky.*
4. CQ68R Tm Unity: *Team members compete with each other rather than cooperate.*

	Mean	Std Dev	Cases
1. CQ14	4.9615	.9268	130.0
2. CQ28	4.5462	1.2705	130.0
3. CQ65R	4.7231	1.2699	130.0
4. CQ68R	4.6462	1.2318	130.0

Correlation Matrix

	CQ14	CQ28	CQ65R	CQ68R
CQ14	1.0000			
CQ28	.5512	1.0000		
CQ65R	.3597	.5317	1.0000	
CQ68R	.4701	.7090	.5514	1.0000

N of Cases = 130.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	18.8769	14.4809	3.8054	4

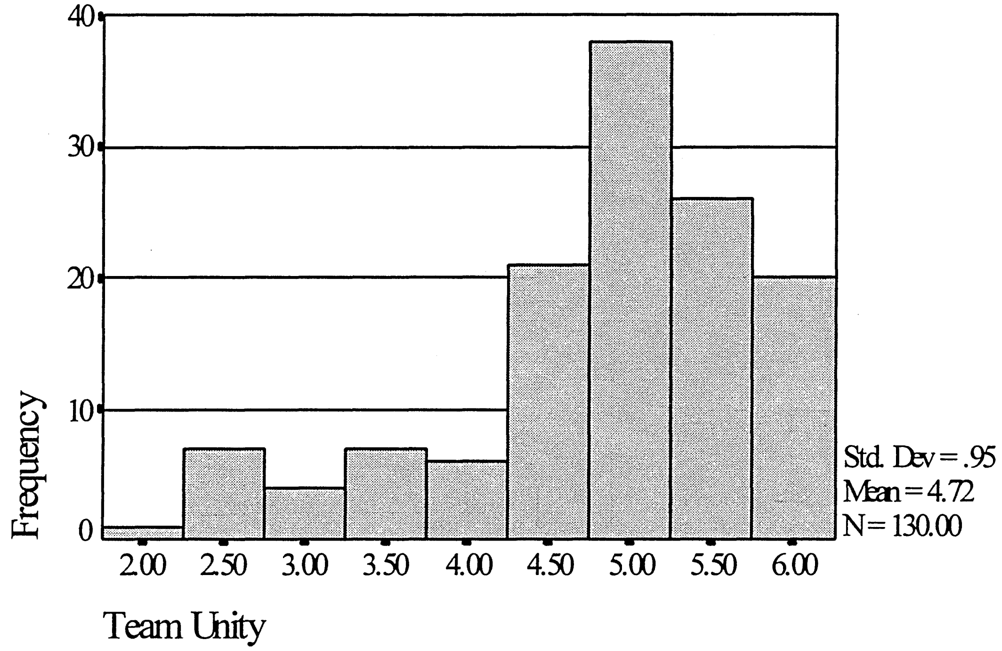
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.7192	4.5462	4.9615	.4154	1.0914	.0313

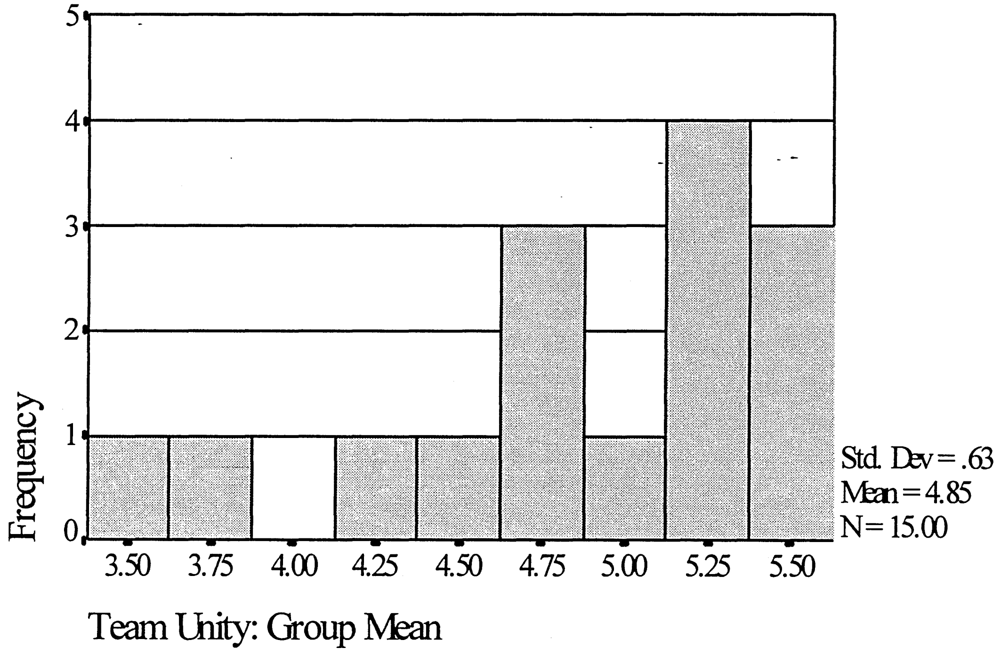
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ14	13.9154	10.4036	.5383	.3188	.8160
CQ28	14.3308	7.6339	.7453	.5822	.7162
CQ65R	14.1538	8.5808	.5763	.3461	.8025
CQ68R	14.2308	7.9463	.7225	.5508	.7287

Reliability Coefficients 4 items

Alpha = .8174   Standardized item alpha = .8178


40
30
20
10
0
Frequency
Std. Dev = .95
Mean = 4.72
N = 130.00
2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
Team Unity


5
4
3
2
1
0
Frequency
Std. Dev = .63
Mean = 4.85
N = 15.00
3.50 3.75 4.00 4.25 4.50 4.75 5.00 5.25 5.50
Team Unity: Group Mean

Team Self-Assessment (TMASMNT)

1. CQ04 Tm Assess: We take the time as a team to examine areas in which we need more skill or experience.
2. CQ33R Tm Assess: *We rarely stop to consider how we can work better as a team.*
3. CQ43R Tm Assess: *We rarely follow through on our plans for improving the team.*
4. CQ58 Tm Assess: We have recently discussed what we did right or wrong on a particular project or job.

		Mean	Std Dev	Cases
1.	CQ04	4.1094	1.1380	128.0
2.	CQ33R	3.7188	1.2732	128.0
3.	CQ43R	4.1406	1.2720	128.0
4.	CQ58	4.2109	1.3141	128.0

Correlation Matrix

	CQ04	CQ33R	CQ43R	CQ58
CQ04	1.0000			
CQ33R	.3420	1.0000		
CQ43R	.4789	.4525	1.0000	
CQ58	.2161	.4452	.4296	1.0000

N of Cases = 128.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	16.1797	13.6761	3.6981	4

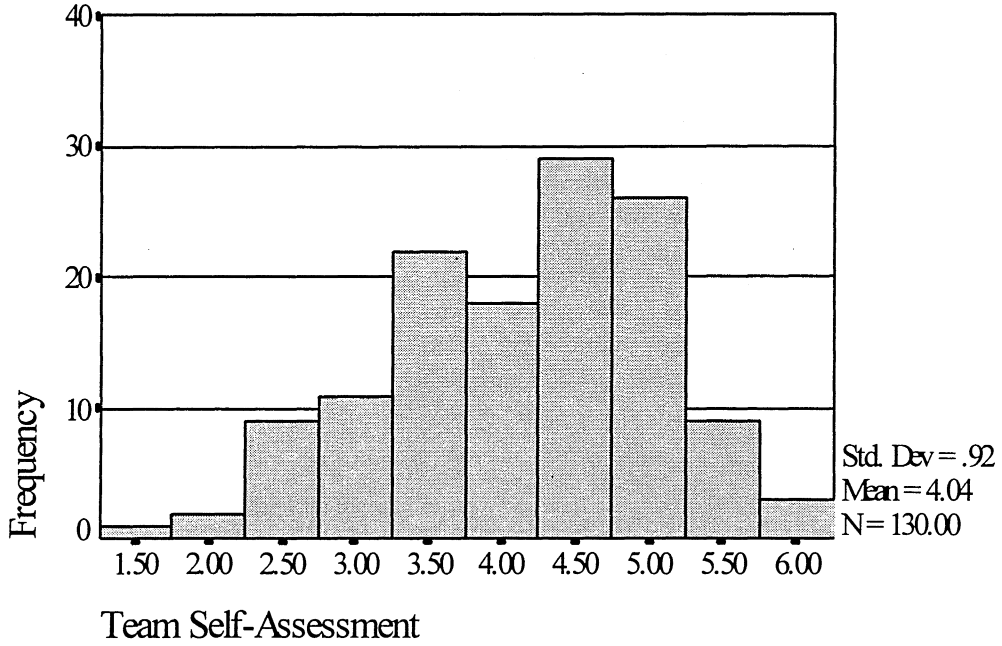
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.0449	3.7188	4.2109	.4922	1.1324	.0491

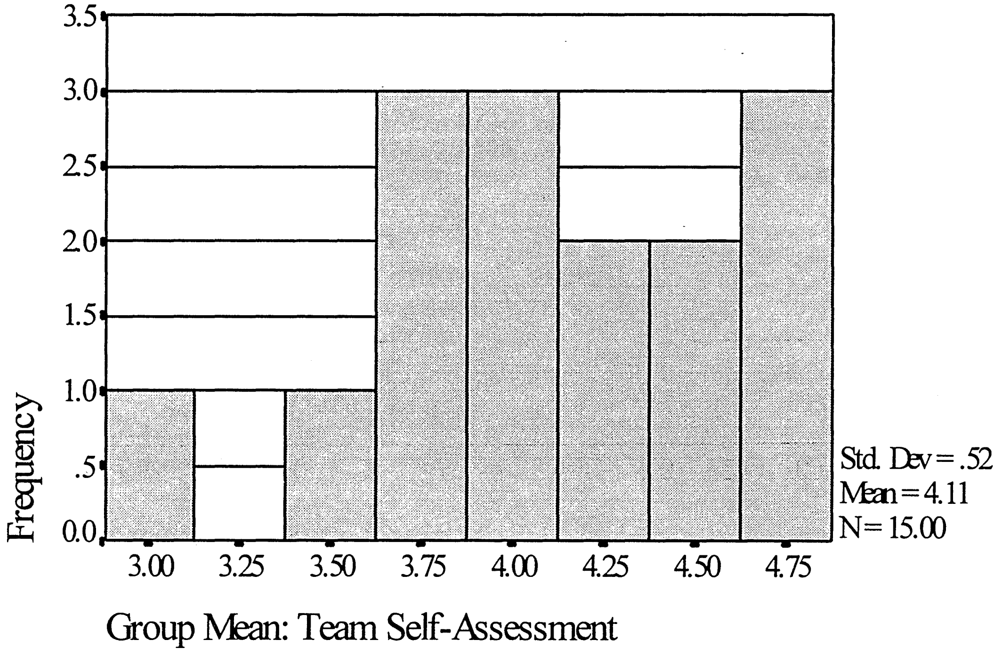
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ04	12.0703	9.3572	.4343	.2502	.7040
CQ33R	12.4609	8.1087	.5442	.3012	.6417
CQ43R	12.0391	7.7701	.6047	.3763	.6037
CQ58	11.9688	8.3770	.4696	.2648	.6881

Reliability Coefficients 4 items

Alpha = .7229 Standardized item alpha = .7223


40
30
20
10
0
Frequency
1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
Team Self-Assessment
Std. Dev = .92
Mean = 4.04
N = 130.00


3.5
3.0
2.5
2.0
1.5
1.0
.5
0.0
Frequency
3.00 3.25 3.50 3.75 4.00 4.25 4.50 4.75
Group Mean: Team Self-Assessment
Std. Dev = .52
Mean = 4.11
N = 15.00

Team Decision Processes (TMDEC)

1.	CQ09R	Tm Coord:	We have a difficult time reaching decisions.
2.	DT25	DM Eff:	We follow well-defined and systematic decision-making processes.
3.	DT27	DM Eff:	Everyone on the team participates in decision processes.
4.	DT32	DM Eff:	We use relevant data to support decisions.
5.	DT35	DM Eff:	We implement decisions in a timely manner.
6.	DT41	Tm Roles:	Team members perform informal roles as needed (e.g., information seeker, information giver, elaborator).
7.	DT45	DM Eff:	We are able to clearly identify the decisions that need our attention.

		Mean	Std Dev	Cases
1.	CQ09R	3.6160	1.3427	125.0
2.	DT25	3.7760	1.1207	125.0
3.	DT27	4.4800	1.1681	125.0
4.	DT32	4.4800	.8670	125.0
5.	DT35	3.8240	1.0478	125.0
6.	DT41	4.6320	.8848	125.0
7.	DT45	4.1680	1.0681	125.0

Correlation Matrix

	CQ09R	DT25	DT27	DT32	DT35	DT41	DT45
CQ09R	1.0000						
DT25	.4140	1.0000					
DT27	.4681	.4339	1.0000				
DT32	.4644	.6096	.4396	1.0000			
DT35	.4388	.5225	.5045	.5377	1.0000		
DT41	.3349	.3391	.3752	.3373	.3732	1.0000	
DT45	.5177	.6178	.4842	.5131	.4806	.4926	1.0000

N of Cases = 125.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	28.9760	30.4591	5.5190	7

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.1394	3.6160	4.6320	1.0160	1.2810	.1635

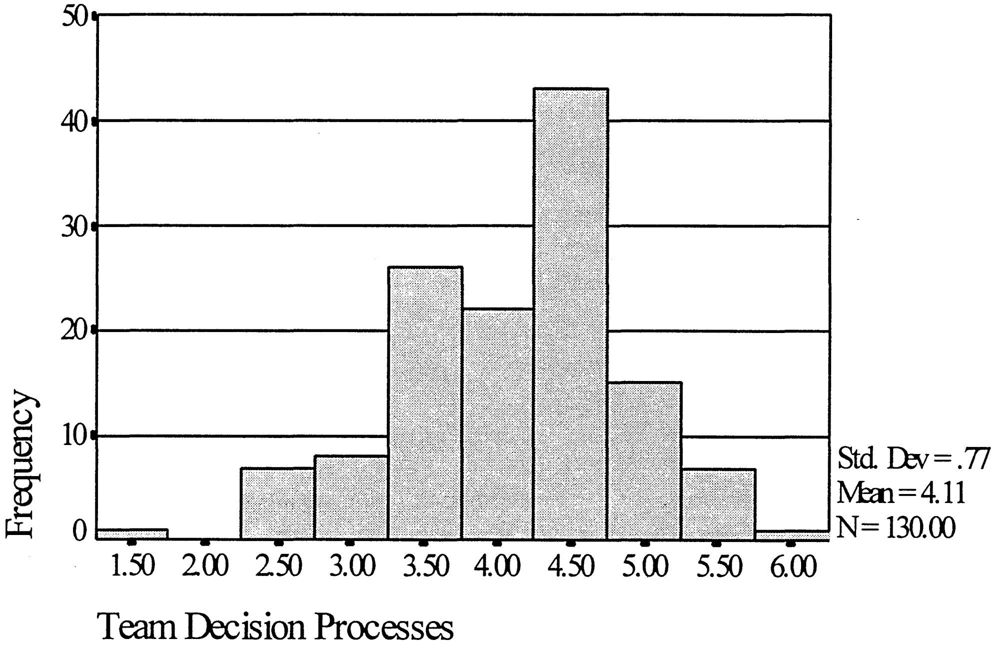
Team Decision Processes (TMDEC) cont'd

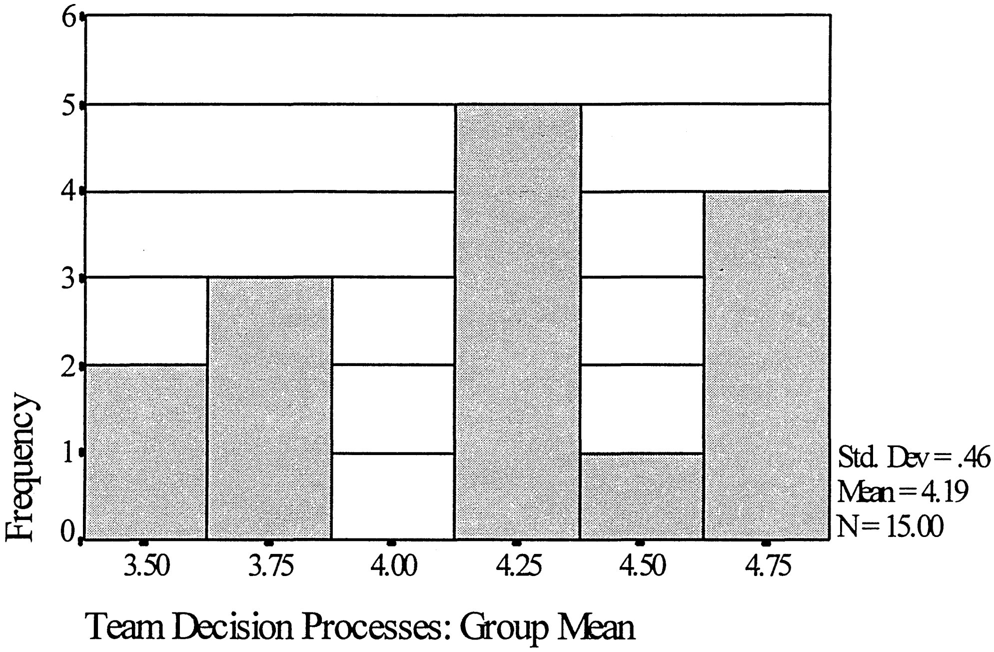
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ09R	25.3600	21.3452	.5893	.3682	.8406
DT25	25.2000	22.2581	.6568	.5180	.8258
DT27	24.4960	22.3810	.6074	.3791	.8337
DT32	24.4960	24.1068	.6579	.4734	.8294
DT35	25.1520	22.9203	.6420	.4310	.8283
DT41	24.3440	25.2920	.4926	.2809	.8483
DT45	24.8080	22.1886	.7085	.5363	.8184

Reliability Coefficients 7 items

Alpha = .8527 Standardized item alpha = .8573





6
5
4
3
2
1
0
Frequency
3.50
3.75
4.00
4.25
4.50
4.75
Team Decision Processes: Group Mean
Std. Dev = .46
Mean = 4.19
N = 15.00

Team Roles (TMROLES)

1.	DT20	Tm Roles:	My team uses clearly defined formal roles within the team.
2.	DT24	Tm Roles:	Formal team roles help us clarify responsibilities within the team.
3.	DT43	Tm Roles:	The formal roles we use help to distribute workload within the team.

	Mean	Std Dev	Cases
1. DT20	4.1484	1.1370	128.0
2. DT24	4.2891	1.0129	128.0
3. DT43	3.9297	1.1307	128.0

Correlation Matrix

	DT20	DT24	DT43
DT20	1.0000		
DT24	.5709	1.0000	
DT43	.6023	.4304	1.0000

N of Cases = 128.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	12.3672	7.4468	2.7289	3

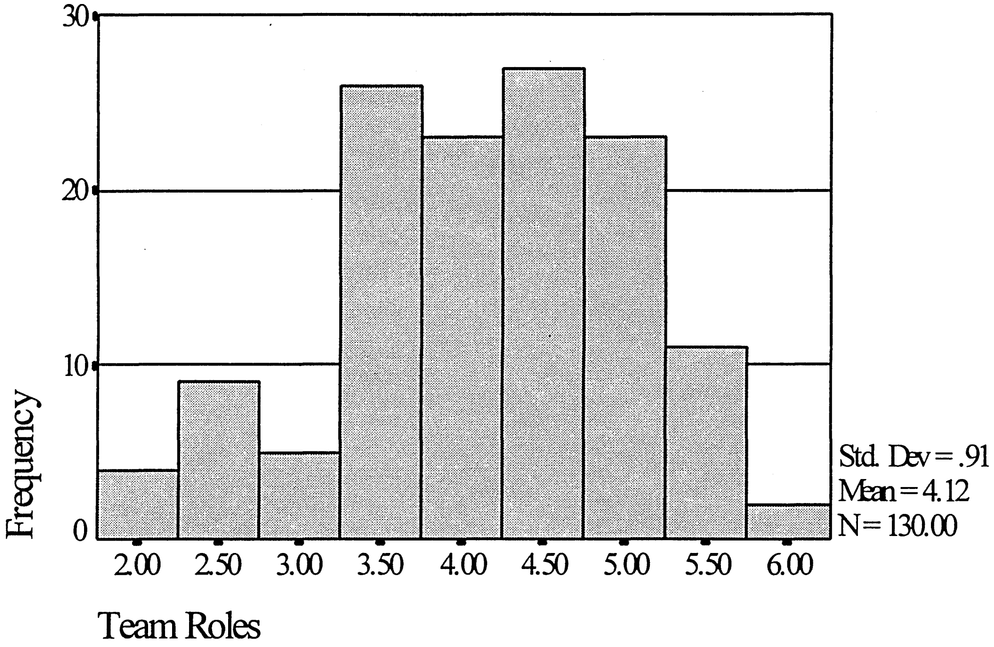
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.1224	3.9297	4.2891	.3594	1.0915	.0328

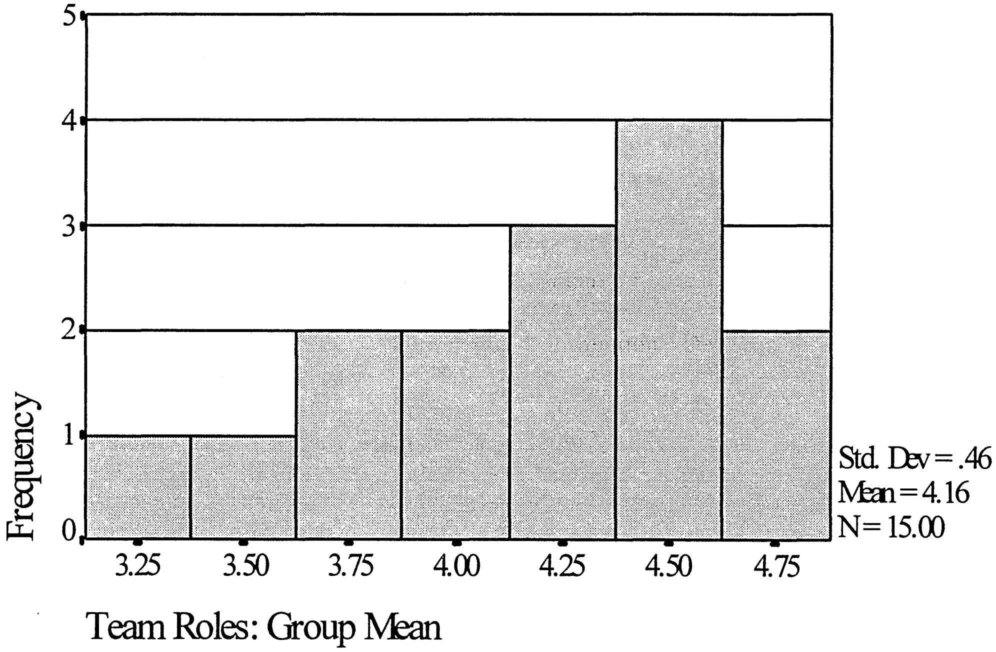
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
DT20	8.2188	3.2904	.6942	.4820	.5992
DT24	8.0781	4.1198	.5596	.3377	.7518
DT43	8.4375	3.6339	.5879	.3739	.7238

Reliability Coefficients 3 items

Alpha = .7754 Standardized item alpha = .7750


30
20
10
0
Frequency
Std. Dev = .91
Mean = 4.12
N = 130.00
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Team Roles


5
4
3
2
1
0
Frequency
Std. Dev = .46
Mean = 4.16
N = 15.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
Team Roles: Group Mean

Team Leadership (TMLDR)

1. CQ25 Tm Leader: The team leader is skilled and experienced.
2. CQ31 Tm Leader: The team leader has a clear vision of where we are going as a team.
3. CQ35 Tm Leader: The team leader gives members the freedom to make their own decisions.
4. CQ47 Tm Leader: The team leader praises or rewards members when they perform well.
5. CQ59 Tm Leader: The team leader encourages members with different opinions to express their ideas.
6. CQ67 Tm Leader: The team leader gives members valuable feedback to help them improve.

	Mean	Std Dev	Cases
1. CQ25	4.7422	1.1242	128.0
2. CQ31	4.3594	1.2343	128.0
3. CQ35	4.8594	.9284	128.0
4. CQ47	4.3984	1.0964	128.0
5. CQ59	4.7891	.9362	128.0
6. CQ67	4.0547	1.1926	128.0

Correlation Matrix

	CQ25	CQ31	CQ35	CQ47	CQ59	CQ67
CQ25	1.0000					
CQ31	.6859	1.0000				
CQ35	.5912	.5529	1.0000			
CQ47	.5440	.4810	.3881	1.0000		
CQ59	.5614	.4818	.4729	.4124	1.0000	
CQ67	.5745	.4894	.4195	.4409	.4688	1.0000

N of Cases = 128.0

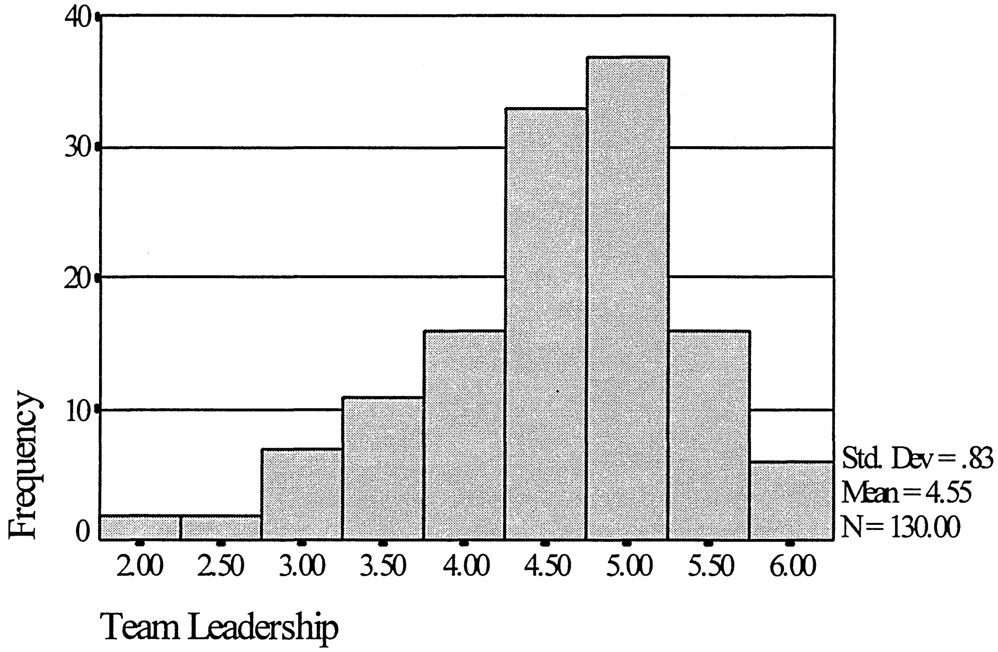
Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	27.2031	25.0608	5.0061	6

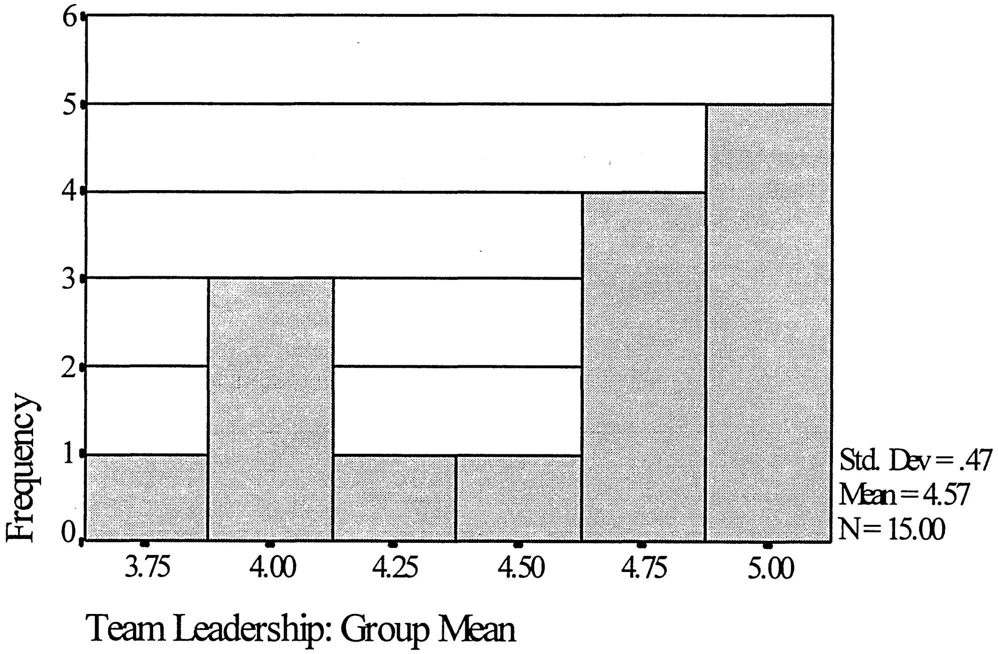
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.5339	4.0547	4.8594	.8047	1.1985	.0986

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ25	22.4609	16.5969	.7861	.6257	.8067
CQ31	22.8438	16.5108	.7005	.5249	.8240
CQ35	22.3438	19.1565	.6204	.4121	.8397
CQ47	22.8047	18.4261	.5771	.3433	.8465
CQ59	22.4141	19.1737	.6112	.3817	.8410
CQ67	23.1484	17.5290	.6118	.3861	.8416

Reliability Coefficients 6 items
Alpha = .8576 Standardized item alpha = .8592


40
30
20
10
0
Frequency
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Team Leadership
Std. Dev = .83
Mean = 4.55
N = 130.00


6
5
4
3
2
1
0
Frequency
3.75
4.00
4.25
4.50
4.75
5.00
Team Leadership: Group Mean
Std. Dev = .47
Mean = 4.57
N = 15.00

Clarity in Sponsor Expectations (CLRSPNEX)

1.	CQ22	Mis Clar:	We have a clear overall team purpose.
2.	CQ38R	Mis Clar:	I am not sure what we are trying to accomplish as a team.
3.	DT26	Spnsr Mgt:	We coordinate with sponsors to get the information we need.
4.	DT33	Spnsr Mgt:	We know what our sponsors expect our team to accomplish.
5.	DT37	Spnsr Mgt:	We have enough guidance from sponsors on the scope of our effort.

		Mean	Std Dev	Cases
1.	CQ22	4.4331	1.3129	127.0
2.	CQ38R	4.6693	1.2852	127.0
3.	DT26	4.3150	.9816	127.0
4.	DT33	4.4409	1.0886	127.0
5.	DT37	3.9764	1.2877	127.0

Correlation Matrix

	CQ22	CQ38R	DT26	DT33	DT37
CQ22	1.0000				
CQ38R	.6829	1.0000			
DT26	.6077	.4796	1.0000		
DT33	.5817	.5305	.5672	1.0000	
DT37	.6023	.5467	.6213	.6699	1.0000

N of Cases = 127.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	21.8346	23.9169	4.8905	5

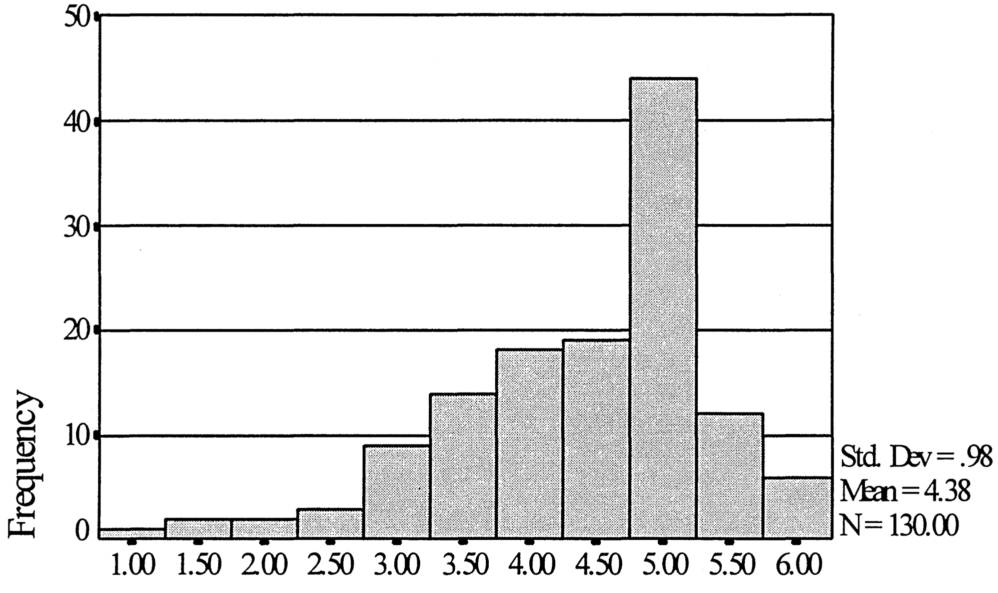
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.3669	3.9764	4.6693	.6929	1.1743	.0641

Item-total Statistics

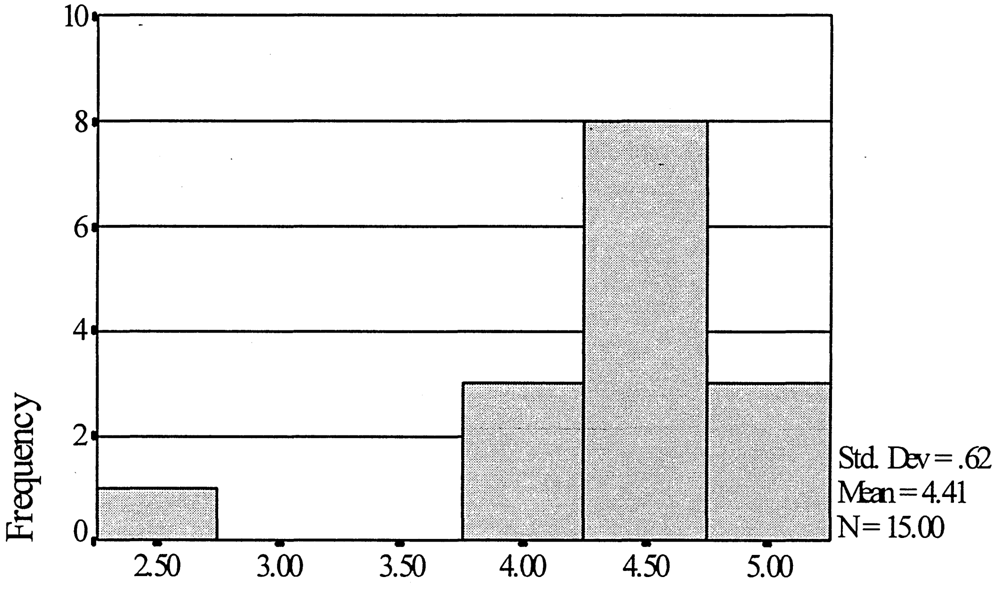
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ22	17.4016	14.6232	.7539	.5944	.8356
CQ38R	17.1654	15.4566	.6738	.5037	.8563
DT26	17.5197	17.3945	.6789	.4862	.8567
DT33	17.3937	16.4946	.7054	.5206	.8486
DT37	17.8583	14.9639	.7322	.5667	.8411

Reliability Coefficients 5 items

Alpha = .8746   Standardized item alpha = .8775



Clarity Sponsor Expectations



Clarity Sponsor Expectations: Group Mean

Keeping Stakeholders Informed (STKINF)

1.	DT30	Cust Mgt:	We communicate regularly to keep customers informed of our plans and progress.
2.	DT31	Stk Mgt:	We communicate regularly to keep key stakeholders informed of our plans and progress.

	Mean	Std Dev	Cases
1. DT30	3.7891	1.1409	128.0
2. DT31	3.8672	1.1180	128.0

Correlation Matrix

	DT30	DT31
DT30	1.0000	
DT31	.7063	1.0000

N of Cases = 128.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	7.6563	4.3533	2.0865	2

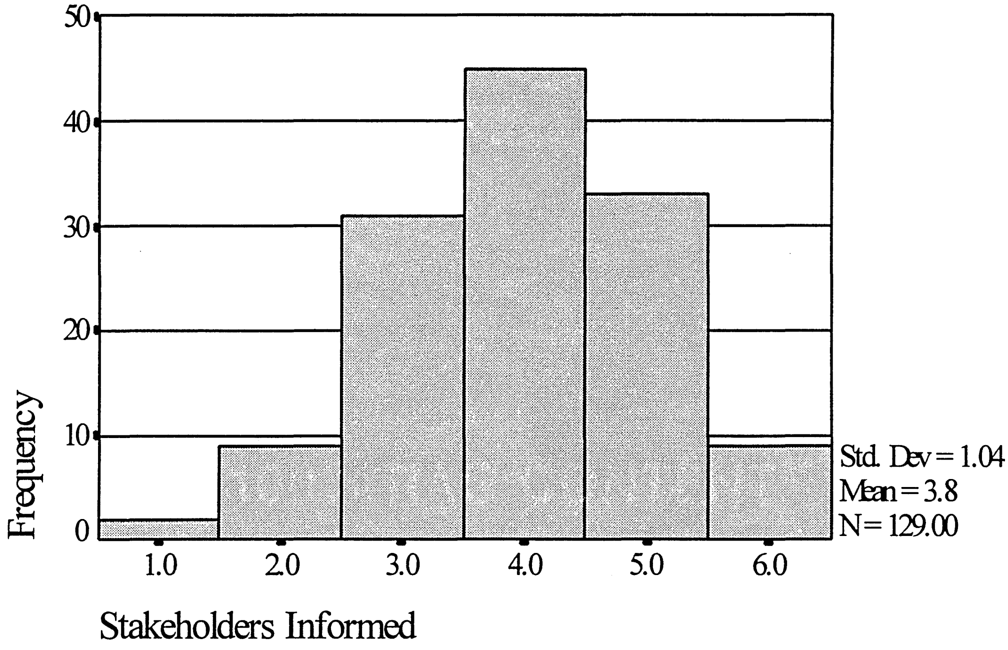
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.8281	3.7891	3.8672	.0781	1.0206	.0031

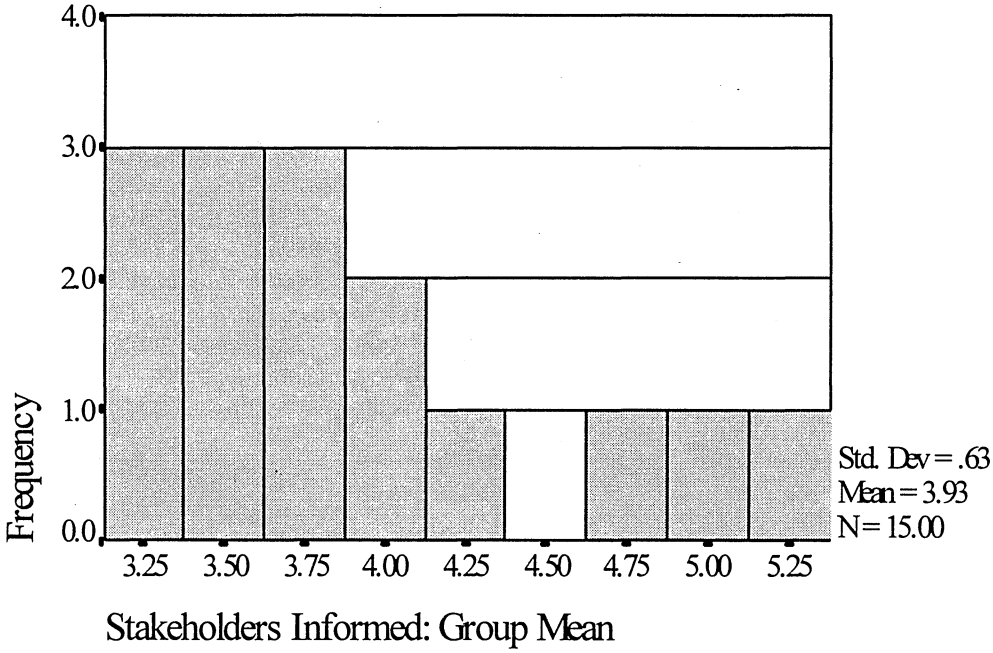
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
DT30	3.8672	1.2499	.7063	.4989	.
DT31	3.7891	1.3016	.7063	.4989	.

Reliability Coefficients 2 items

Alpha = .8278   Standardized item alpha = .8279


50
40
30
20
10
0
Frequency
1.0
2.0
3.0
4.0
5.0
6.0
Stakeholders Informed
Std. Dev = 1.04
Mean = 3.8
N = 129.00


4.0
3.0
2.0
1.0
0.0
Frequency
3.25
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
Stakeholders Informed: Group Mean
Std. Dev = .63
Mean = 3.93
N = 15.00

Building Commitment with Stakeholders (CMTBLD)

1.	DT21	Cust Mgt:	We are effective at building customer commitment to what we are doing.
2.	DT22	Stk Mgt:	We are effective at building key stakeholder commitment to what we are doing.
3.	DT23	Spnsr Mgt:	We are effective at building sponsor commitment to what we are doing.

	Mean	Std Dev	Cases
1. DT21	4.0000	1.1055	127.0
2. DT22	4.2126	1.0811	127.0
3. DT23	4.5197	1.0605	127.0

Correlation Matrix

	DT21	DT22	DT23
DT21	1.0000		
DT22	.7105	1.0000	
DT23	.5348	.6367	1.0000

N of Cases = 127.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	12.7323	7.9278	2.8156	3

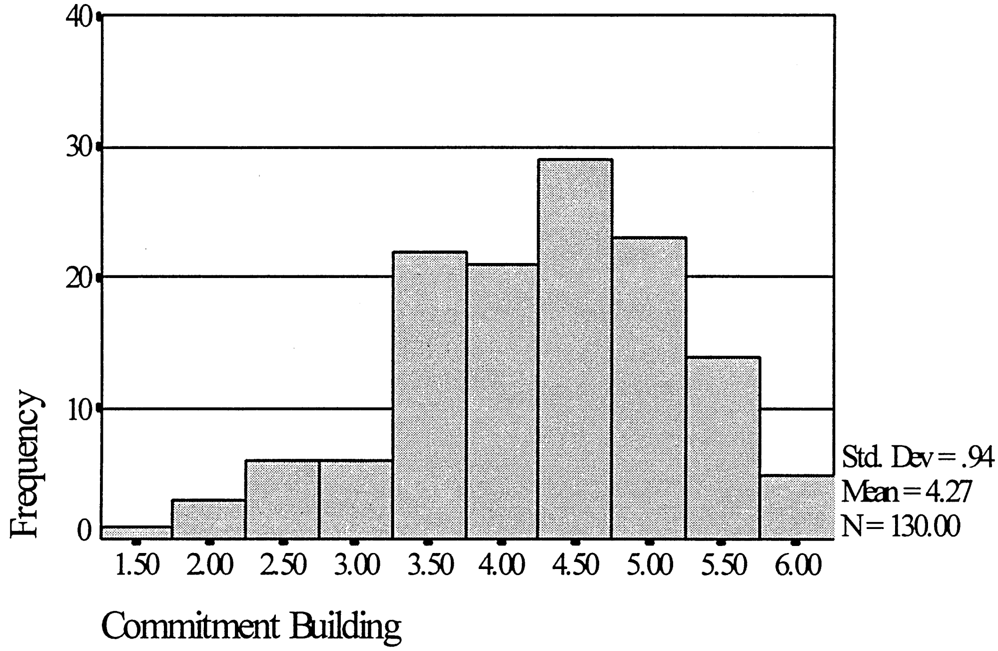
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.2441	4.0000	4.5197	.5197	1.1299	.0683

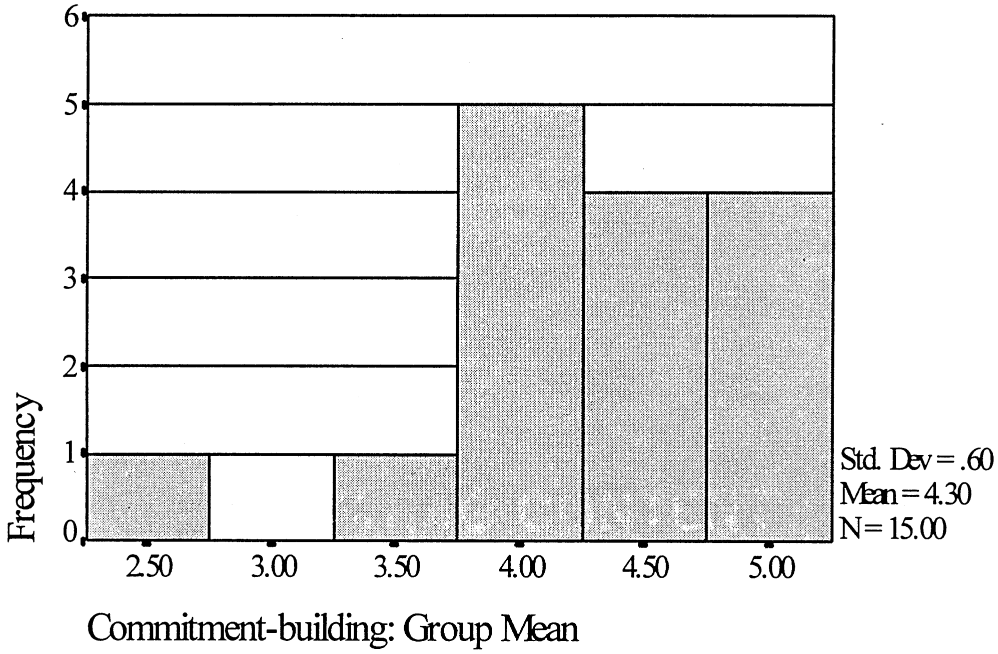
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
DT21	8.7323	3.7532	.6892	.5163	.7779
DT22	8.5197	3.6008	.7698	.5971	.6965
DT23	8.2126	4.0894	.6327	.4191	.8306

Reliability Coefficients 3 items

Alpha = .8348 Standardized item alpha = .8347


40
30
20
10
0
Frequency
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Commitment Building
Std. Dev = .94
Mean = 4.27
N = 130.00


6
5
4
3
2
1
0
Frequency
2.50
3.00
3.50
4.00
4.50
5.00
Commitment-building: Group Mean
Std. Dev = .60
Mean = 4.30
N = 15.00

Inter-organizational Perspective (INTRORG)

1.	DT34	Introrg impact:	We consider the impact of what we're doing on other parts of the organization outside the target system.
2.	DT44	ImprTm Coord:	We coordinate with other improvement teams that may be impacted by our work.
3.	DT48	ImprTm Coord:	We are well-informed about other improvement teams that might impact what we're doing.

	Mean	Std Dev	Cases
1. DT34	4.6797	.9130	128.0
2. DT44	3.8984	1.1072	128.0
3. DT48	3.6719	1.1162	128.0

Correlation Matrix

	DT34	DT44	DT48
DT34	1.0000		
DT44	.5829	1.0000	
DT48	.5374	.5845	1.0000

N of Cases = 128.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	12.2500	7.0236	2.6502	3

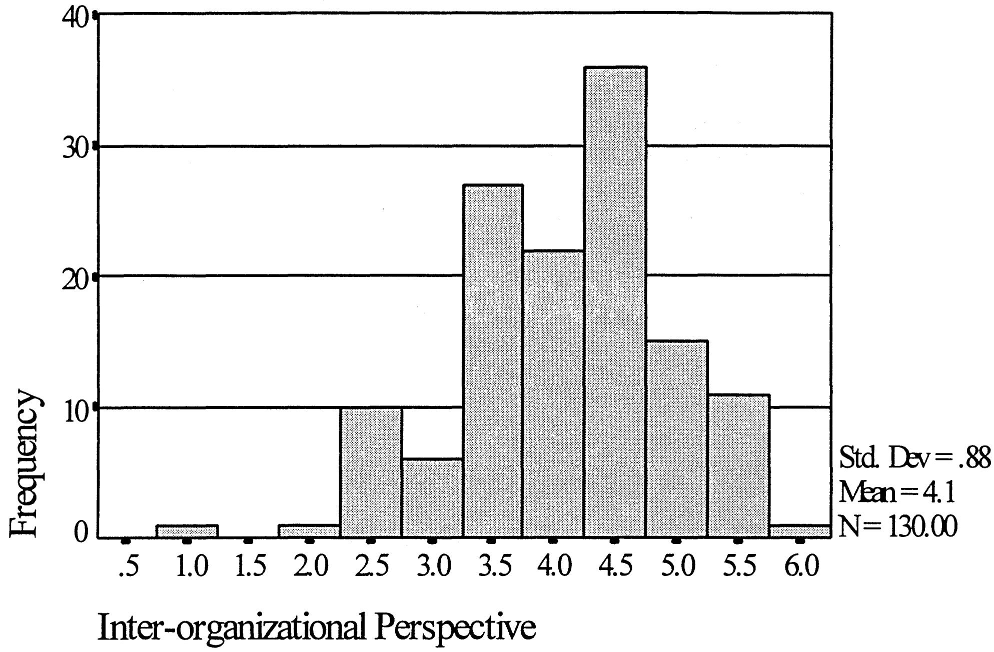
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.0833	3.6719	4.6797	1.0078	1.2745	.2796

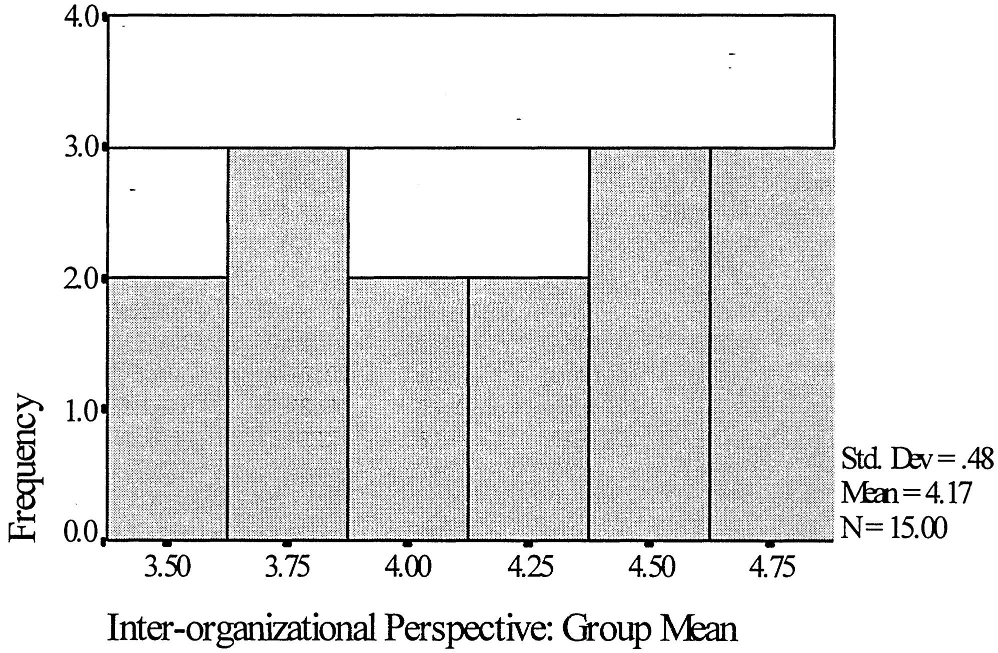
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
DT34	7.5703	3.9163	.6292	.3985	.7378
DT44	8.3516	3.1746	.6649	.4433	.6900
DT48	8.5781	3.2379	.6323	.4002	.7279

Reliability Coefficients 3 items

Alpha = .7941 Standardized item alpha = .7979


40
30
20
10
0
Frequency
Std. Dev = .88
Mean = 4.1
N = 130.00
.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Inter-organizational Perspective


4.0
3.0
2.0
1.0
0.0
Frequency
Std. Dev = .48
Mean = 4.17
N = 15.00
3.50
3.75
4.00
4.25
4.50
4.75
Inter-organizational Perspective: Group Mean

Organization Support to Team (OSPTTM)

1.	CQ13	Orgn Supt:	Our organization fully supports this team and its mission.
2.	CQ19	Information:	We usually have access to the information we need.
3.	CQ26	Time:	We have enough time and people to perform well.
4.	CQ44	Matl Resources:	We have enough money and other material resources to do our work.
5.	DT40	Orgn Supt:	We get what need from leadership of organization.

Note: The organization's name was inserted in each team's survey in question DT40.

	Mean	Std Dev	Cases
1. CQ13	4.6744	1.2000	129.0
2. CQ19	4.8295	.8303	129.0
3. CQ26	3.7132	1.3299	129.0
4. CQ44	4.2868	1.4042	129.0
5. DT40	3.9225	1.3728	129.0

Correlation Matrix

	CQ13	CQ19	CQ26	CQ44	DT40
CQ13	1.0000				
CQ19	.3986	1.0000			
CQ26	.1564	.3516	1.0000		
CQ44	.3016	.3907	.3707	1.0000	
DT40	.6200	.3584	.3343	.4169	1.0000

N of Cases = 129.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	21.4264	18.8246	4.3387	5

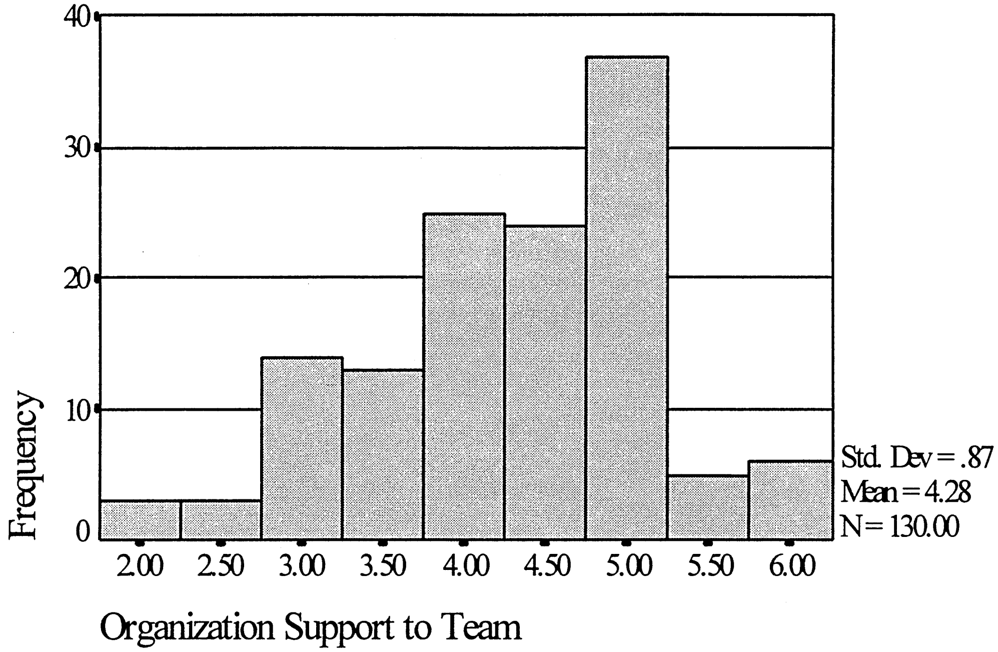
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.2853	3.7132	4.8295	1.1163	1.3006	.2266

Item-total Statistics

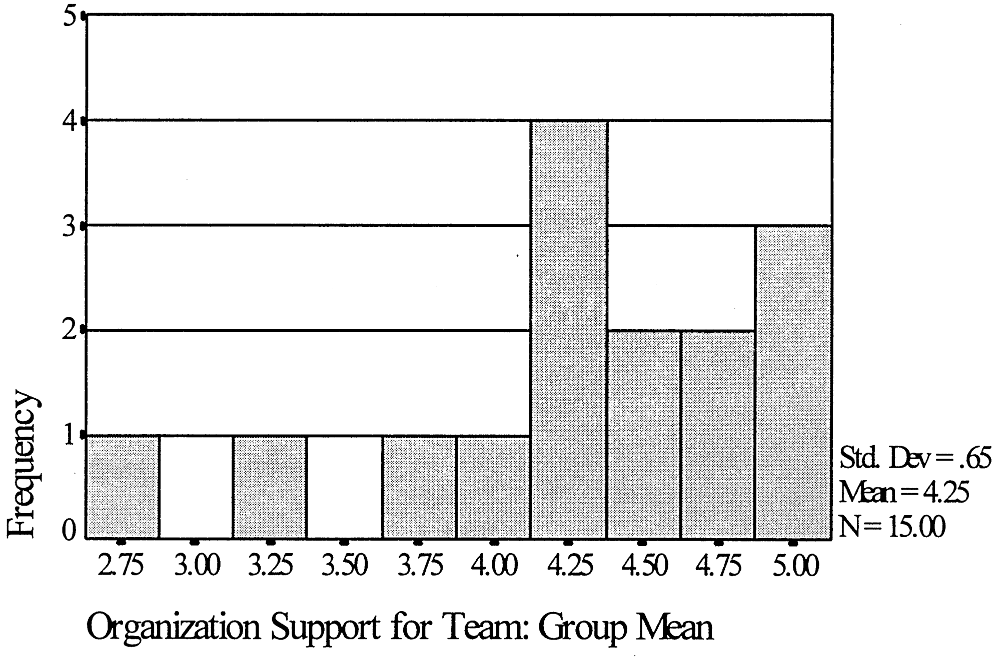
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ13	16.7519	13.0317	.5024	.4320	.6873
CQ19	16.5969	14.8362	.5157	.2828	.6984
CQ26	17.7132	13.1749	.4020	.2263	.7276
CQ44	17.1395	11.9335	.5071	.2748	.6872
DT40	17.5039	11.2519	.6176	.4708	.6378

Reliability Coefficients 5 items

Alpha = .7351 Standardized item alpha = .7459



40
30
20
10
0
Frequency
2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
Organization Support to Team
Std. Dev = .87
Mean = 4.28
N = 130.00



5
4
3
2
1
0
Frequency
2.75 3.00 3.25 3.50 3.75 4.00 4.25 4.50 4.75 5.00
Organization Support for Team: Group Mean
Std. Dev = .65
Mean = 4.25
N = 15.00

Organization Support to Individuals (ORGSPTIN)

1. CQ11R Feedback: I am never sure how well I am performing on this team.
2. CQ18 Rewards: I am valued for my contribution to this team.
3. CQ55R Rewards: *I receive few rewards for performing well on this team.*
4. CQ62R Information: *I often find it difficult to get answers to important questions about my work.*

		Mean	Std Dev	Cases
1.	CQ11R	3.7907	1.3444	129.0
2.	CQ18	4.6434	.9168	129.0
3.	CQ55R	3.5194	1.2996	129.0
4.	CQ62R	4.1860	1.1843	129.0

Correlation Matrix

	CQ11R	CQ18	CQ55R	CQ62R
CQ11R	1.0000			
CQ18	.5411	1.0000		
CQ55R	.3355	.3271	1.0000	
CQ62R	.4663	.4213	.3885	1.0000

N of Cases = 129.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	16.1395	12.6210	3.5526	4

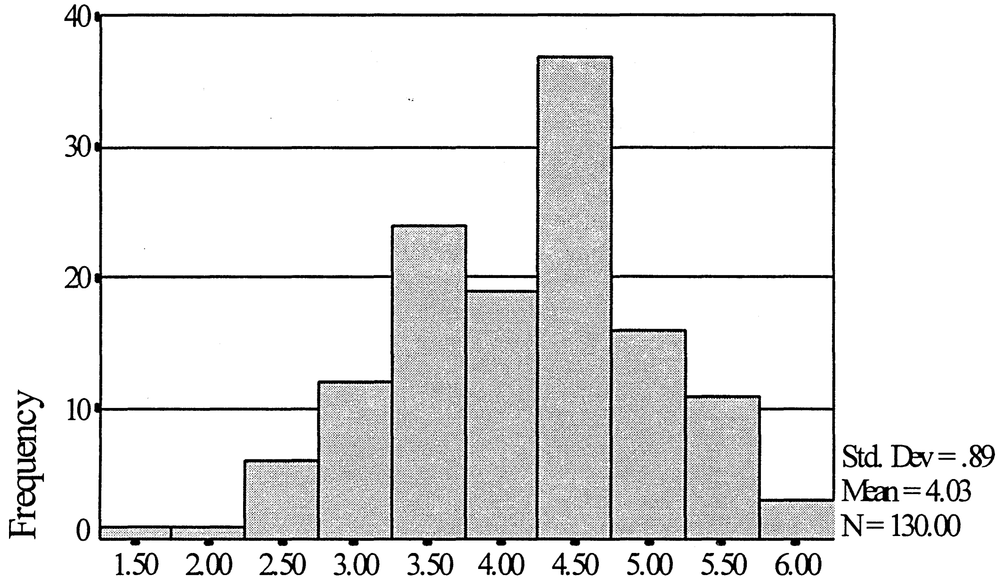
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.0349	3.5194	4.6434	1.1240	1.3194	.2395

Item-total Statistics

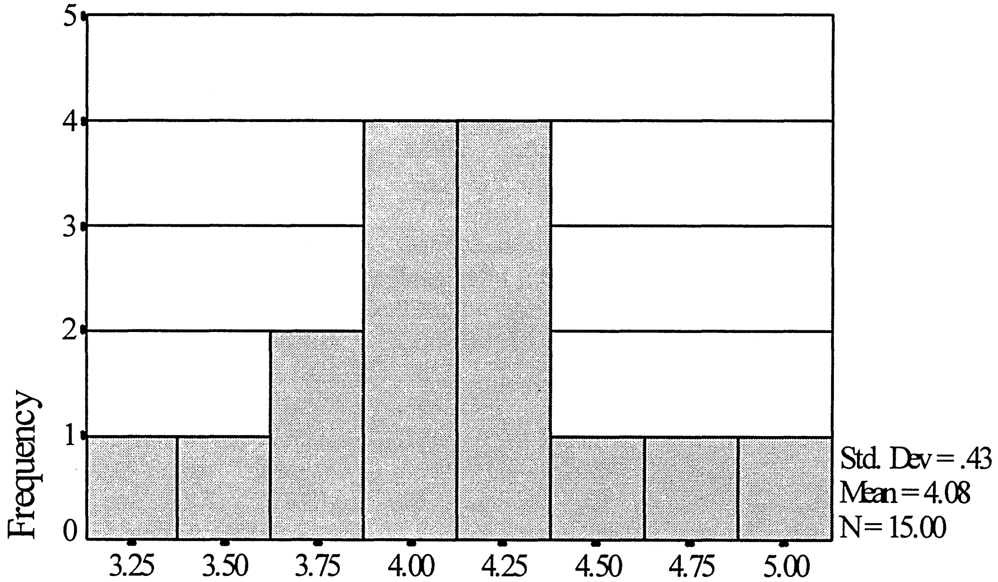
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ11R	12.3488	6.8227	.5682	.3708	.6355
CQ18	11.4961	8.7519	.5583	.3404	.6603
CQ55R	12.6202	7.7843	.4340	.1949	.7195
CQ62R	11.9535	7.6228	.5498	.3032	.6466

Reliability Coefficients 4 items

Alpha = .7270 Standardized item alpha = .7381



Organization Support to Individuals



Organizational Support for Individuals: Group Mean

Team Performance-1 (TMPERF1)

1.	CQ02	Tm Perf1:	Reports on our performance are favorable.
2.	CQ17	TmPerf1:	We are meeting our team objectives.
3.	CQ40	Tm Perf1:	Our work is high quality.
4.	CQ60	Tm Perf1:	The people who evaluate our team performance are happy with our results.
5.	CQ72	Tm Perf1:	So far, our team has been a great success.

		Mean	Std Dev	Cases
1.	CQ02	4.1890	1.0964	127.0
2.	CQ17	4.0551	1.2039	127.0
3.	CQ40	4.2992	1.0489	127.0
4.	CQ60	3.7480	1.3567	127.0
5.	CQ72	3.9921	1.3244	127.0

Correlation Matrix

	CQ02	CQ17	CQ40	CQ60	CQ72
CQ02	1.0000				
CQ17	.7376	1.0000			
CQ40	.6129	.6782	1.0000		
CQ60	.7045	.7228	.5888	1.0000	
CQ72	.7061	.8017	.7501	.7144	1.0000

N of Cases = 127.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	20.2835	27.8079	5.2733	5

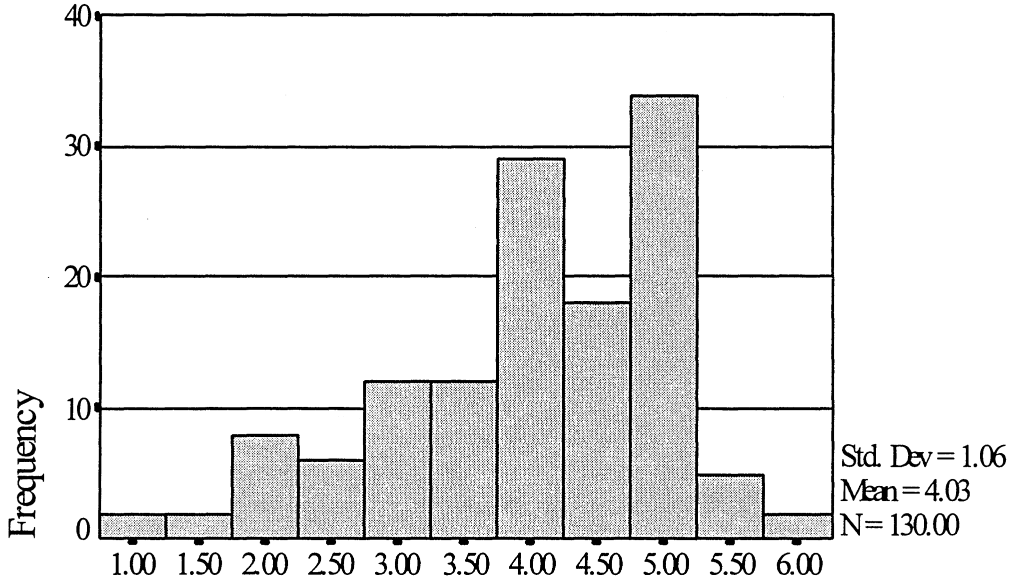
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.0567	3.7480	4.2992	.5512	1.1471	.0439

Item-total Statistics

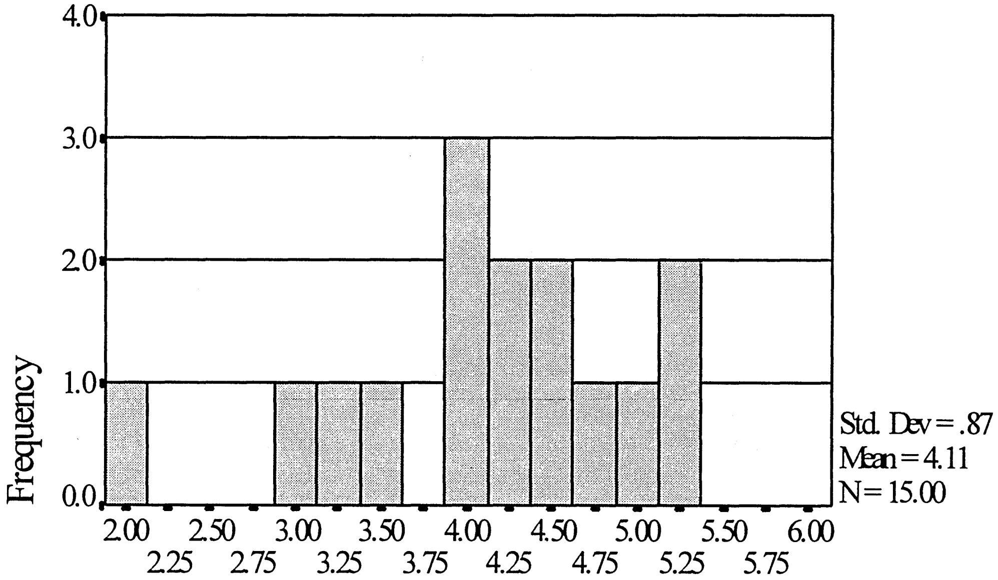
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ02	16.0945	19.1021	.7829	.6232	.9045
CQ17	16.2283	17.7808	.8449	.7224	.8911
CQ40	15.9843	19.8251	.7368	.5845	.9133
CQ60	16.5354	17.2666	.7716	.6126	.9082
CQ72	16.2913	16.7954	.8529	.7464	.8894

Reliability Coefficients 5 items

Alpha = .9198 Standardized item alpha = .9217



Team Performance-1 (TDS)



Team Performance-1: Group Mean

Team Performance-2 (TMPERF2)

1.	DT57	Tm perf2:	Quality of team decisions and solutions.
2.	DT58	Tm perf2:	Quality of team deliverables (plans, reports, etc.)
3.	DT59	Tm perf2:	Timeliness of team deliverables, e.g., meeting deadlines.
4.	DT62	Tm perf2:	Customer and stakeholder satisfaction - internal or external
5.	DT63	Tm perf2:	Improving business results in the target system.
6.	DT64	Tm perf2:	Overall performance of the team.

Note: Team members rated percent effectiveness in each of the above areas. The specific name of the target system was inserted into each team's survey.

	Mean	Std Dev	Cases
1. DT57	75.5738	16.7253	122.0
2. DT58	69.0820	19.2700	122.0
3. DT59	66.5410	21.2860	122.0
4. DT62	66.0902	22.2855	122.0
5. DT63	68.7951	23.8074	122.0
6. DT64	73.1352	20.1156	122.0

Correlation Matrix

	DT57	DT58	DT59	DT62	DT63	DT64
DT57	1.0000					
DT58	.6842	1.0000				
DT59	.5437	.6774	1.0000			
DT62	.5795	.7101	.6130	1.0000		
DT63	.6011	.7025	.6050	.7054	1.0000	
DT64	.7228	.7951	.7368	.7691	.8210	1.0000

N of Cases = 122.0

Statistics for	Mean	Variance	Std Dev	N of Variables	
Scale	419.2172	11274.3181		106.1806	6

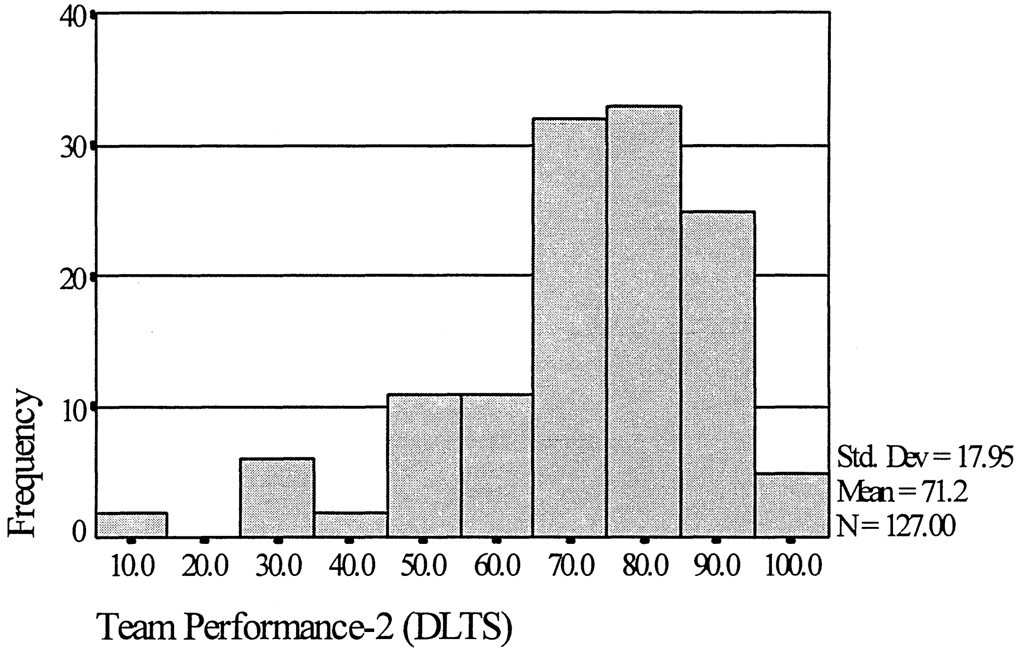
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	69.8695	66.0902	75.5738	9.4836	1.1435	14.0682

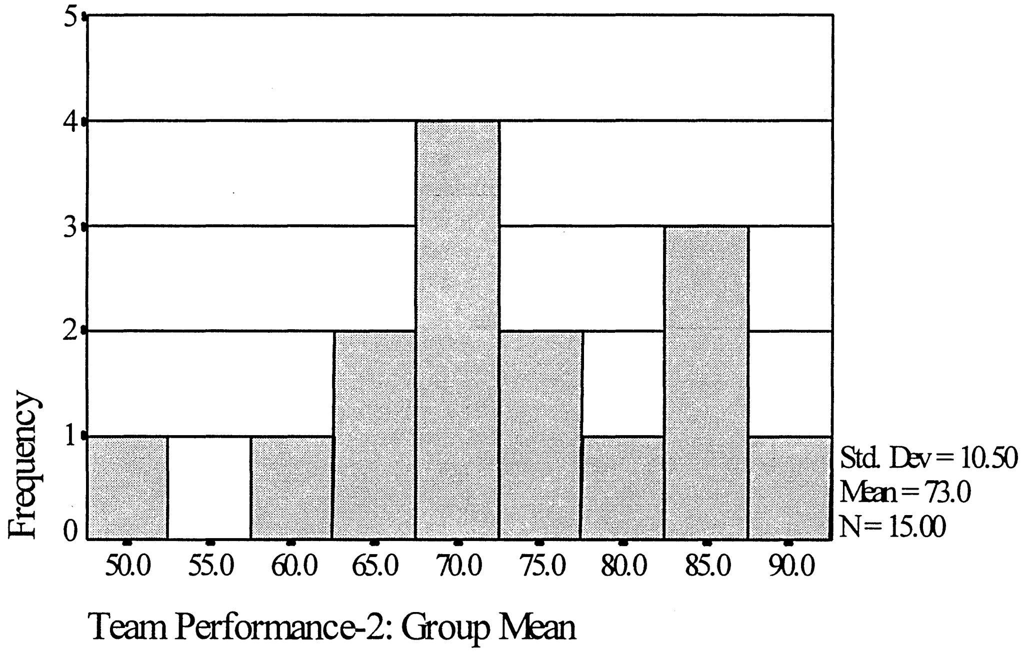
Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
DT57	343.6434	8769.2706	.7104	.5559	.9232
DT58	350.1352	8035.3390	.8301	.6957	.9076
DT59	352.6762	8052.6402	.7247	.5683	.9210
DT62	353.1270	7716.1593	.7820	.6308	.9138
DT63	350.4221	7436.0869	.7968	.6911	.9129
DT64	346.0820	7660.0098	.9116	.8357	.8963

Reliability Coefficients 6 items

Alpha = .9262 Standardized item alpha = .9286


40
30
20
10
0
Frequency
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Std. Dev = 17.95
Mean = 71.2
N = 127.00
Team Performance-2 (DLTS)


5
4
3
2
1
0
Frequency
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
Std. Dev = 10.50
Mean = 73.0
N = 15.00
Team Performance-2: Group Mean

Team satisfaction (TMSATF)

1.	CQ06	Tm Satisf:	I like being part of this team.
2.	CQ32	Tm Satisf:	I am proud to be part of this team.
3.	CQ52R	Tm Satisf:	*I am unhappy on this team.*

	Mean	Std Dev	Cases
1. CQ06	5.0391	1.1392	128.0
2. CQ32	5.0625	1.0777	128.0
3. CQ52R	4.8125	1.3733	128.0

Correlation Matrix

	CQ06	CQ32	CQ52R
CQ06	1.0000		
CQ32	.7228	1.0000	
CQ52R	.7094	.7582	1.0000

N of Cases = 128.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	14.9141	10.5831	3.2532	3

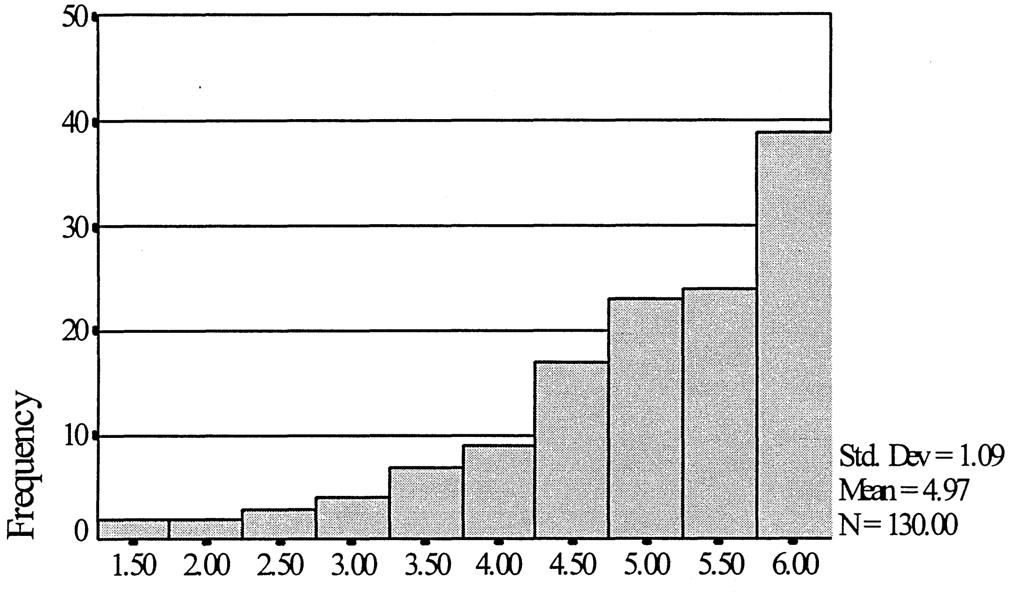
Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	4.9714	4.8125	5.0625	.2500	1.0519	.0191

Item-total Statistics

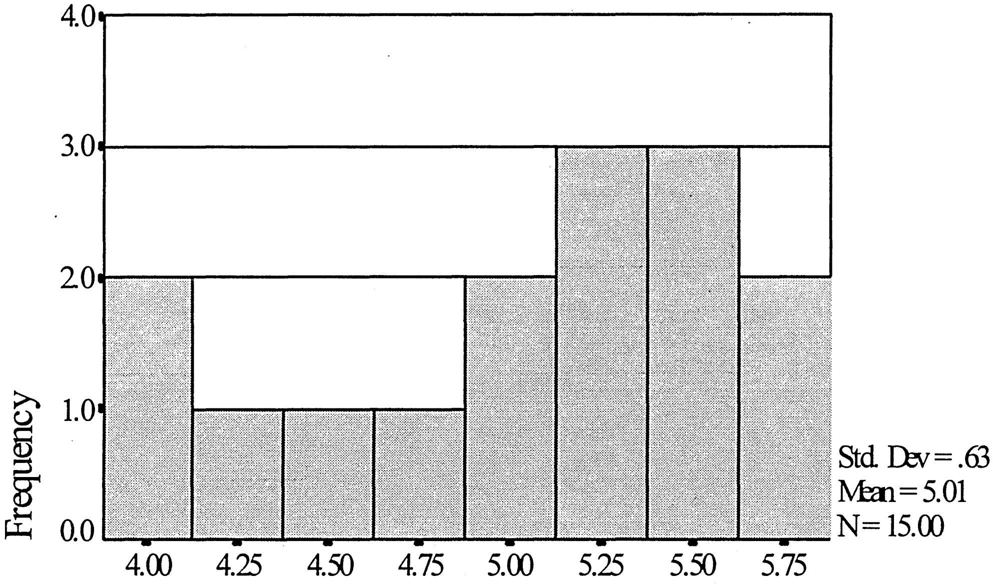
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
CQ06	9.8750	5.2913	.7621	.5837	.8482
CQ32	9.8516	5.4030	.8021	.6437	.8216
CQ52R	10.1016	4.2337	.7898	.6294	.8383

Reliability Coefficients 3 items

Alpha = .8842 Standardized item alpha = .8903



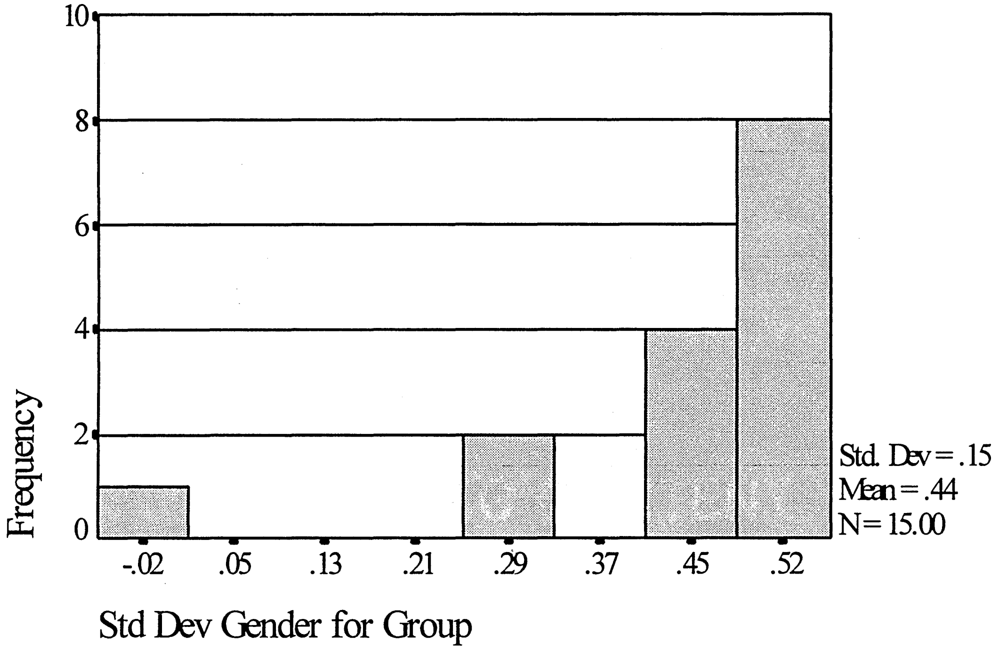
Team Satisfaction



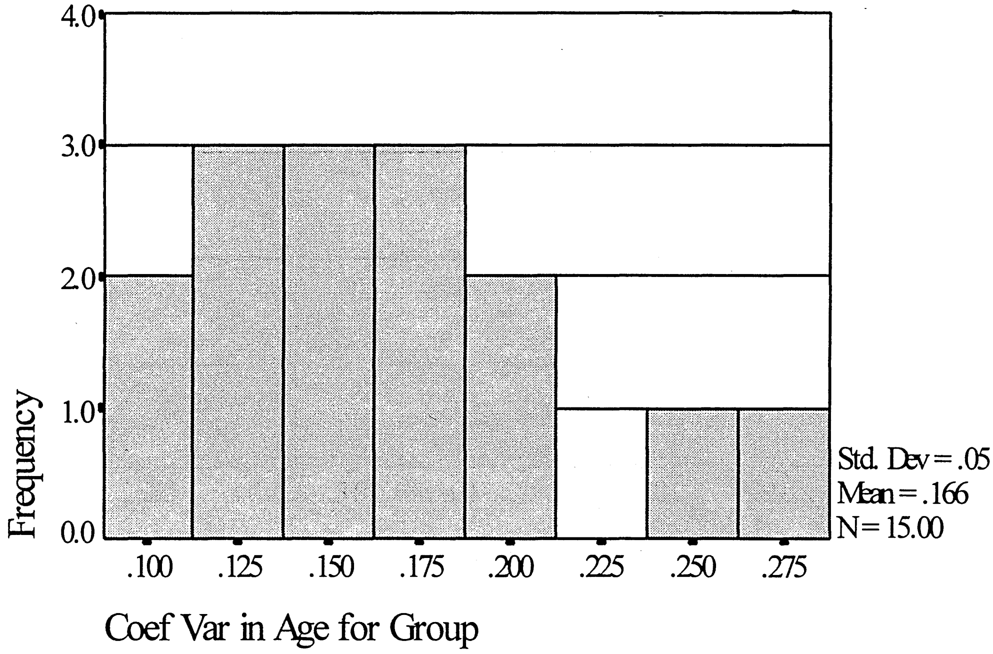
Team Satisfaction: Group Mean

Histograms for Single-Item Questions Used in Data Analysis

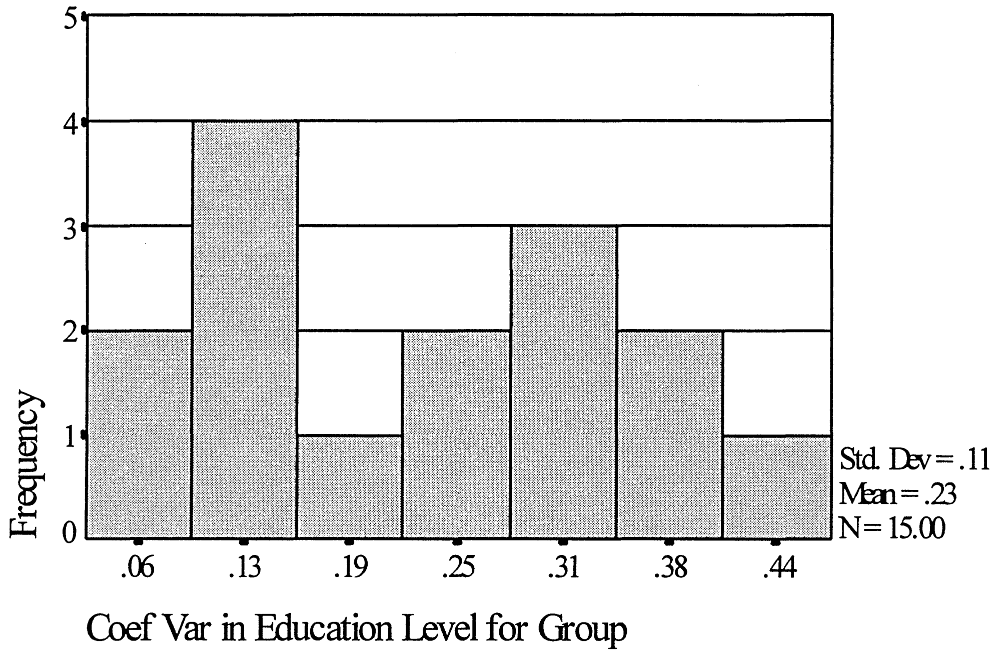
Diversity in Gender (Std Dev) for Team (DMGNDR)



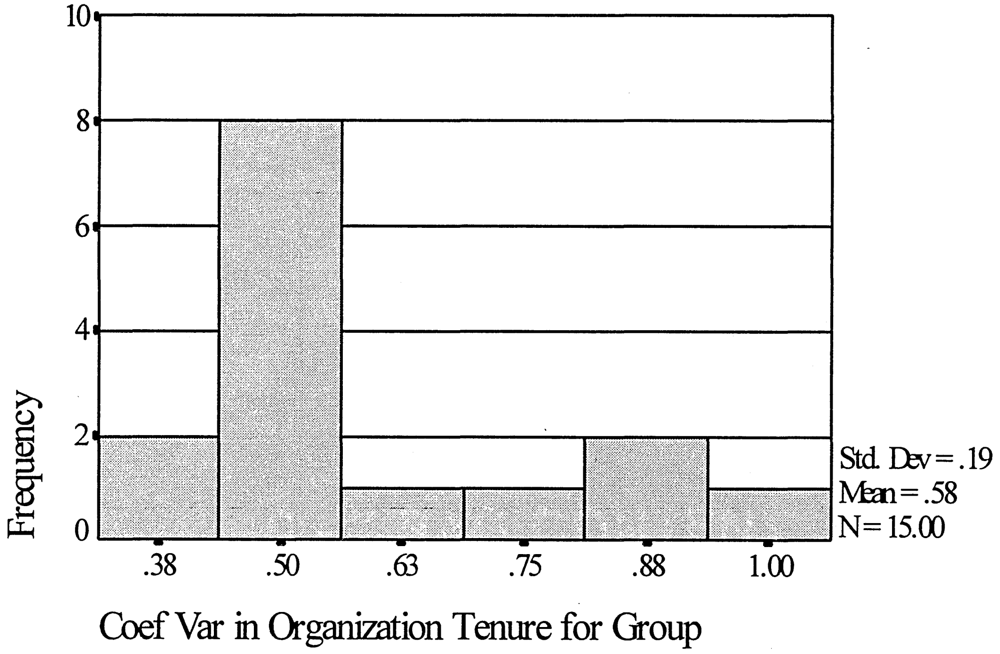
Diversity in Age (Coef Var) for Team (DMAGE)



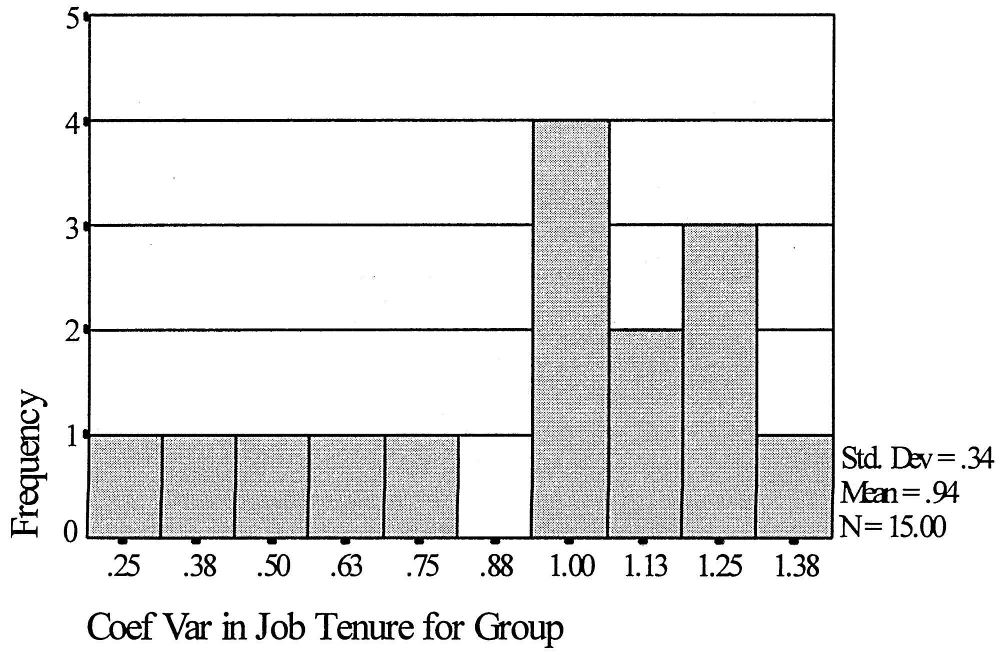
Diversity in Education Level (Coef Var) for Team (DMEDL)



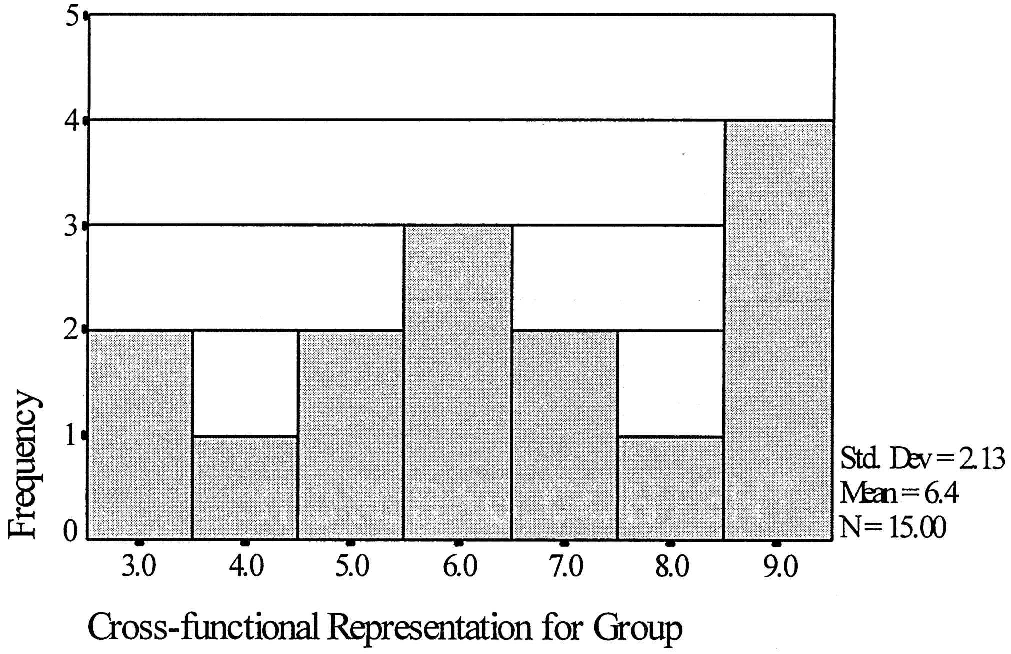
Diversity in Organizational Tenure (Coef Var) for Team (DMORGTEN)



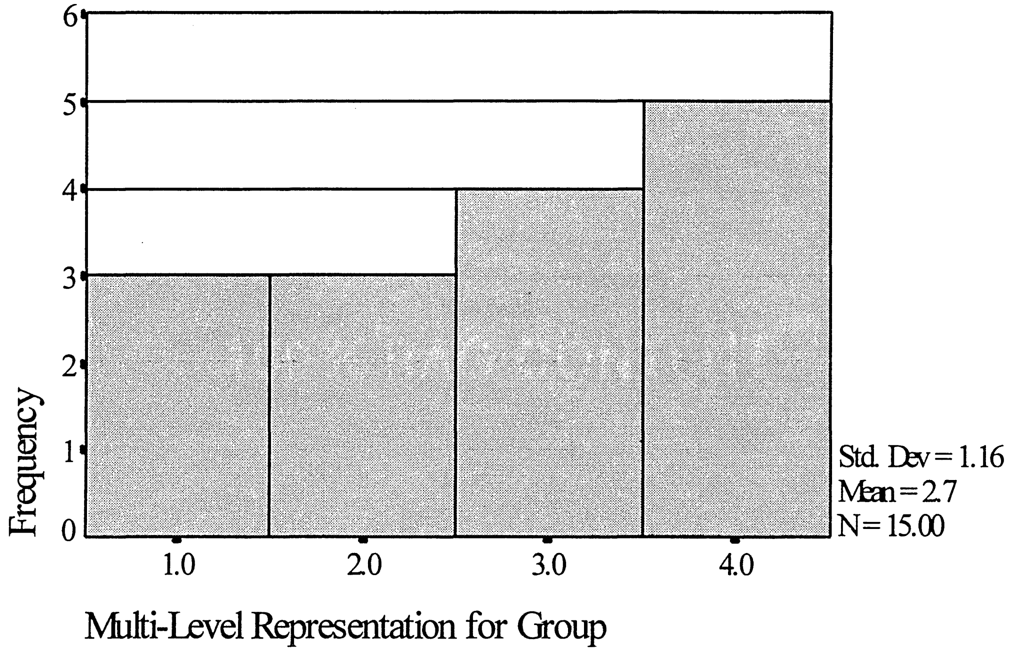
Diversity in Job Tenure (Coef Var) for Team (DMJBTEN)



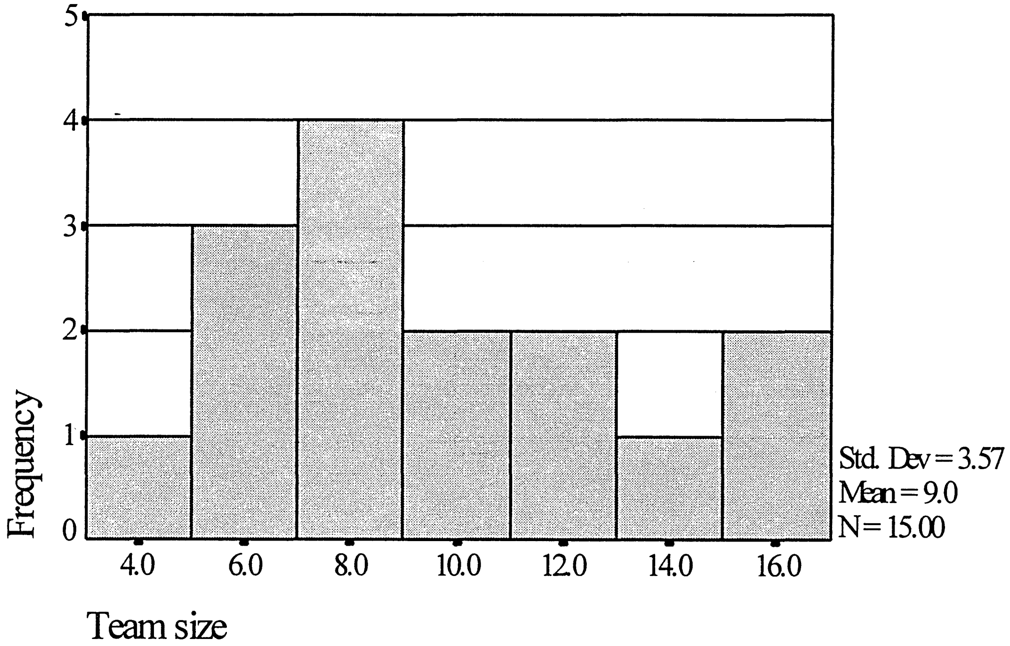
Cross-functional Representation Within Team (XFCNS)



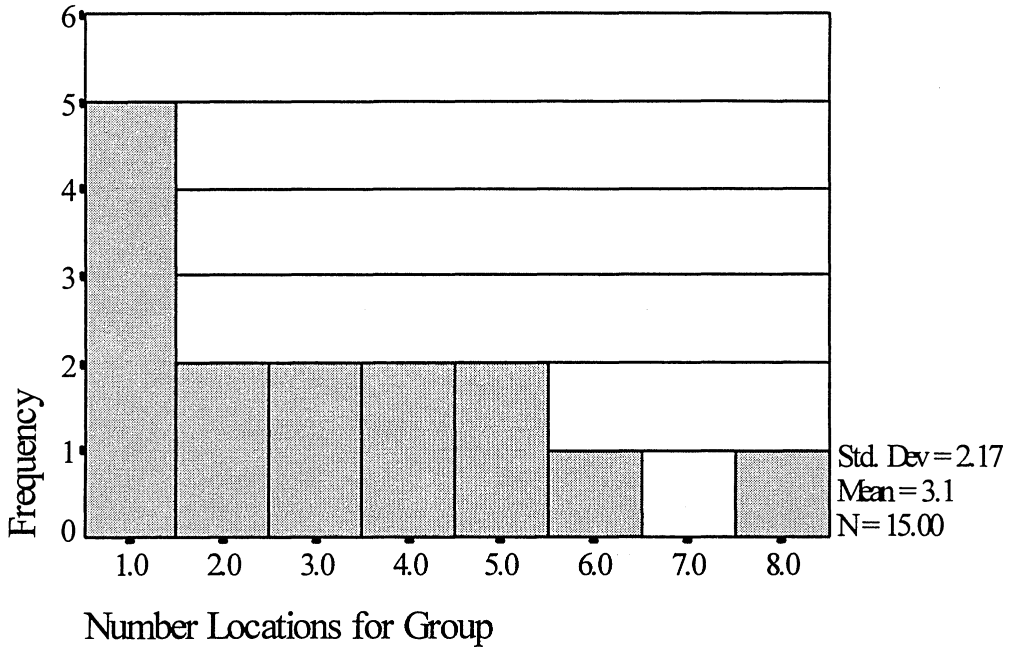
Multi-Level Representation Within Team (MLVLS)



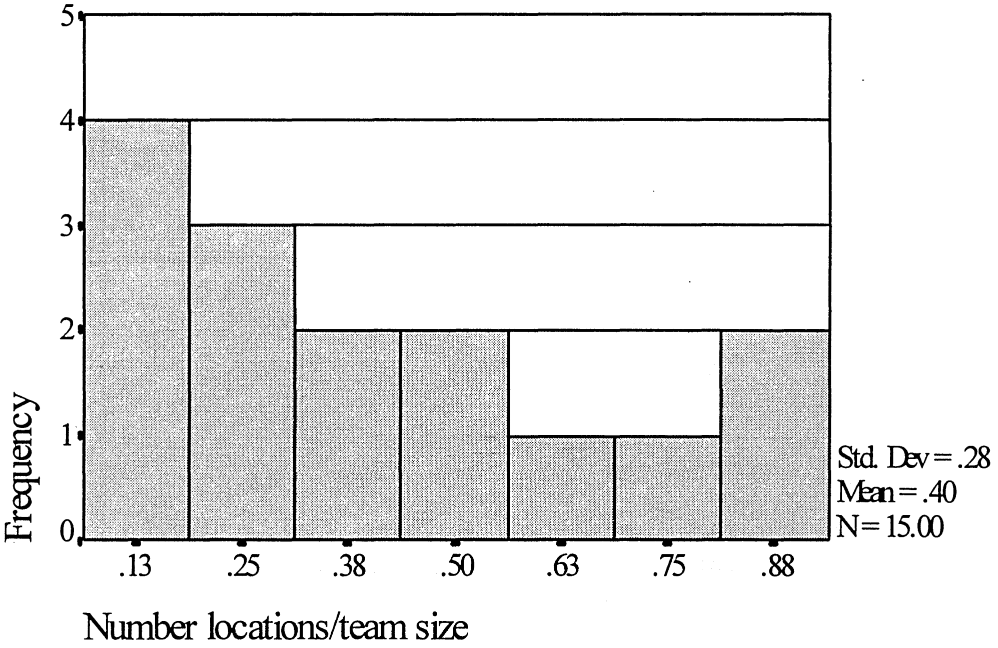
Team Size (TMSIZE)



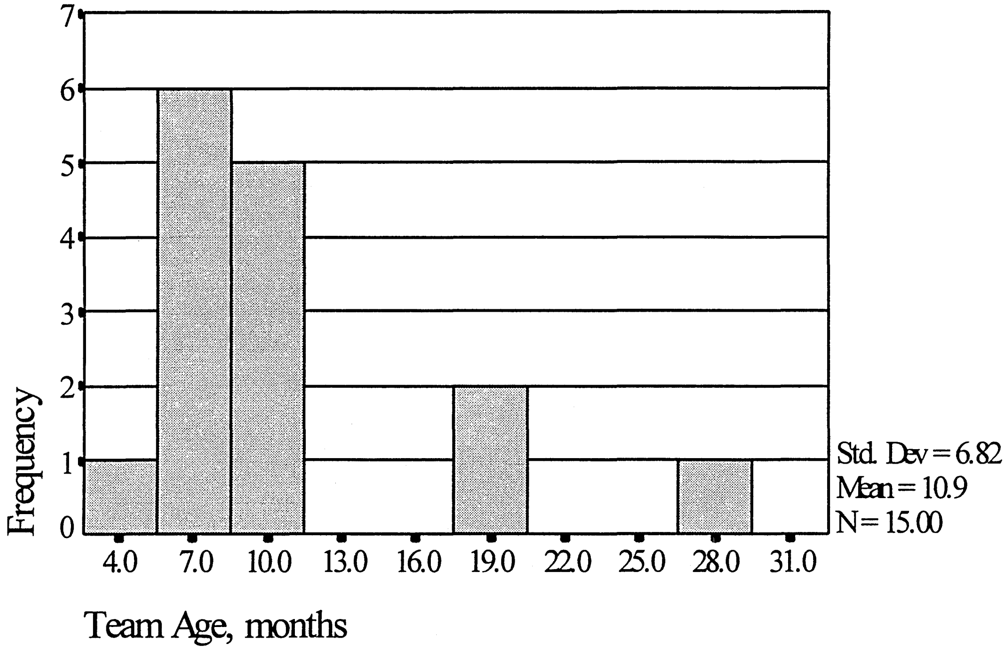
Co-location for Team (no. locations, NLCNS)



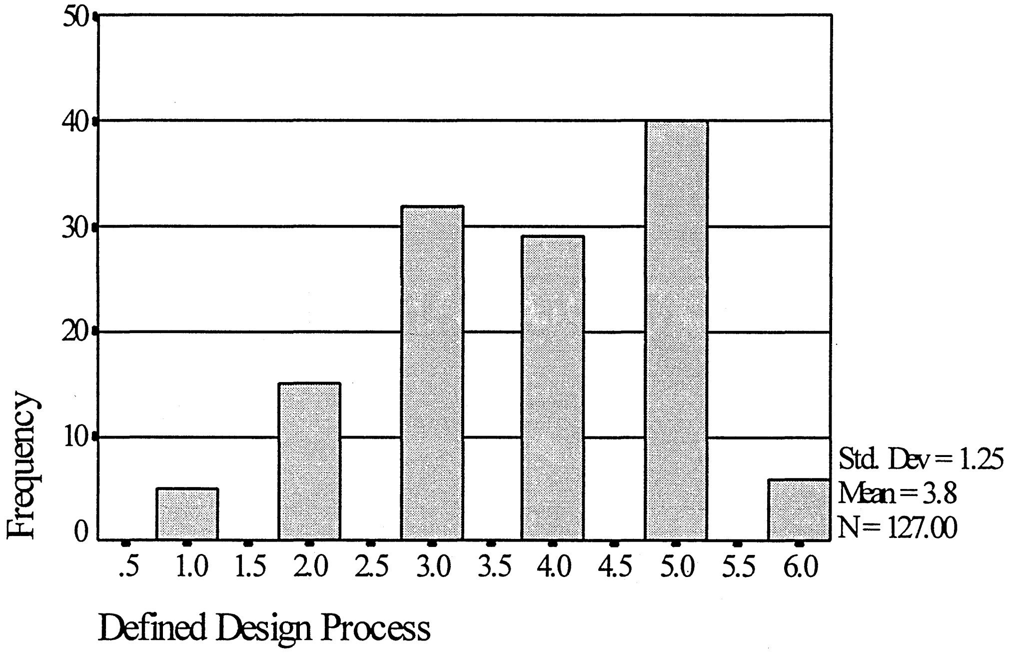
Co-location for Team (no. locations/team size, LCNS_SZ)



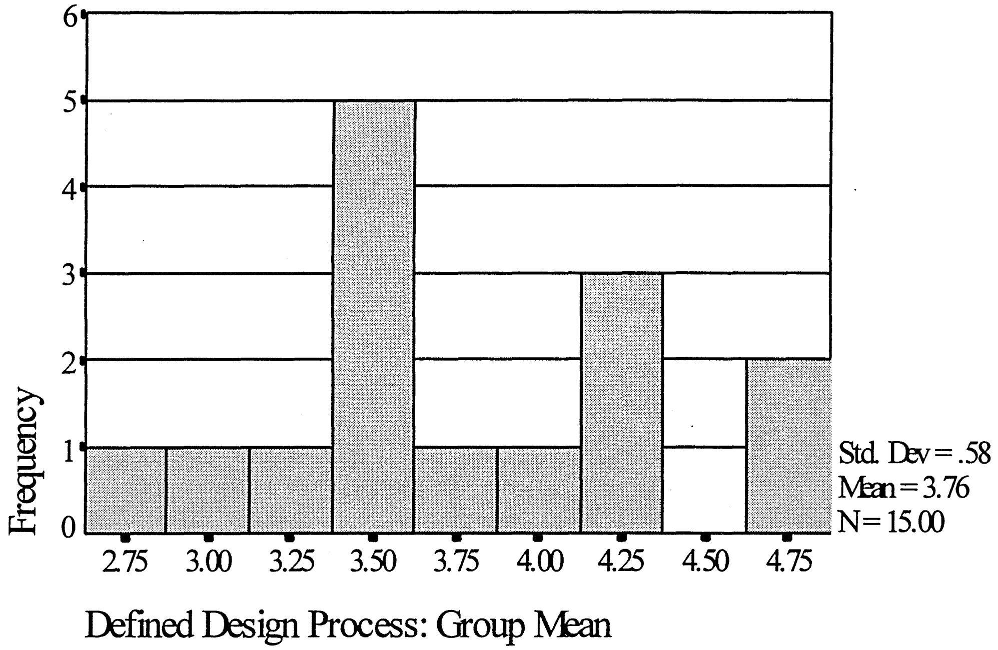
Team Age, months (TMAGE)



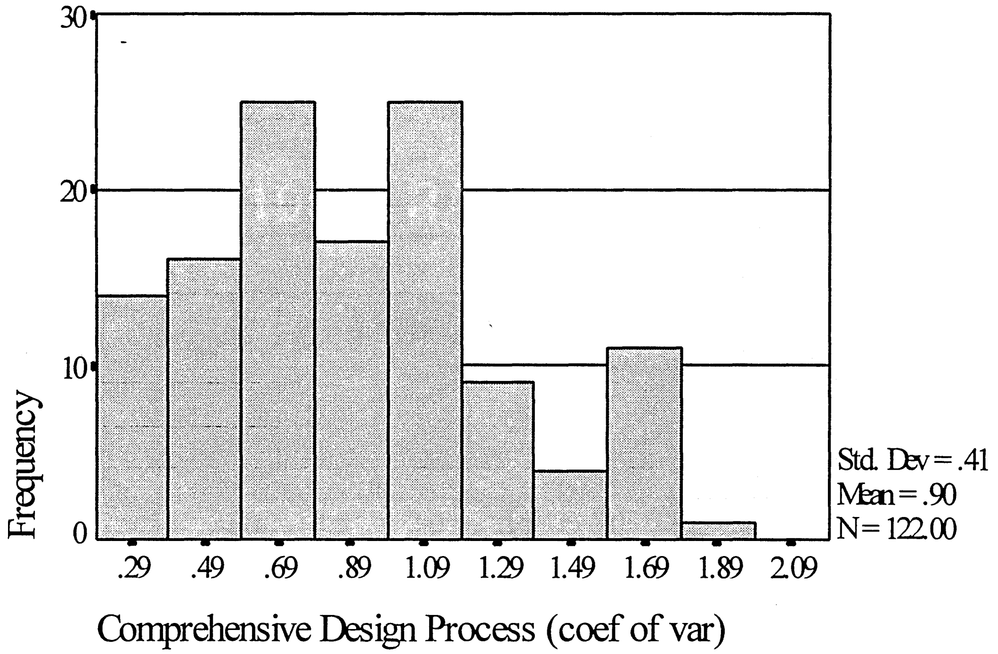
Defined Design Process (DEFPRC)



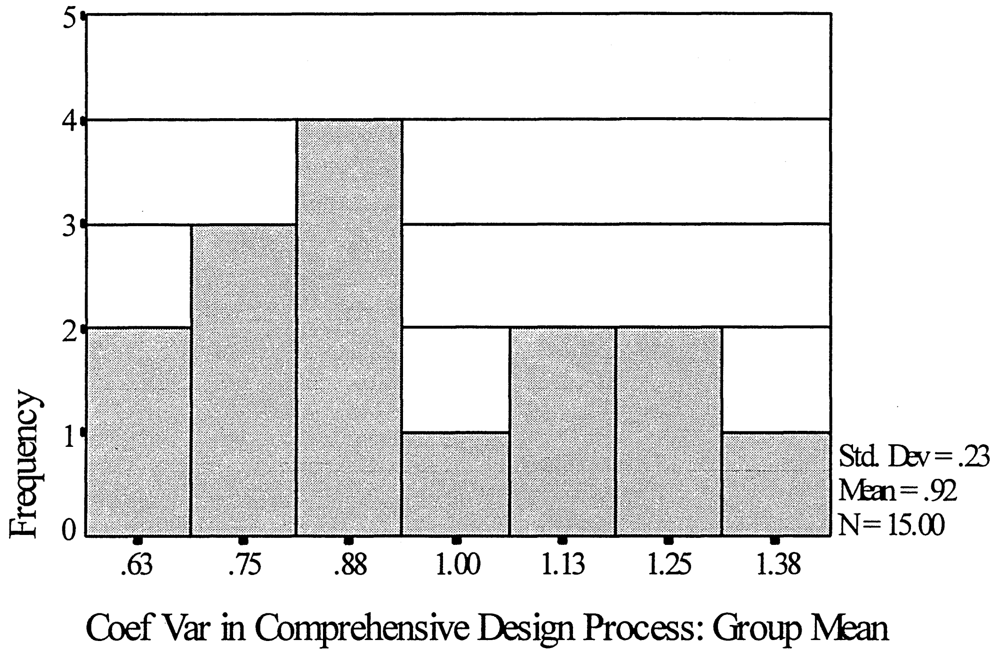
Defined Design Process: Group Mean (DEFPRC)



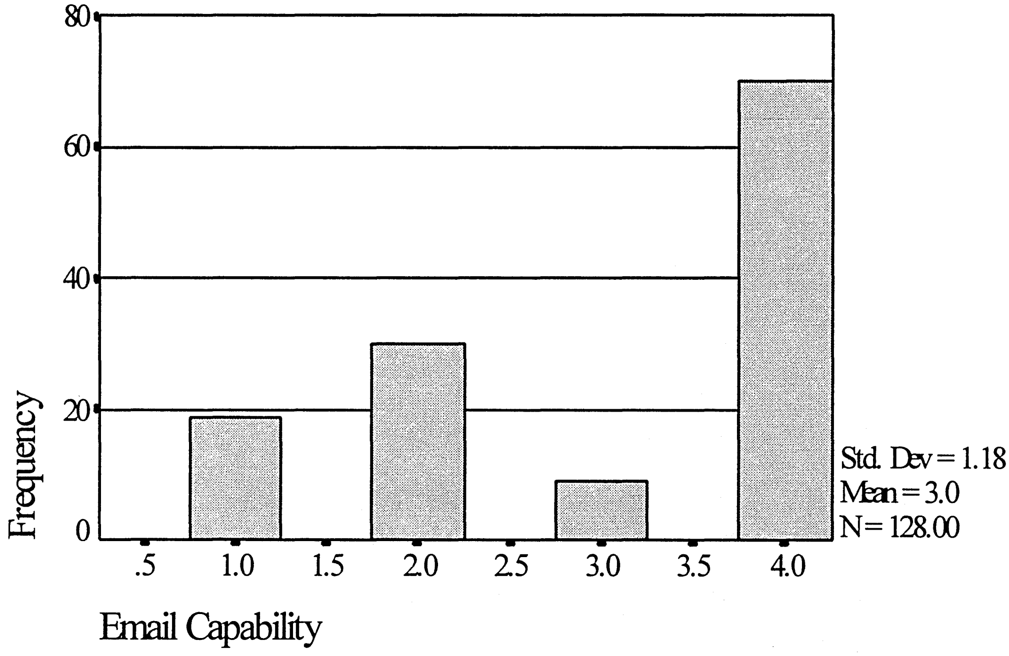
Comprehensive Design Process (coefficient of variation of time spent in design process stages, CMPDES)



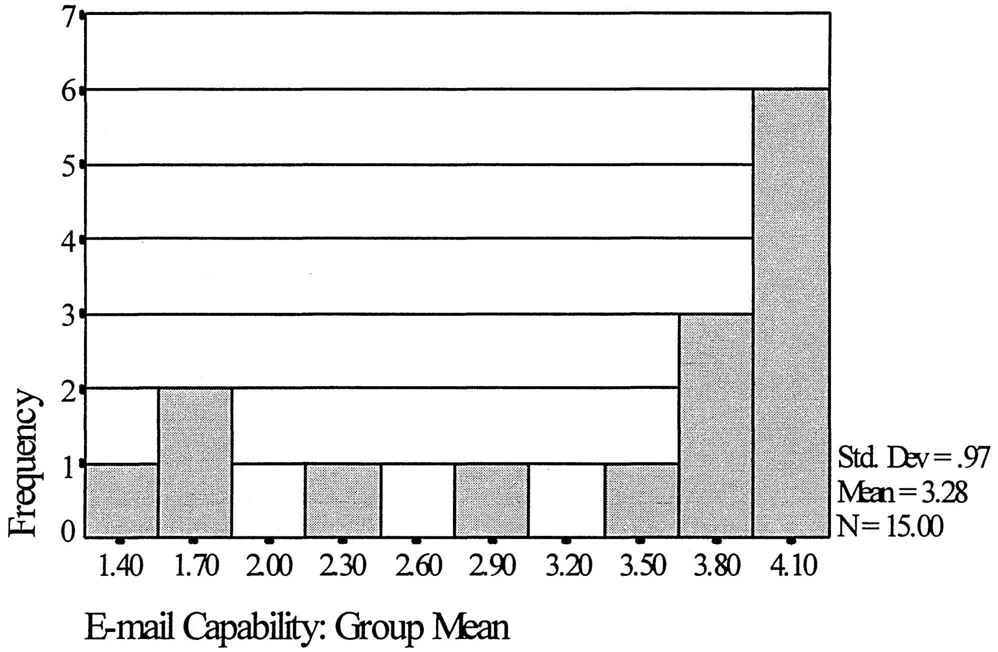
Comprehensive Design Process: Group Mean (CMPDES)



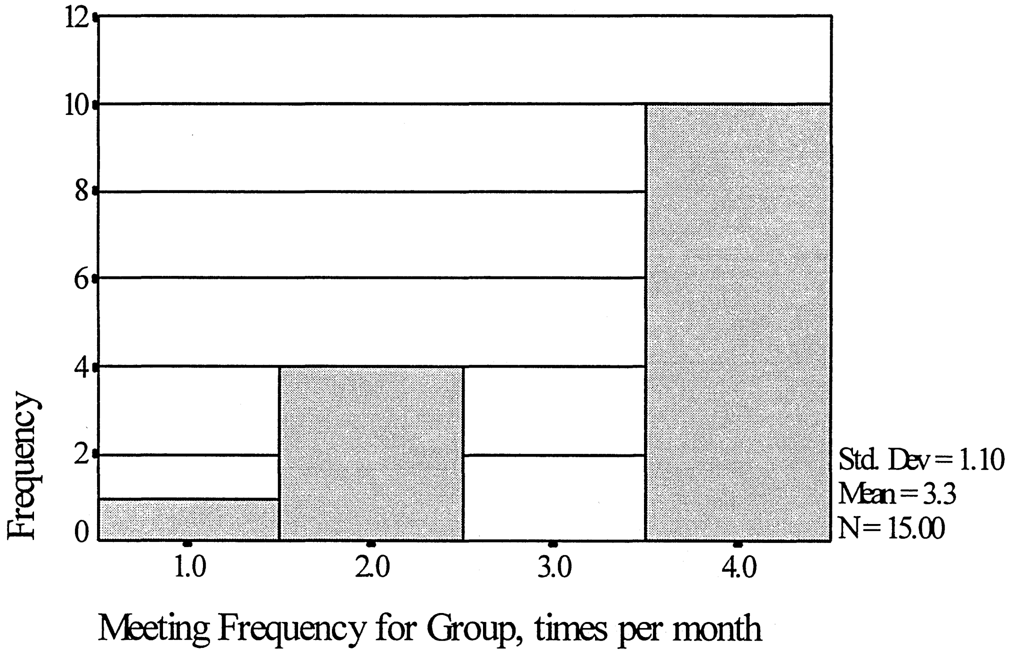
Electronic Mail Capability Within Team (EMAIL)



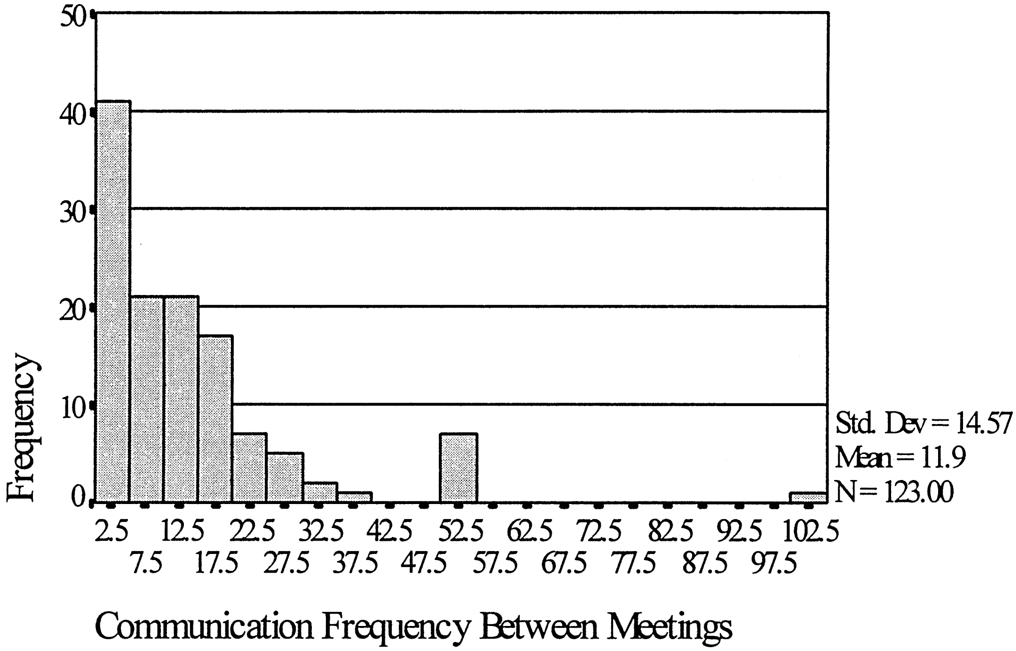
Electronic Mail Capability: Group Mean (EMAIL)



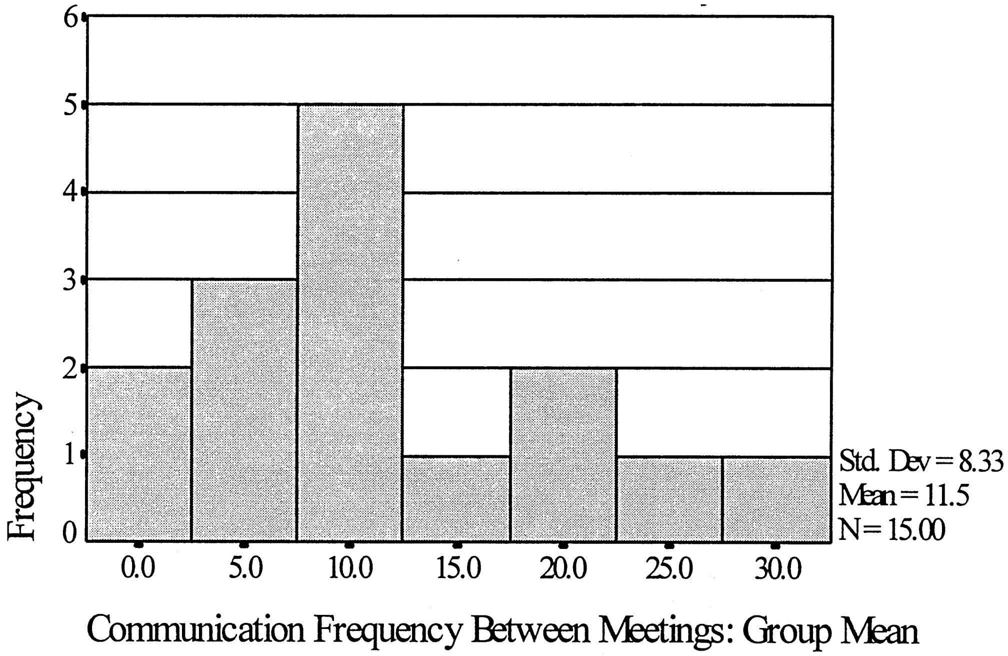
Meeting Frequency for Team, times per month (MTGFRQ)



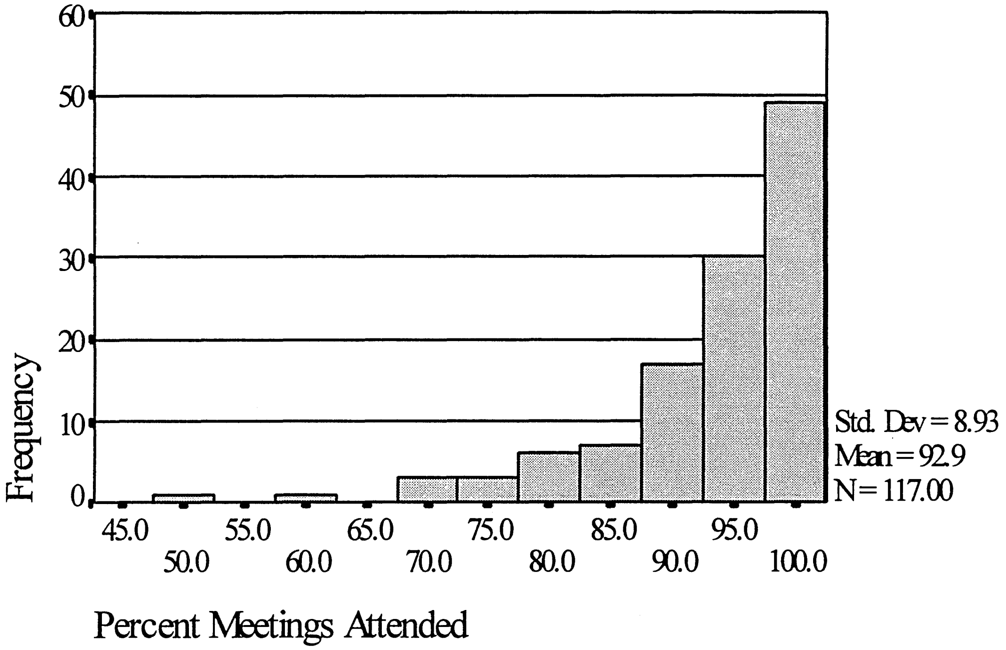
Communication Frequency Between Team Meetings (CMFRQ)



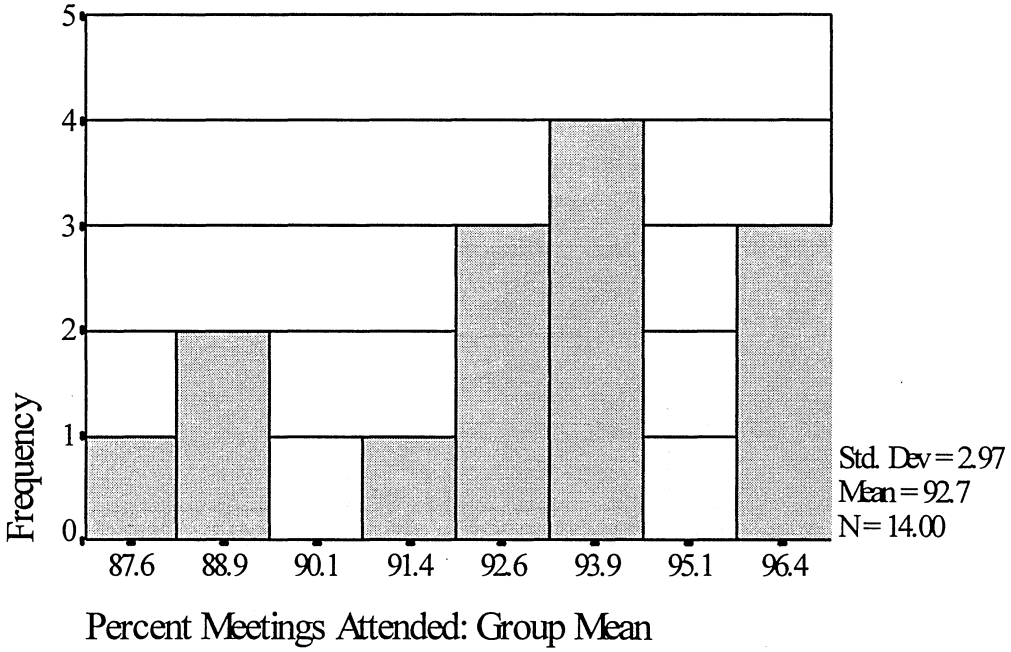
Communication Frequency Between Team Meetings - Group Mean (CMFRQ)



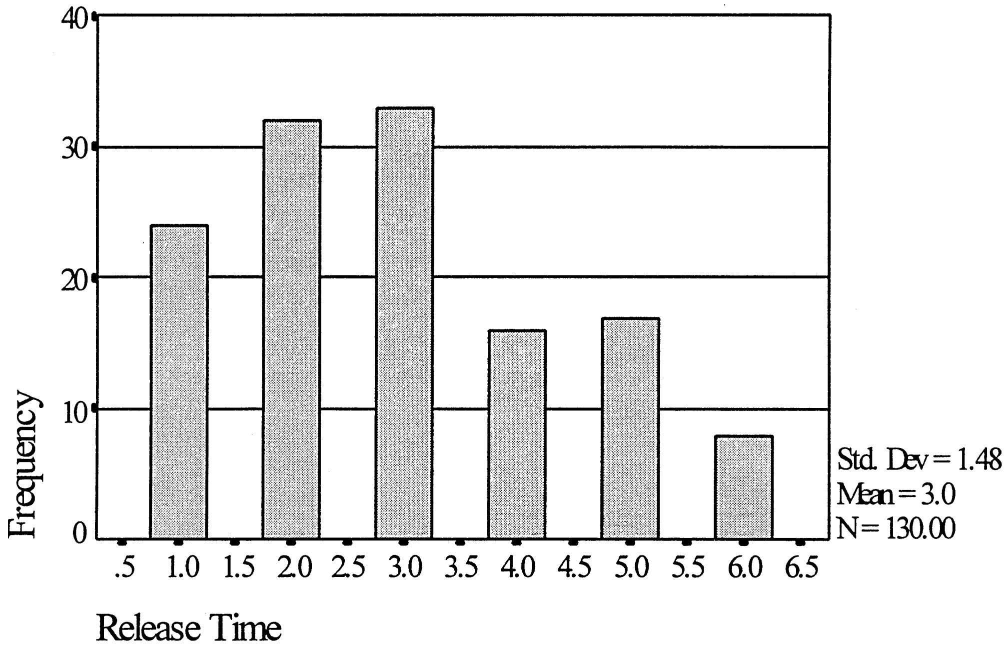
Percent Meetings Attended (MTGATN)



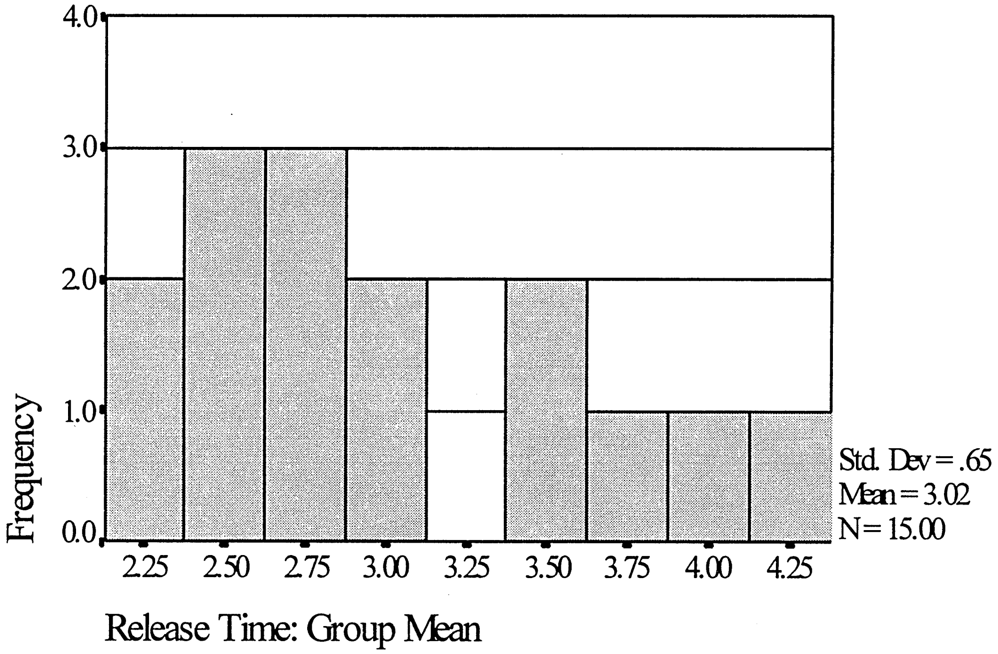
Percent Meetings Attended: Group Mean (MTGATN)



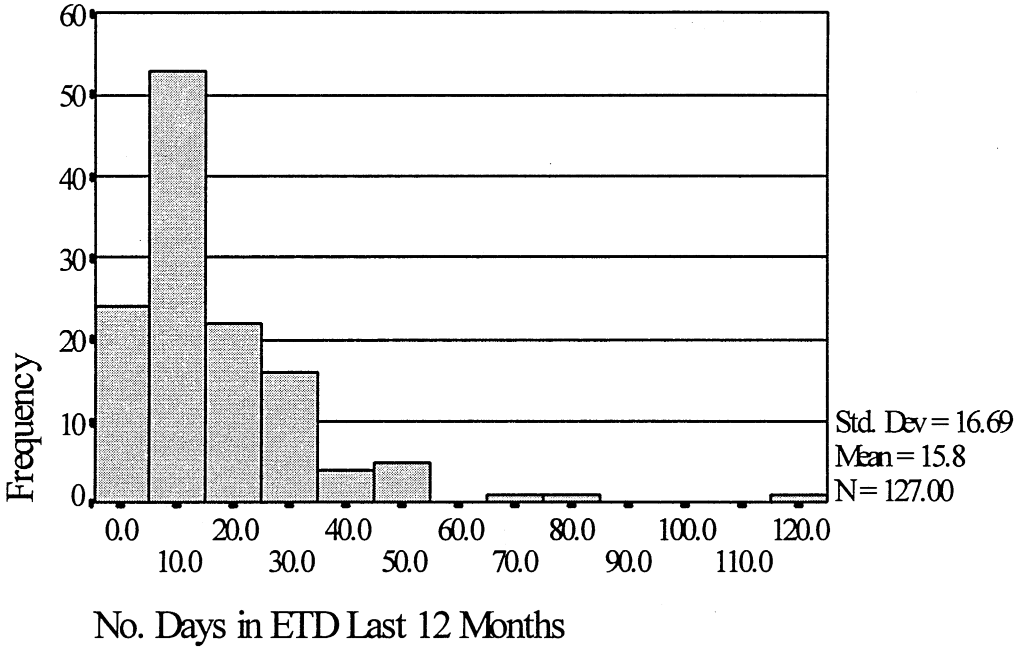
Release Time (RELTIME)



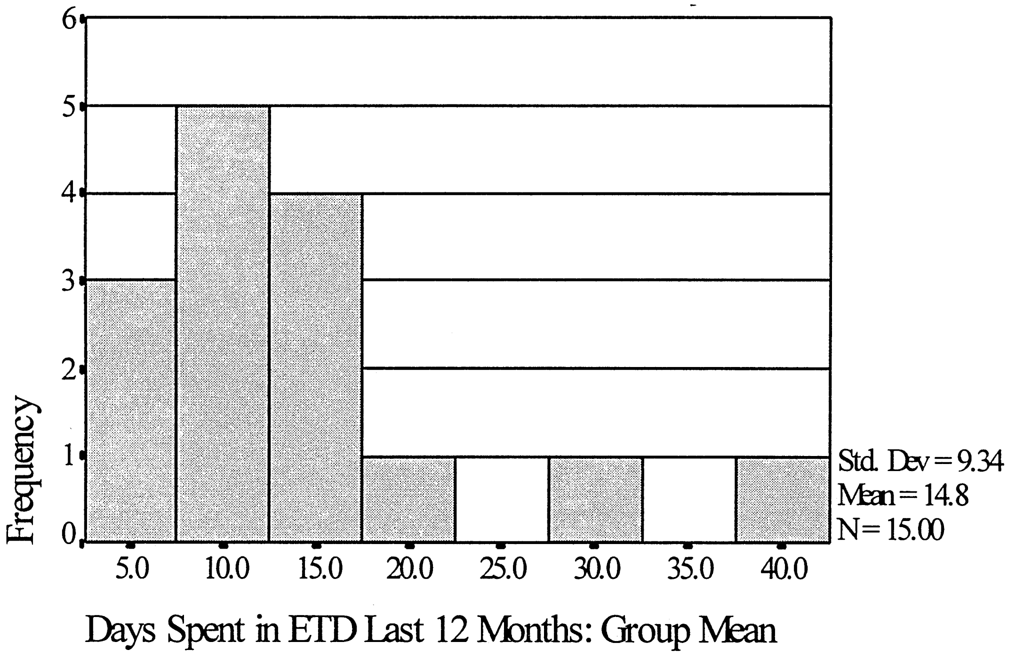
Release Time - Group Mean (RELTIME)



Time Spent in ETD Last 12 Months (ETDTIME)

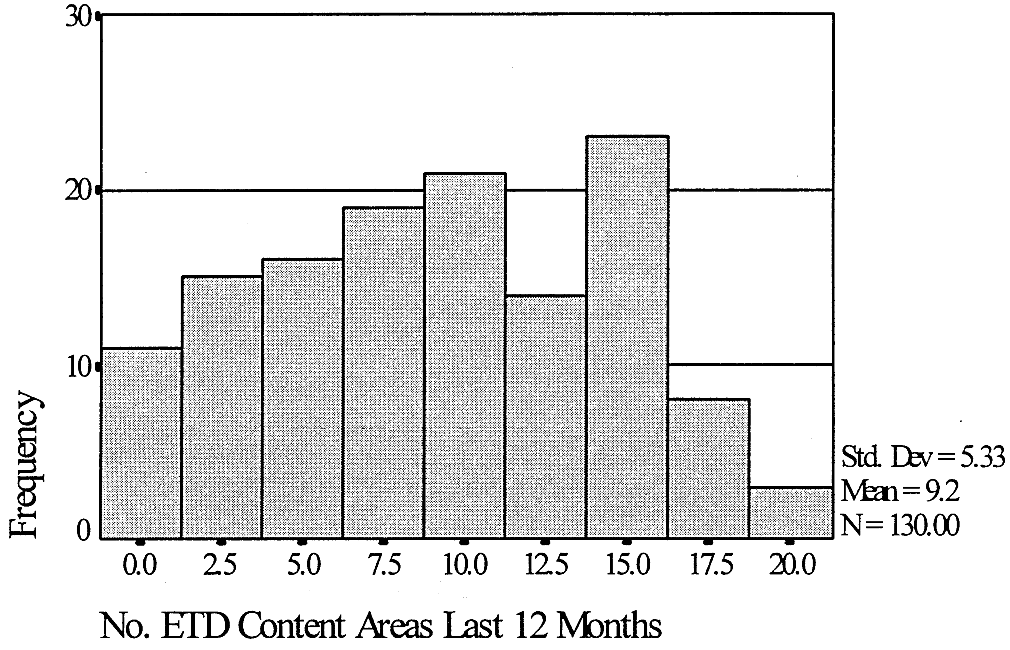


Time Spent in ETD Last 12 Months - Group Mean (ETDTIME)

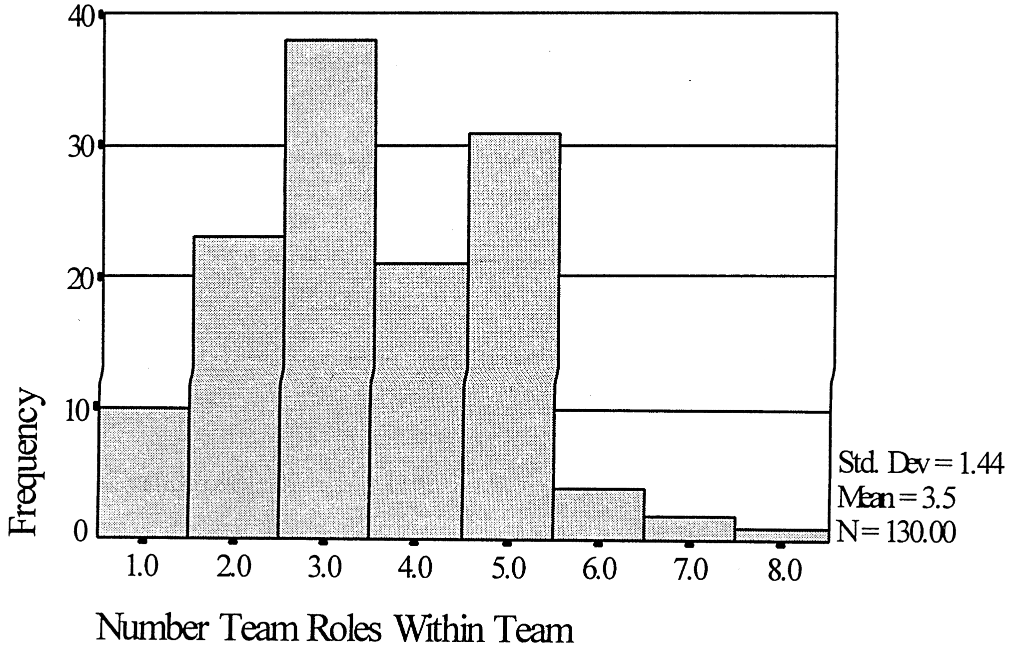


Additional Survey Data Collected

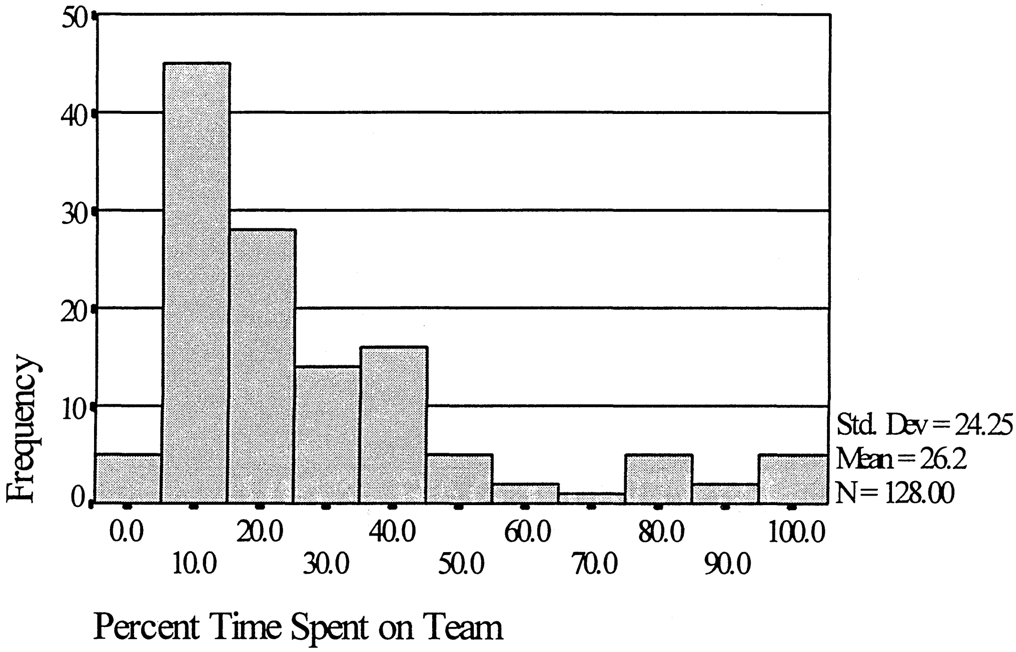
Number ETD Content Areas Received Last 12 Months (ETDCON)



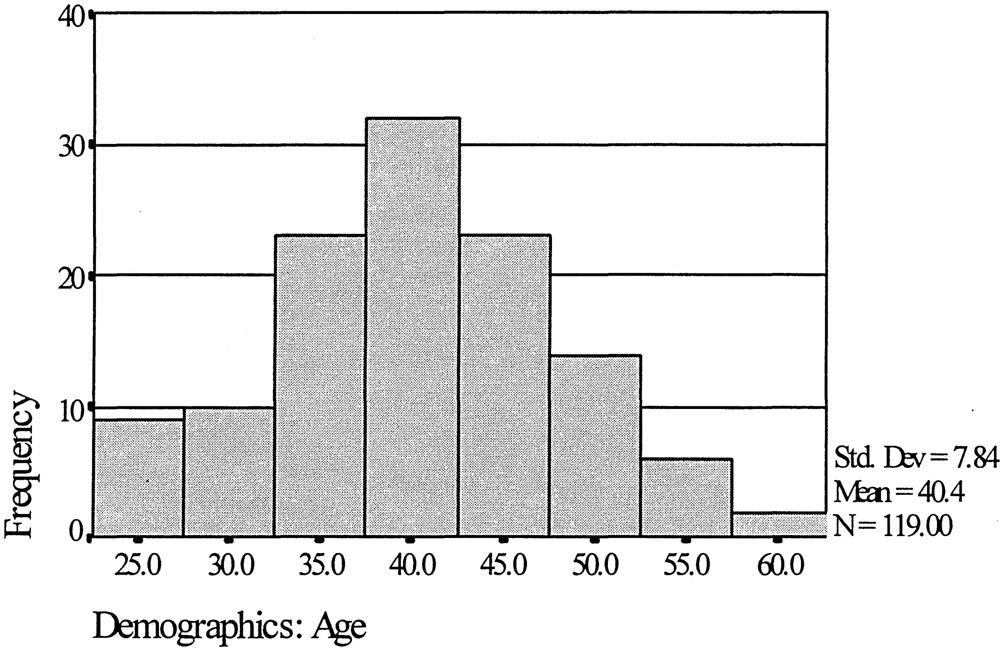
Number of Formal Team Roles Used (NOROLES)

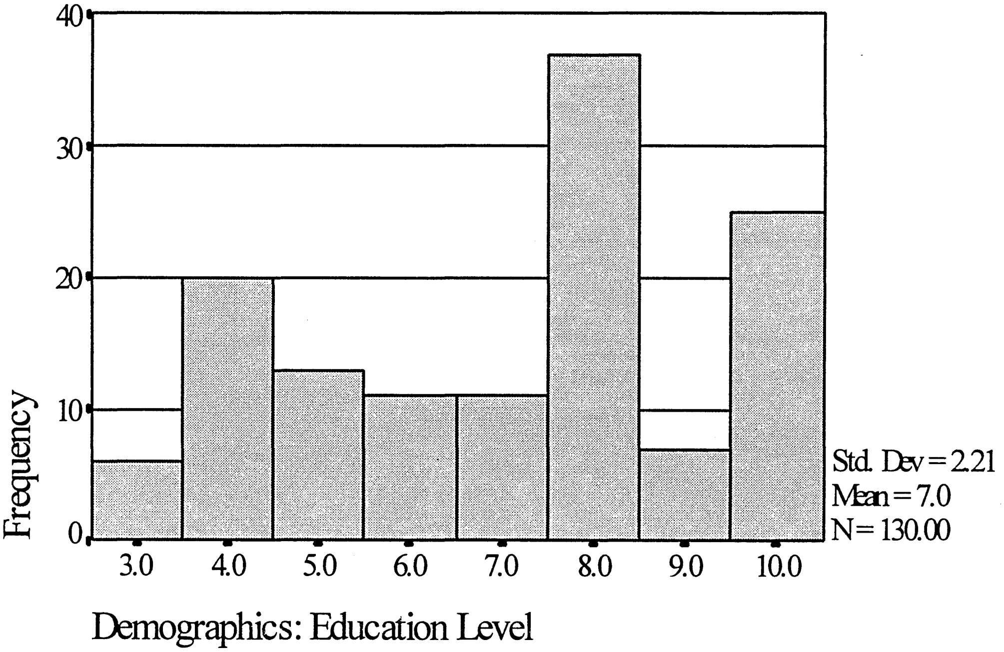


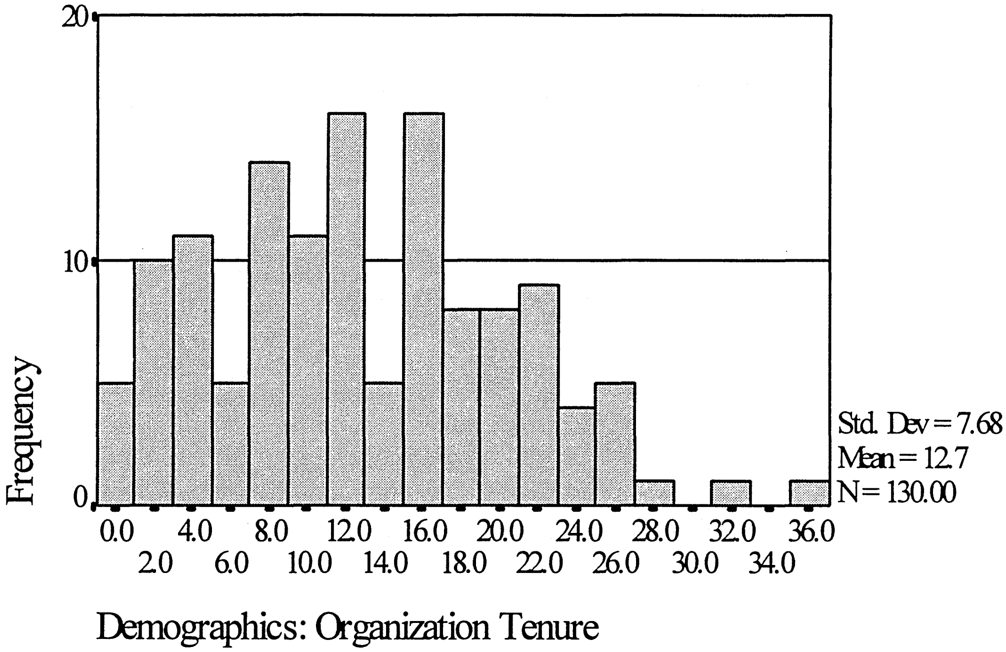
Percent Time Spent on Team (PRCTIME)

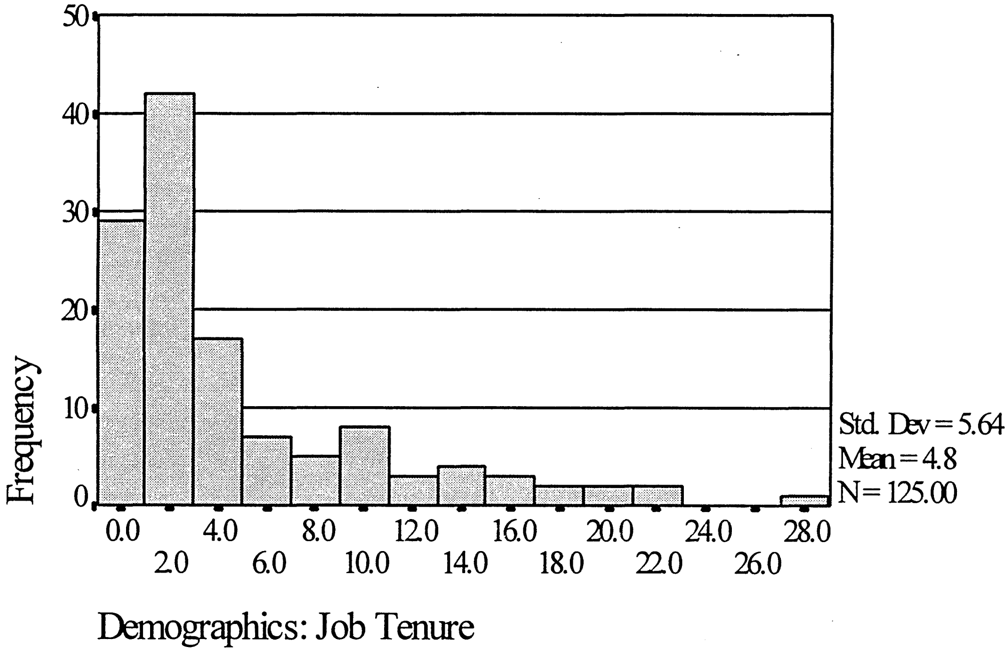


Histograms of Demographic Variables for Teams






20
10
0
Frequency
Std. Dev = 7.68
Mean = 12.7
N = 130.00
0.0 4.0 8.0 12.0 16.0 20.0 24.0 28.0 32.0 36.0
2.0 6.0 10.0 14.0 18.0 22.0 26.0 30.0 34.0
Demographics: Organization Tenure


50
40
30
20
10
0
Frequency
Std. Dev = 5.64
Mean = 4.8
N = 125.00
0.0 4.0 8.0 12.0 16.0 20.0 24.0 28.0
2.0 6.0 10.0 14.0 18.0 22.0 26.0
Demographics: Job Tenure

Appendix E Calculations for Within and Between Analysis

This appendix contains the SPSS output and data for results summarized in Chapter 4. Specifically, the following are included:

- The SPSS output for the calculation of *eta*-between and *eta*-within, used to address Research Question 2, and used for Within and Between Analysis in Research Question 4;
- For each relationship between independent variables (design features) and dependent variables examined using Within and Between Analysis, three correlations were used (and are included here): the total correlation, the between-team correlation, and the within-team correlations between two variables;
- The calculation of the Z-statistic for examining the difference between the between-team and within-team correlations; and
- WABA calculations for relationships between additional variables to ensure technical completeness when reporting the between-team correlations in Chapter 4 (these WABA tables were not included in section 4.4.2 in Chapter 4).

E.1. *Eta*-Between and *Eta*-Within Correlations

The *eta*-between and *eta*-within correlations were determined using the total data file of n=130 individuals. A series of one-way analyses of variance (ANOVAs) was run treating each independent variable (design feature) as a dependent variable and team number as a factor with 15 levels. This analysis to determine the *eta*-between for a variable was used to determine whether there were significant differences between teams for a given variable, and therefore, whether it was appropriate to aggregate data using a group mean to represent a team. These results were reported in Chapter 4, Research Question 2, and were also used for the Within and Between Analysis to address Research Question 4. The command lines from SPSS are also shown below.

SPSS Command Lines

```
ONEWAY
BY tm_no(1 15)
HARMONIC NONE
FORMAT NOLABELS
MISSING ANALYSIS
```

The following formulas were used:

$$R\text{-}square = \frac{Between\ groups\ sums\ of\ squares}{Total\ sums\ of\ squares}$$

$$Eta - between = \sqrt{R - square}$$

$$Eta - within = \sqrt{1 - (R - square)}$$

Variable **ODMAGE** Demographics, Age, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	1902.1891	135.8706	2.9235	.0008
Within Groups	115	5344.6345	46.4751		
Total	129	7246.8235			

R-square= (1902.1891)/(7246.8325)=.2625
Eta-between= .5123
Eta-within= .8588

Variable **ODMEDL** Demographics, Education Level
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	310.6811	22.1915	8.0220	.0000
Within Groups	115	318.1266	2.7663		
Total	129	628.8077			

R-square= (310.6811)/(628.8077)= .4941
Eta-between= .7029
Eta-within= .7127

Variable **ODMORGTEN** Demographics, Organization Tenure
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	1914.1661	136.7262	2.7626	.0015
Within Groups	115	5691.4886	49.4912		
Total	129	7605.6548			

R-square= (1914.1661)/(7605.6548)=.2517
Eta-between= .5017
Eta-within= .8650

Variable **ODMJOBTEN** Demographics, Job Tenure, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	642.8982	45.9213	1.5967	.0903
Within Groups	115	3307.4329	28.7603		
Total	129	3950.3311			

R-square= (642.8982)/(3950.3311)= .1627
Eta-between= .4034
Eta-within= .9150

Variable **TMSKLS** Team Skills
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	37.9463	2.7104	4.5984	.0000
Within Groups	115	67.7842	.5894		
Total	129	105.7305			

R-square= (37.9463)/(105.7305)= .3589
Eta-between= .5991
Eta-within= .8007

Variable **INDGLS** Individual Goals
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	24.9713	1.7837	2.3821	.0060
Within Groups	115	86.1090	.7488		
Total	129	111.0803			

R-square= (24.9713)/(111.0803)= .2248
Eta-between= .4741
Eta-within= .8805

Variable **DEFPRC** Defined Design Process, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	38.8278	2.7734	2.0282	.0213
Within Groups	115	157.2510	1.3674		
Total	129	196.0787			

R-square= (38.8278)/(196.0787)= .1980
Eta-between= .4449
Eta-within= .8955

Variable **SYSPERS** Systemic Perspective
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	15.1471	1.0819	2.7874	.0013
Within Groups	115	44.6372	.3881		
Total	129	59.7843			

R-square= (15.1471)/(59.7843)= .2534
Eta-between= .5034
Eta-within= .8641

Variable **CMPDES** Comprehensive Design Process, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	5.8820	.4201	3.3768	.0001
Within Groups	115	14.3083	.1244		
Total	129	20.1904			

R-square= (5.8820)/(20.1904)= .2913
Eta-between= .5397
Eta-within= .8418

Variable **TMCMT**		Commitment to Team			
By Variable TM_NO		Team number			
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	33.1811	2.3701	3.7731	.0000
Within Groups	115	72.2369	.6281		
Total	129	105.4180			
R-square=	(33.1811)/(105.4180)=		.3148		
Eta-between=			.5610		
Eta-within=			.8278		

Variable **TMUNTY**		Team Unity			
By Variable TM_NO		Team number			
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	54.3925	3.8852	7.1648	.0000
Within Groups	115	62.3594	.5423		
Total	129	116.7519			
R-square=	(54.3925)/(116.7519)=		.4659		
Eta-between=			.6826		
Eta-within=			.7308		

Variable **TMASSMNT**		Team Self-Assessment			
By Variable TM_NO		Team number			
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	33.2055	2.3718	3.5895	.0001
Within Groups	115	75.9890	.6608		
Total	129	109.1945			
R-square=	(33.2055)/(109.1945)=		.3041		
Eta-between=			.5514		
Eta-within=			.8342		

Variable **TMDEC**	Team Decision Processes				
By Variable TM_NO	Team number				
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	24.3367	1.7383	3.8835	.0000
Within Groups	115	51.4765	.4476		
Total	129	75.8132			
R-square=	(24.3367)/(75.8132)=		.3210		
Eta-between=			.5666		
Eta-within=			.8240		

Variable **TMROLES**	Team Roles				
By Variable TM_NO	Team number				
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	23.4777	1.6770	2.3302	.0072
Within Groups	115	82.7618	.7197		
Total	129	106.2395			
R-square=	(23.4777)/(106.2395)=		.2209		
Eta-between=			.4701		
Eta-within=			.8827		

Variable **TMLDR**	Team Leadership				
By Variable TM_NO	Team number				
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	22.7951	1.6282	2.7968	.0013
Within Groups	115	66.9496	.5822		
Total	129	89.7448			
R-square=	(22.7951)/(89.7448)=		.2540		
Eta-between=			.5040		
Eta-within=			.8637		

Variable **EMAIL** Email Capability
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	133.7382	9.5527	25.5611	.0000
Within Groups	113	42.2306	.3737		
Total	127	175.9687			

R-square=	(133.7382)/(175.9687)=	.7600
Eta-between=		.8718
Eta-within=		.4899

Variable **CMFRQ** Frequency Communication Between Meetings, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	6418.2572	458.4469	2.7061	.0018
Within Groups	115	19482.2378	169.4108		
Total	129	25900.4950			

R-square=	(6418.2572)/(25900.4950)=	.2478
Eta-between=		.4978
Eta-within=		.8673

Variable **MTGATN** Meeting Attendance
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	13	867.5536	66.7349	.8205	.6376
Within Groups	103	8377.9512	81.3393		
Total	116	9245.5048			

R-square=	(867.5536)/(9245.5048)=	.0938
Eta-between=		.3063
Eta-within=		.9519

Variable **CLRSPNEX**		Clarity Sponsor Expectations			
By Variable TM_NO		Team number			
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	45.7724	3.2695	4.8318	.0000
Within Groups	115	77.8145	.6766		
Total	129	123.5869			
R-square=	(45.7724)/(123.5969)=		.3704		
Eta-between=			.6086		
Eta-within=			.7935		

Variable **STKINF**		Stakeholders Informed, mv			
By Variable TM_NO		Team number			
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	39.6601	2.8329	3.3045	.0002
Within Groups	115	98.5880	.8573		
Total	129	138.2481			
R-square=	(39.6601)/(138.2481)=		.2869		
Eta-between=			.5357		
Eta-within=			.8444		

Variable **CMTBLD**		Commitment Building			
By Variable TM_NO		Team number			
Analysis of Variance					
		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	14	40.9111	2.9222	4.6200	.0000
Within Groups	115	72.7387	.6325		
Total	129	113.6498			
R-square=	(40.9111)/(113.6498)=		.3560		
Eta-between=			.6000		
Eta-within=			.8025		

Variable **INTRORG** Inter-organizational Perspective
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	24.9048	1.7789	2.7563	.0015
Within Groups	115	74.2200	.6454		
Total	129	99.1248			

R-square= (24.9048)/(99.1248)= .2512
Eta-between= .5012
Eta-within= .8653

Variable **RELTIME** Release Time
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	39.0405	2.7886	1.3106	.2118
Within Groups	115	244.6825	2.1277		
Total	129	283.7231			

R-square= (39.0405)/(283.7231)= .1376
Eta-between= .3709
Eta-within= .9287

Variable **ETDTIME** No. Days in ETD Last 12 Months, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	9916.3596	708.3114	3.2347	.0002
Within Groups	115	25182.0734	218.9746		
Total	129	35098.4331			

R-square= (9916.3596)/(35098.4331)= .2825
Eta-between= .5315
Eta-within= .8471

Variable **ORGSPTTM** Organization Support to Team
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	44.8309	3.2022	7.1043	.0000
Within Groups	115	51.8354	.4507		
Total	129	96.6663			

R-square = (44.8309)/(96.6663)= .4638
Eta-between= .6810
Eta-within= .7323

Variable **ORGSPTIN** Organization Support to Individuals
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	23.4375	1.6741	2.4789	.0042
Within Groups	115	77.6651	.6753		
Total	129	101.1026			

R-square= (23.4375)/(101.1026)= .2318
Eta-between= .4815
Eta-within= .8765

Variable **TMPERF1** Team Performance-1 TDS
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	89.8038	6.4146	13.0723	.0000
Within Groups	115	56.4302	.4907		
Total	129	146.2340			

R-square= (89.8038)/(146.2340)= .6141
Eta-between= .7837
Eta-within= .6212

Variable **TMPERF2** Team Performance-2 DLTS, mv
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	12812.5904	915.1850	3.7907	.0000
Within Groups	115	27764.3365	241.4290		
Total	129	40576.9270			

R-square= (12812.5904)/(40576.9270)= .3158
Eta-between= .5619
Eta-within= .8272

Variable **TMSATF** Team Satisfaction
By Variable TM_NO Team number

Analysis of Variance

Source	Sum of D.F.	Mean Squares	F Squares	F Ratio	Prob.
Between Groups	14	50.3902	3.5993	4.0513	.0000
Within Groups	115	102.1707	.8884		
Total 129	152.5609				

R-square= (50.3902)/(152.5609)= .3303
Eta-between= .5747
Eta-within= .8184

E.2. Calculations for Within and Between Analysis

For each relationship of interest in Within and Between Analysis (between an x and y), three correlations were calculated using SPSS: total correlation between x and y (based on 130 individual raw scores, d.f.=N-2=130-2); between-cell correlation between x and y (based on 15 weighted group means, d.f.=J-2=15-2), and a within-cell correlation between x and y (based on 130 individual within-cell (residual) deviation scores, d.f.=N-J-1=130-15-1)). These correlations are summarized in the following three tables.

Total Correlations ($r_{xy,T}$) Between Independent and Dependent Variables.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMSKLS	.6917	.6811	.5112
INDGLS	.4949	.2857	.5843
DEFPRC	.3955	.3439	.1804
SYSPERS	.4144	.4625	.3745
TMCMT	.6761	.6516	.6480
TMUNTY	.6240	.5177	.5697
TMASSMNT	.6709	.5895	.5645
TMDEC	.6304	.6215	.4253
TMROLES	.3935	.4385	.2851
TMLDR	.4895	.4446	.3481
EMAIL	.1030	.2497	-.0211
CLRSPNEX	.7684	.6415	.5611
CMTBLD	.6472	.5295	.3890
STKINF	.3640	.3749	.1722
INTRORG	.4811	.4520	.3886
ORGSPTIN	.5817	.5026	.5902

Degrees of freedom, d.f. = N-2 = 130-2

Between-Team Correlations ($r_{xy,B}$) Between Independent and Dependent Variables*.

Independent Variable	Team Performance-1 (TMPERF1)	Team Performance-2 (TMPERF2)	Team Satisfaction (TMSATF)
TMSKLS	.8290	.8740	.6405
INDGLS	.5702	.4662	.7132
DEFPRC	.6220	.3434	.5160
SYSPERS	.6241	.5607	.6612
TMCMT	.8252	.8106	.8131
TMUNTY	.8001	.8086	.6866
TMASSMNT	.8973	.8430	.8467
TMDEC	.7808	.7596	.5356
TMROLES	.5533	.4727	.3637
TMLDR	.5540	.5752	.3206
EMAIL	.1412	.4284	-.0375
CLRSPNEX	.8882	.7839	.6372
CMTBLD	.8505	.7178	.5792
STKINF	.4879	.5772	.2094
INTRORG	.7209	.7410	.3605
ORGSPTIN	.7666	.7314	.7500

*Between-team correlations based on weighted group means.
Degrees of freedom, d.f. = J-2 = 15-2.

Within-Team Correlations ($r_{xy,W}$) Between Independent and Dependent Variables

Independent Variable	Residual for Team Performance-1 (RSDTPRF1)	Residual for Team Performance-2 (RSDTPRF2)	Residual for Team Satisfaction (RSDTMSAT)
RSDTMSKLS	.6082	.5841	.4436
RSDINDGLS	.5175	.2218	.5412
RSDDEFPRC	.3210	.3484	.0662
RSDSYSPERS	.3135	.4253	.2592
RSDTMCMT	.6092	.5784	.5695
RSDTMUNT	.4317	.3433	.5023
RSDTMASSMNT	.5463	.4757	.4338
RSDTMDEC	.5544	.5570	.3721
RSDTMRLS	.3460	.4296	.2586
RSDTMLDR	.5044	.3943	.3612
RSDEMAIL	.0302	.1056	.0070
RSDCLRS	.6994	.5689	.5209
RSDCMTBLD	.4977	.4346	.2891
RSDSTKINF	.3034	.2879	.1559
RSDINTRORG	.3681	.3400	.4021
RSDINDSPT	.5371	.4203	.5335

Degrees of freedom, d.f.= N-J-1 = 130-15-1

Next, the Z-statistics are presented which were used to examine whether $r_{xy,B}$ and $r_{xy,W}$ were significantly different for a given relationship. The following formula, from Dansereau et al. (1984), was used (where N=130 and J=15):

$$Z_{BW} = \frac{Z'_B - Z'_W}{\sqrt{1/(N-J-2)+1/(J-3)}}$$

The transformation of $r_{xy,B}$ and $r_{xy,W}$ to Z'_B and Z'_W was performed using Table A.2 in Dansereau et al. (1984), which uses the hyperbolic tangent function.

Z-Statistics for Team Performance-1 (TMPERF1)

Variable	Variable Name	Z'_B	Z'_W	Z
TMSKLS	Team skills	1.19	0.71	1.58
INDGLS	Individual Goals	0.65	0.58	0.23
DEFPRC	Defined design process	0.73	0.33	1.32
SYSPERS	Systemic perspective	0.73	0.32	1.35
TMCMT	Team commitment	1.19	0.71	1.58
TMUNTY	Team unity	1.1	0.46	2.11
TMASSMNT	Team self-assessment	1.47	0.62	2.80
TMDEC	Team decision processes	1.05	0.62	1.42
TMROLES	Team roles	0.62	0.27	1.15
TMLDR	Team leader	0.62	0.55	0.23
EMAIL	E-mail capability	0.14	0.03	0.36
CLRSPNEX	Clarity in sponsor expectations	1.42	0.87	1.81
CMTBLD	Commitment-building	1.26	0.55	2.34
STKINF	Keeping stakeholders informed	0.54	0.31	0.76
INTRORG	Inter-organizational perspective	0.91	0.39	1.71
ORGSPTIN	Organizational support to individuals	1.02	0.60	1.38
TMPERF2	Team performance-2	1.53	0.56	3.19

Z-Statistics for Team Performance-2 (TMPERF2)

Variable	Variable Name	Z'_B	Z'_W	Z
TMSKLS	Team skills	1.33	0.68	2.14
INDGLS	Individual Goals	0.51	0.22	0.95
DEFPRC	Defined design process	0.35	0.37	-0.07
SYSPERS	Systemic perspective	0.63	0.46	0.56
TMCMT	Team commitment	1.13	0.66	1.55
TMUNTY	Team unity	1.13	0.35	2.57
TMASSMNT	Team self-assessment	1.22	0.71	1.68
TMDEC	Team decision processes	1.0	0.63	1.22
TMROLES	Team roles	0.51	0.46	0.16
TMLDR	Team leader	0.66	0.41	0.82
EMAIL	Email capability	0.46	0.11	1.15
CLRSPNEX	Clarity in sponsor expectations	1.05	0.65	1.32
CMTBLD	Commitment-building	0.91	0.46	1.48
STKINF	Keeping stakeholders informed	0.66	0.30	1.19
INTRORG	Inter-organizational perspective	0.95	0.35	1.98
ORGSPTIN	Organizational support to individuals	0.93	0.45	1.58

Z-Statistics for Team Satisfaction (TMSATF)

Variable	Variable Name	Z'_B	Z'_W	Z
INDGLS	Individual goals	0.89	0.6	0.96
DEFPRC	Defined design process	0.58	0.07	1.68
SYSPERS	Systemic perspective	0.79	0.27	1.71
TMCMT	Team commitment	1.13	0.65	1.58
TMUNTY	Team unity	0.85	0.55	0.99
TMASSMNT	Team self-assessment	1.26	0.47	2.60
TMDEC	Team decision processes	0.60	0.39	0.69
TMROLES	Team roles	0.38	0.27	0.36
TMLDR	Team leader	0.33	0.38	-0.16
EMAIL	E-mail capability	0.04	0.00	0.13
CLRSPNEX	Clarity in sponsor expectations	0.76	0.58	0.59
CMTBLD	Commitment-building	0.66	0.30	1.18
STKINF	Keeping stakeholders informed	0.21	0.16	0.16
INTRORG	Inter-organizational perspective	0.38	0.64	-0.86
ORGSPTIN	Organization support to individuals	0.97	0.59	1.25
TMPERF1	Team performance-1	0.91	0.56	1.15
TMPERF2	Team performance-2	0.74	0.44	0.99

Lastly, calculations and tests for additional analyses between variables for Within and Between Analysis are shown in the following tables. The additional independent variables for which calculations are shown are: team roles, team leadership, and keeping stkakeholders informed. WABA was performed for these independent variables and each of the three dependent variables. These results were reported in footnotes throughout section 4.4.2 of Chapter 4.

Group Level WABA Results for Team Roles and Team Performance-1

Team Roles (TMROLES) and Team Performance-1 (TMPERF1)	**Induction**
Covariance Equation: (.3935)*** = (.4701)**(.7837)***(.5533)** + (.8827)(.6212)(.3460)***	
WABA I Tests: TMROLES: F = 2.33, p= .0072 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.5533, p<.01 Difference between r_b and r_w: Z'= 1.15, n.s.	EQUIVOCAL
COMPONENTS: Between: .2038 Within: .1897	WHOLES
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Roles and Team Performance-2

Team Roles (TMROLES) and Team Performance-2 (TMPERF2)	**Induction**
Covariance Equation: (.4385)*** = (.4701)**(.5619)***(.4727)* + (.8827)(.8272)(.4296)***	
WABA I Tests: TMROLES: F = 2.33, p= .0072 TMPERF2: F=3.79, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.4727, p<.025 Difference between r_b and r_w: Z'= 0.16, n.s.	EQUIVOCAL
COMPONENTS: Between: .1249 Within: .3137	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Roles and Team Satisfaction

Team Roles (TMROLES) and Team Satisfaction (TMSATF)	Induction
Covariance Equation: (.4385)*** = (.4701)**(.5747)***(.3637) + (.8827)(.8184)(.4296)***	
WABA I Tests: TMROLES: F = 2.33, p=.0072 TMSATF: F=4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.3637, n.s.	NULL
COMPONENTS: Between: .1249 Within: .3137	PARTS
FINAL Induction	WHOLES (Category II - weaker)

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Leadership and Team Performance-1

Team Leadership (TMLDR) and Team Performance-1 (TMPERF1)	Induction
Covariance Equation: (.4895)*** = (.5040)***(.7837)***(.5540)** + (.8637)(.6212)(.5044)***	
WABA I Tests: TMLDR: F = 2.80, p= .0013 TMPERF1: F=13.07, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.5540, p<.01 Difference between r_b and r_w: Z'= 0.23, n.s.	EQUIVOCAL
COMPONENTS: Between: .2188 Within: .2706	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Leadership and Team Performance-2

Team Leadership (TMLDR) and Team Performance-2 (TMPERF2)	Induction
Covariance Equation: (.4446)*** = (.5040)***(.5619)***(.5752)** + (.8637)(.8272)(.3943)***	
WABA I Tests: TMLDR: F = 2.80, p= .0013 TMPERF2: F=3.79, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.5752, p<.01 Difference between r_b and r_w: Z'= 0.82, n.s.	EQUIVOCAL
COMPONENTS: Between: .1629 Within: .2817	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Leadership and Team Satisfaction

Team Leadership (TMLDR) and Team Satisfaction (TMSATF)	Induction
Covariance Equation: (.3481)*** = (.5040)***(.5747)***(.3206) + (.8637)(.8184)(.3612)***	
WABA I Tests: TMLDR: $F = 2.80$, $p= .0013$ TMSATF: $F=4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.3206$, n.s.	NULL
COMPONENTS: Between: .0929 Within: .2553	PARTS
FINAL Induction	WHOLES (Category II - weaker)

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Keeping Stakeholders Informed and Team Performance-1

Keeping Stakeholders Informed (STKINF) and Team Performance-1 (TMPERF1)	Induction
Covariance Equation: (.3640)*** = (.5357)***(.7837)***(.4879)* + (.8444)(.6212)(.3034)***	
WABA I Tests: STKINF: $F = 3.30$, $p= .0002$ TMPERF1: $F=13.07$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.4879$, $p<.025$ Difference between r_b and r_w: $Z'= 0.76$, n.s.	EQUIVOCAL
COMPONENTS: Between: .2048 Within: .1591	WHOLES
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Keeping Stakeholders Informed and Team Performance-2

Keeping Stakeholders Informed (STKINF) and Team Performance-2 (TMPERF2)	**Induction**
Covariance Equation: (.3749)*** = (.5357)***(.5619)***(.5772)** + (.8444)(.8272)(.2879)***	
WABA I Tests: STKINF: $F = 3.30$, $p = .0002$ TMPERF2: $F=3.79$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.5772$, $p<.01$ Difference between r_b and r_w: $Z' = 1.19$, n.s.	EQUIVOCAL
COMPONENTS: Between: .1737 Within: .2011	PARTS
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Keeping Stakeholders Informed and Team Satisfaction

Keeping Stakeholders Informed (STKINF) and Team Satisfaction (TMSATF)	**Induction**
Covariance Equation: (.1722)* = (.5357)***(.5747)***(.2094) + (.8444)(.8184)(.1559)	
WABA I Tests: STKINF: $F = 3.30$, $p = .0002$ TMSATF: $F=4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.2094$, n.s.	NULL
COMPONENTS: Between: .0645 Within: .1077	PARTS
FINAL Induction	WHOLES (Category II - weaker)

*p<.05, **p<.01, ***p<.005

Appendix F Qualitative Data from the Design and Leadership Team Survey

This appendix contains qualitative data compiled from responses to the Design and Leadership Team Survey (DLTS) that team members completed as part of this research. Specifically, this appendix contains summaries of the DLTS that were compiled for each team (as feedback to the team to accompany the Campbell-Hallam Team Member Reports). In addition, this appendix contains the themes that were extracted from responses to two questions of particular interest (about contributors to and obstacles to team effectiveness). This data was portrayed in a condensed form in Chapter 4 Results.

F.1. Team Summaries from the Design and Leadership Team Survey

The summaries prepared from the Design and Leadership Team Survey for each of the 15 teams in the research sample are presented in this section. These summaries were distributed back to each team member, along with their individual Team Member Report from the Campbell-Hallam Team Development Survey. Team names are not provided in the team summaries, and specific names or information that might lead to identification of a team are removed. The purpose of these summaries is to provide benchmark data to other design teams on deliverables, expectations, and results of design teams in this research sample.

Summary Information from the Design and Leadership Team Survey
Design Team for Knowledge Work Support Division

Received responses from 100% of the team.

Clarity in Team Roles (question 11)

- all 8 team members responded that there is a team leader; all 8 people said there is a convener; 8 people said there is a recorder; 5 people said there is a facilitator; 7 people said there is a reporter; and 2 people said there are front owners.
- Some disagreement within the team on whether the convener, recorder, facilitator, and reporter roles are rotated or permanent.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **computer skills** (avg 1.6) and **technical skills in my area** (avg 1.6).
- **Lowest** self-scored skills, for the team overall, were: **knowledge about personality styles** (avg 3.0) and **quality tools** (avg 2.9).
- Areas recommended for additional education and training:
  - responsibility
  - decision making
  - tactical plan development
  - feedback
  - facilitation
  - implementation
  - focus
  - communication outside the team

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **9 days**. Ranged from 0 to 20 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team meetings and team activities is **22.5%**. Ranged from 5% to 40%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	13.9	2	30
Education/training to develop team's knowledge/skills	22.9	0	50
Analyzing and collecting data on the Division	18.3	5	40
Redesigning or planning changes to the Division	24.3	0	55
Implementing the team's design for change	8.6	0	20
Evaluating/assessing the implemented design or changes	4.3	0	10

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**61.4**	40	85
Customer and stakeholder satisfaction - internal or external	50.7	20	75
Improving business results in the Division (2)	55	30	80
Timeliness of team deliverables, e.g., meeting deadlines	58.6	30	90
Quality of team deliverables (plans, reports, etc.)	60.7	30	90
Quality of team decisions and solutions	68.6	50	90
Utilization of key skills of team members	75.7	40	90
Managing costs, e.g., staying within budget	90.7	80	100

Sponsor expectations on deliverables (question 66)

- *Creating and implementing a plan/design (4)*: plans to improve along each front; implementation of a design to improve the Division
- produce opportunity for process reengineering by evaluating current process

Sponsor expectations for improving results in the Division (question 67)

- implement common systems (2)
- achievement of vision 98
- delivery of systems/technology on time and on budget
- having customers who are "delighted" by service delivered by Division
- assist in business reengineering (make it a success)

Results achieved by the team (question 68)

- established a VMS (3)
- KPI down 15%; KPI reduction (2) *(KPI disguised)*
- 3 year plan
- education of Division on vision and performance improvement and performance measures
- have raised the general level of system thinking
- chartered PATs to evaluate opportunities
- have pursued and evaluated results returned by PATs
- initiated restructuring as requested

Contributors to team effectiveness (question 69)

- *Commitment and desire (5)*: determination to succeed; everyone tries hard; commitment; desire to improve; desire to improve Division performance
- great ability of team for conceptual thought; individual competence and knowledge (2)
- high percentage of group members easily grasp theoretical concepts
- convener did good job of preparing and guiding meetings
- many team members quite outspoken and articulate
- the right people are involved (they are committed and have authority to change Division)
- we are supported by senior management
- we meet regularly (or used to)

Obstacles to team effectiveness (question 70)

- internal silos
- direction change each 6 months
- new members undermining
- lack of a "cohesive" approach to deliverables/tasks (i.e., gap analysis, activity plans, etc.)
- need to work as a team to improve together and share
- closing conversations and arriving at a decision
- senior management team vs. the team line blurred
- Division's customers (staff) are out of touch with activities
- keeping approaches and processes simple
- lack of trust
- time
- too many initiatives
- communication

Additional information (question 71)

- clarity of purpose is a big issue.
- we spend too much time talking about "nothing" - where the goal of the discussion is not clear to all therefore we appear to get nowhere.
- the feedback from customers of the team (Division staff in general) indicated that they viewed the team as a senior management team and often mistook initiatives by the team as management initiatives, although I believed we were quite open on motives and where initiatives came from.
- we are currently in a temporary transitional phase and I believe my role will be clarified in the next month.
- ultimately, we will achieve our goals and carry NG to a higher performance.
- need to understand the restructuring initiatives/roles and responsibilities before taking on more improvement initiatives.

Time spent on survey (question 72)

- Average time spent on DLTS was 47 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Knowledge Work Support Division

Received responses from 92% of the team.

Clarity in Team Roles (question 11)

- 10 team members responded that there is a team leader/convener and a facilitator; 12 said there was a recorder; 4 said there was a reporter.
- Some disagreement within the team on whether some of the team roles are permanent or rotated; and if rotated, there were different responses on how often roles are rotated, e.g., responses for how often rotated ranged from 2 to 6 times a year.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **technical skills in individual areas** (avg 1.6), **problem-solving and decision-making** (avg 1.75), **leading groups or teams** (avg 1.92).
- **Lowest** self-scored skills, for the team overall, were: **quality tools** (avg 3.3), **computer skills** (avg 2.9), **measurement and data collection** (avg 2.9), **improvement methodologies** (avg 2.8).
- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - problem-solving and decision-making (3 responses)
  - improvement methodologies/CPI/benchmarking (3)
  - communication and listening (2)
  - meeting management (2)
  - working effectively as a team (2)
  - managing political fronts (2)
  - leading groups or teams
  - managing change
  - understanding great performance
  - developing milestones
  - developing tactical vs. strategic objectives
  - team-building exercises

Note: problem-solving and decision-making skills were one of the highest self-scored skills for the team, yet was also the most-suggested area for additional training.

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **6.5 days**. Ranged from 1 to 20 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team meetings and team activities is **12.5%**. Ranged from 5% to 25%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	19.2	5	50
Education/training to develop team's knowledge/skills	8.8	0	30
Analyzing and collecting data on the target system	15	0	50
Redesigning or planning changes to the target system	25.4	5	50
Implementing the team's design for change	14.6	0	30
Evaluating/assessing the implemented design or changes	8.8	0	20

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**72.5**	**50**	**90**
Utilization of key skills of team members	65	20	90
Timeliness of team deliverables, e.g., meeting deadlines	65.4	40	90
Customer and stakeholder satisfaction, internal and external	68.3	50	90
Quality of team deliverables (plans, reports, etc.)	72.1	50	85
Improving business results in the target system (1)	73.3	50	95
Quality of team decisions and solutions	74.6	50	90
Managing costs (e.g., staying within budget)	88	70	100

Sponsor expectations on deliverables (question 66)

Developing a plan for the future (8)

- plan to make CPI part of our culture; leadership in designing and ensuring success of the plan's implementation; plan which moves the Division towards its vision; future strategic initiatives; chart a course for the Division

Other expectations related to improvement

- integration with customer
- organizational structure redesign
- more defined role in the decision-making process
- future systems requirements, redefining processes
- PATs deliverables and updates

Sponsor expectations for improving results in the Division (question 67)

- reduced costs for Division; lower costs (10)
- improved customer satisfaction, service; responsive to customer needs (7)
- improve timeliness of reports; provide more timely reporting; reduce cycle time (5)
- improve information quality (3)
- efficient systems and processes; simplified processes and elimination of non-value added work (3)
- measure success

- increase quality of work life

Results achieved by the team (question 68)
- flat costs (7)
- developed plan, strategic initiatives (6)
- developed plan and strategic initiatives (6)
- implemented formal planning process and structure; taken ownership of planning process; some PATs have provided deliverables and others are ready to roll out (5)
- The team is more empowered, better direction on mandate, awareness to bootcamp principles, knowledge of NG 98; working as a cohesive unit; improved group dynamics (3)
- a VMS is in place for total Division (3)
- provided training (2)
- customer satisfaction and employee satisfaction survey is being developed
- many people acknowledging the need for change

Contributors to team effectiveness (question 69)
- willingness to change; desire for success; certain members of the team driving forward; team members are hard working (8)
- good teamwork and supportive environment; teamwork and following our 7 principles; great teamwork and support for each other (4)
- bootcamp to learn and intent and commitment; bootcamp experience (3)
- sponsor focus/commitment; leadership (2)
- larger feeling of a common purpose; shared purpose (2)

Obstacles to team effectiveness (question 70)
- demands/expectations from our customers (external to Division) who have different priorities; lots of workload; conflicting demands on time (5)
- ability to stay focused on what's important; sustained focus; too little focus on true decision-making; prioritize our issues so we can better focus our energies (5)
- open and honest communication still not practiced (afraid to hurt each other), affecting trust; not communicating and trusting each other; lack of open and honest dialogue (4)
- managing the political front more effectively; politics of other parts of the organization in not using strategic approach (2)
- going to the old way; not following our 7 principles (2)
- cooperation from other NG divisions; operators don't buy-in to Division's initiative (2)
- what's recognized/rewarded; time spent on initiatives or "regular job"
- perhaps taken on a few too many PATs
- members are more aligned to serving customers than participating on the team

Additional information (question 71)
- formal planning process is key
- buy-in or commitment from senior people in Division is required for success
- the team does not spend enough time on the long-term, and using the wall as our planning document
- we tend to look for the perfect solution before implementing; this tends to stall progress and momentum.
- it's a continual process of plan-do-study-act; today's solutions are tomorrow's problems; resolve issues so next month's problems are different.

Time spent on survey (question 72)
- Average time spent on DLTS was 50 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Knowledge Work Support Division

Received responses from 100% of the team.

Clarity in Team Roles (question 11)

- 4 team members responded that there is a team leader, recorder, and reporter; 3 said there was a convener and facilitator in addition.
- Some disagreement within the team on whether the facilitator and reporter roles are rotated or permanent.

Team Skills/Training (questions 13 and 17)

- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 2.0), **technical skills in individual areas** (avg 1.5), and **knowledge about the IPCF Division** (avg 2.0) (scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none).
- **Lowest** self-scored skills, for the team overall, were: **knowledge about personality style** (avg 3.7), **quality tools** (avg 3.5), and **measurement and data collection** (avg 3.5).
- Areas recommended for additional education and training: none were listed.

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is 9 **days**. Ranged from 8 to 10 days.

Time Spent on Team Activities (question 18)

- Four team members responded to this question; **average percent of time** spent on team meetings and team activities is **10%**. Ranged from 5% to 15%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Steps	**Avg % Team Time**	**MIN Team Time**	**MAX Team Time**
Scoping the team's task	25	10	50
Education/training to develop team's knowledge/skills	3.75	0	10
Analyzing and collecting data on the target system	12.5	5	25
Redesigning or planning changes to the target system	29	10	50
Implementing the team's design for change	13.8	0	25
Evaluating/assessing the implemented design or changes	16.3	10	20

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**72.5**	70	75
Improving business results in the Division (4)	52.5	0	80
Customer and stakeholder satisfaction, internal and external	60	50	70
Utilization of key skills of team members	66.3	25	90
Quality of team deliverables (plans, reports, etc.)	72.5	60	80
Timeliness of team deliverables, e.g., meeting deadlines	75	60	90
Managing costs (e.g., staying within budget)	76.7	60	90
Quality of team decisions and solutions	85	75	90

Sponsor expectations on deliverables (question 66)

- a game plan to establish measurements within Division
- analyze and improve technologies
- effective infrastructure for the future; new infrastructure to empower qualified people
- overall plan and framework for the Division change initiative

Sponsor expectations for improving results in the Division (question 67)

- identify and benchmark key business measurements
- streamline and improve technologies/communication
- reduce cost/head count; improve overall cost management
- increase flexibility in team(s) to handle changing workloads and responsibilities
- accuracy for deliverables
- not sure we have solicited this information from sponsors

Results achieved by the team (question 68)

- organizing all hands meeting to inform all employees of Division work underway
- organizing quarterly review meeting
- acted as steering committee for change effort
- detailed out "fuzzy" parts of the plan
- begun soliciting and giving feedback to/from other team leaders
- developed a working understanding of what the major components of the wall are achieving
- implemented minor infrastructure and major accountability change
- prioritizing the areas that require focus to make the most effective results
- coordination of continuous improvement areas in our business development, i.e., the wall, the fronts (roles and responsibilities, maximizing usage), quarterly meetings, all hands meetings
- involvement of customers and stakeholders in our processes

Contributors to team effectiveness (question 69)

- outside facilitation and guidance
- common commitment to improving Division effectiveness
- belief that change MUST happen
- regular communication
- intention
- strong desire to improve the processes that exist
- willingness to learn and share

- open and honest
- participative

Obstacles to team effectiveness (question 70)
- “time” (2) - we lack time to focus and communicate on what we are doing and what others are doing
- lack of consistency in approach, time, commitment
- balancing of business priorities and time to allow proper focus and dedication to the team’s responsibilities and initiatives is extremely difficult.
- better understanding of roles we may play as a team member

Additional information (question 71)
- we certainly need guidance and experience to help us along - our collective skills for this type of work could be of a higher level to be effective

Time spent on survey (question 72)
- Average time spent on DLTS was 59 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team in Distribution System

Received responses from 82 % of the team.

Clarity in Team Roles (question 11)

- 8 team members responded that there is a team leader, 5 said there is a convener, 8 said there is a recorder, 9 said there is a facilitator, and 4 said there is a reporter.
- All but one team member reported that team roles are permanent.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 1.89) and **technical skills in my area** (2.0).
- **Lowest** self-scored skills, for the team overall, were: **quality tools** (avg 3.3) and **measurement and data collection** (avg 3.6).
- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - meeting management (1)
  - managing change (1)
  - leading group and teams (1)
  - communication and listening (1)
  - creating specific expectations and alignment to company vision (1)
  - large-scale organizational change (1)

Time Spent on Team Activities (question 18)

- **Average percent of time** spent on team meetings and team activities is **14.6%**. Ranged from 1.5% to 75% (outlier of 75%; without this data point, the average is 7% and the maximum is 20%).

Percent of Time Spent in Steps of Change/Redesign Process (question 19)

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	22.4	2	60
Education/training to develop team's knowledge/skills	22.9	0	50
Analyzing and collecting data about the target system	8.5	0	20
Redesigning or planning changes to the target system	30	5	65
Implementing the team's design or plan for change	6.4	0	10
Evaluating/assessing the implemented design or changes	6.9	0	18

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**44**	**10**	**80**
Improving business results in the target system (5)	37	0	90
Quality of team deliverables (plans, reports, etc.)	47	10	90
Customer and stakeholder satisfaction, internal and external	47	20	90
Timeliness of team deliverables, e.g., meeting deadlines	51	5	80
Utilization of key skills of team members	53	30	90
Quality of team decisions and solutions	63	20	100
Managing costs (e.g., staying within budget)	68	20	100

Sponsor expectations on deliverables (question 66)

Plan to improve target system (7)

- plan to improve the target system (including implementation)
- to design the target system to align to our company 98 vision and ensure commitments are achieved.
- a plan for roll-out
- to develop a plan to drive the change initiative, including the provision of education, training and skill development.
- design, plan, and implement the change initiative

Others

- a set of metrics to evaluate performance improvement
- guide the installation of a participatory management system whereby today's 'managers and supervisors' become leaders and employees participate in the management of the facility. Self-directed, involved employees producing extraordinary results.
- ETD to move the target system forward.

Sponsor expectations for improving results in the target system (question 67)

- minimum 30% performance improvement in productivity
- improve quality by 30%
- cultural improvement/sustainability
- costs down
- not applicable
- reduce cycle time by 50%
- improve customer satisfaction

Results achieved by the team (question 68)

- nothing measurable
- at this point we discovered that our team mission was not aligned with our sponsors' and we have redesigned our team, and are in the process of getting a clarified mandate and charter.
- breaking ground with initiatives
- not certain that any actual "achievements" exist
- it is my opinion that the efforts of this team can not be linked to any of the cost savings initiatives that have occurred.
- not applicable - the original team was re-structured early on.
- none

Contributors to team effectiveness (question 69)

- facilitation; outside facilitation (2)
- our commitment to be the best and think outside the box
- wide range of skill in group
- leader's energy
- can't comment on the team's effectiveness due to the clear lack of achieving results.

Obstacles to team effectiveness (question 70)

- not having clarity of our specific expectations; not clear understanding of what or how; no clarity in roles and responsibilities; team objective not clearly defined or understood (4)
- lack of trust (2)
- different agendas; too much work being done individually not enough collective results (2)
- not all team members committed to team or process; lack of commitment (2)
- skill requirements - clearly the members of this group are not equipped with the knowledge/skill/ability to drive organization change.
- lack of leadership and direction from sponsors

Additional information (question 71)

- I believe that the major cause for poor/no results in this team was the lack of a clear vision for the target system, and a clear and concise charter for the team.
- the additional team really never had an opportunity to get off the ground. The commitment needed to be successful was never clearly defined.

Time spent on survey (question 72)

- Average time spent on DLTS was 62 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team in Distribution System

Received responses from 94% of the team.

Clarity in Team Roles (question 11)

- Some disagreement about what roles are used: 14 team members responded that there is a team leader, 2 said there is a convener, 11 said there is a recorder, 9 said there is a facilitator, and 4 said there is a reporter.
- Some disagreement on whether roles are rotated; for example, 4 people said recorder is permanent while 7 said the recorder is rotated (either every week or meeting); 6 people said the facilitator is permanent while 2 people said the facilitator is rotated.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 2.4), **meeting management** (avg 2.47), **technical skills in my area** (avg 2.3) and **knowledge about the Distribution Centre** (avg 2.3).
- **Lowest** self-scored skills, for the team overall, were: **computer skills** (avg 3.7), **large-scale change** (avg 3.9), and **writing reports and plans** (avg 3.5).
- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - computer skills (4)
  - measurements, measurement analysis (3)
  - making effective presentations
  - economic models
  - cost-benefit analysis
  - open mind
  - process evaluation
  - more education on VMS on how to build charts
  - conflict resolution
  - process thinking
  - change

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is 28 days. Ranged from 5 to 51 days.

Time Spent on Team Activities (question 18):

- **Average percent of time** spent on team meetings and team activities is **39%**. Ranged from 15% to 85%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	15	0	40
Education/training to develop team's knowledge/skills	37	5	70
Analyzing and collecting data on the warehouse	16	5	35
Redesigning or planning changes to the warehouse	17	2	40
Implementing the team's design for change	7	0	20
Evaluating/assessing the implemented design or changes	9	0	33

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**75**	**50**	**96**
Timeliness of team deliverables, e.g., meeting deadlines	59	10	100
Customer and stakeholder satisfaction, internal or external	62	10	80
Improving business results in the warehouse (7)	65	30	90
Quality of team deliverables (plans, reports, etc.)	66	15	95
Quality of team decisions and solutions	68	10	90
Utilization of key skills of team members	77	30	100
Managing costs (e.g., staying within budget)	85	65	100

Sponsor expectations on deliverables (question 66)

- a design to be more productive and cost efficient; plan to improve warehouse; design/plan, implementation plan (4)
- PAT teams
- improve productivity, cost, effectiveness, employee morale
- roll-out plan for improvement process for other leadership teams in other warehouses
- progress updates

Sponsor expectations for improving results in the warehouse (question 67)

- labour improvement; reduction in costs (7)
- improve customer satisfaction (4)
- improve quality (4)
- meet NG98 expectations (2)
- NG has clearly defined goals and Senior Corporate management has given us the go ahead to do what we can to achieve their goals.
- sanitation
- safety
- increase profits
- increased performance resulting in increased capacity of warehouse

Results achieved by the team (question 68)

- PATs formed and effective (2)
- none (2)
- ETD on floor on DSOTF; education and training in process improvement (2)

- limited - we are in the process of learning new skills and are just beginning to use them. Too early to see results but we are building a strong foundation for future use.
- defined problem areas and started to collect data
- identification of process improvement opportunities
- positive teamwork
- learning process - foundations only, unchecked progress only, no control boundaries --> no tangible progress
- work plans for process redesign/changes

Contributors to team effectiveness (question 69)
- as a team we work well together; well-rounded team we work well together (4)
- process improvement process (3)
- willingness to learn (2)
- satisfaction gained from improvements
- willingness to participate
- we respect one another and we value each other's opinion
- good leadership
- total cooperation and input from everyone
- atmosphere/support from management

Obstacles to team effectiveness (question 70)
- time management between "A" and "B" work; difficulty in managing time commitments; timing; getting time from "A" work to have meetings (5)
- history is difficult to ignore; old baggage, old habits; history, paradigms; stuck in the past (4)
- collective agreement; union negotiations (3)
- on-site management's commitment (low)
- lack of experience
- the biggest obstacle would be trust; we have to convince the employees that this is not just another flavor of the month idea; we have to work on building their trust.
- union management relationships
- resistance to change
- coordination with other PATs
- closed minds
- lack of commitment by all team members
- attendance

Additional information (question 71)
- we are all learning a lot about the business and the improve process is a good tool to learn.
- improvement process consumes a lot of time
- the team is losing speed quickly, not as motivated as in the beginning, need to get re-focused
- more coaching, establish a roadmap, set goals, I'm not sure everyone realizes the task/consequence.

Time spent on survey (question 72)
- Average time spent on DLTS was 68 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team in Distribution System

Received responses from 94% of the team.

Clarity in Team Roles (question 11)
- Some disagreement about what roles were used: 11 team members responded that there was a team leader, 7 said there was a convener, all 15 said there was a recorder, 14 said there was a facilitator, and 9 said there was a reporter.
- Some disagreement on whether roles were rotated; for example, 11 people said recorder was permanent while 3 said the recorder was rotated; 6 people said the facilitator was permanent while 6 said the facilitator was rotated (from once a week to once a year).

Team Skills/Training (questions 13 and 17)
- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 1.93), **meeting management** (avg 1.93), and **knowledge about the Warehouse** (avg 1.67).
- **Lowest** self-scored skills, for the team overall, were: **computer skills** (avg 3.33), **organizational redesign** (avg 3), **large-scale change** (avg 3.13), and **writing reports and plans** (avg 3.13).
- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - problem solving and decision making (4)
  - communication and listening (4)
  - making presentations (2)
  - how to stay focused
  - writing reports and plans
  - leading groups and teams
  - how to run effective meetings
  - effective leadership capabilities
  - implementing a plan and follow-through
  - interpersonal skills training
  - stress management
  - CP improvement
  - group facilitation
  - self-managing
  - building trust among team members

Days Spent in Education/Training (question 16):
- **Average number days spent in education/training** the last 12 months was **17.4 days**. Ranged from 0 to 50 days.

Time Spent on Team Activities (question 18):
- **Average percent of time** spent on team meetings and team activities was **24%**. Ranged from 10% to 70%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	**Avg % Team Time**	**MIN Team Time**	**MAX Team Time**
Scoping the team's task	20	5	72
Education/training to develop team's knowledge/skills	16	0	40
Analyzing and collecting data on the warehouse	14	5	25
Redesigning or planning changes to the warehouse	16	5	30
Implementing the team's design for change	19	2	50
Evaluating/assessing the implemented design or changes	9	0	20
Other; 6 of 15 people filled in "other" (e.g., "non-productive," "wasting time arguing," "fighting fires," "PATs."	26	5	50

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	**Avg**	**Min**	**Max**
Overall performance of the team	**59**	**0**	**90**
Utilization of key skills of team members	52	0	100
Timeliness of team deliverables, e.g., meeting deadlines	58	0	95
Quality of team deliverables (plans, reports, etc.)	58	10	80
Customer and stakeholder satisfaction, internal or external	59	0	95
Managing costs (e.g., staying within budget)	60	0	90
Improving business results in the warehouse (8)	62	10	90
Quality of team decisions and solutions	63	10	90

Sponsor expectations on deliverables (question 66)

- continuous improvement of processes of the warehouse (6)
- design and develop plans for major change and savings
- to keep customers informed of the changes at the warehouse and how these changes can improve their service and satisfaction
- give progress updates (i.e., chartbook) which illustrates both quantitative, qualitative and process planned improvements

Sponsor expectations for improving results in the warehouse(question 67)

- lower cost per ton (4)
- continuous improvement 30% (3)
- improve service level to customer to (3)
- improve total productivity (3)
- quality; reduce damages and shorts (3)
- reduce lead time on receiving product
- 100% "great place to work" attitude

Results achieved by the team (question 68)

- cost per ton is reduced (7)
- the 4 quality measures (damages, shorts, scratches, mispicks) are reduced (5)
- communication and education to our customers (3)
- employee involvement; employee input and involvement through PATs (3)
- thru-put and productivity improvement (3)
- customer satisfaction improved (2)
- teamwork among employees
- the project has come to a grinding halt; the team is not sure how to move forward now
- have organized some PATs to tackle some issues
- none
- identify areas within processes that can drive our costs down

Contributors to team effectiveness (question 69)

- committed employees and team leaders; desire to improve; employees willingness to accept change (3)
- communication (2)
- smaller, restructured team; a small team (2)
- strong vision of sponsors which rolls down to business plans for warehouse (2)
- defined plan and sense of direction
- continue to maintain the energy level that the members have
- continued education/development of team members
- necessity to succeed
- cannot at this time consider this team effective
- the ability to work together

Obstacles to team effectiveness (question 70)

- lack of support from management (5)
- not all employees buying in; employee cooperation or buy-in (2)
- lack of working as a team (2)
- the management team's ability to accept their new roles and be able to lead the warehouse employees through the change process
- contract negotiations
- lack of education
- lack of direction, commitment, cooperation, and communication
- personal agendas

Additional information (question 71)

- if upper management does not buy in, give up!
- this team is full of energy and desire; the team members must be chosen more carefully and more detailed education is needed.
- interpersonal squabbles have essentially halted all activity at this point
- The change initiative or any other start-up group or warehouse will be in jeopardy unless you have strong leadership (committed) to the project
- at present, the doubts and fears of fellow employees - the lack of trust.
- some give it all (110%), others think it is flavour of the month

Time spent on survey (question 72)

- Average time spent on DLTS was 81 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team in Distribution System

Received responses from 92% of the team.

Clarity in Team Roles (question 11)

- Responses on roles used: 4 team members responded that there is a team leader, 4 said there is a convener, all 9 said there is a recorder, all 9 said there is a facilitator, and 3 said there is a reporter.
- Some disagreement on whether roles are rotated; for example, 6 people said the facilitator is permanent while 3 said the facilitated is rotated weekly.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **leading groups or teams** (avg 1.9) and **knowledge about the Distribution Centre** (avg 1.9).
- **Lowest** self-scored skills, for the team overall, were: **computer skills** (avg 3.3), **large-scale organizational change** (avg 3.2), and **quality tools** (avg 3.5).
- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - quality tools (3)
  - computer skills (2)
  - problem solving (2)
  - communication skills (2)
  - measurement
  - self-management
  - systems thinking
  - group process and facilitation
  - presentation skills
  - decision-making

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **16.6 days**. Ranged from 4 to 65 days.

Time Spent on Team Activities (question 18):

- **Average percent of time** spent on team meetings and team activities is **28.5%**. Ranged from 5% to 50%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	17.5	5	50
Education/training to develop team's knowledge/skills	13.9	5	25
Analyzing and collecting data on the warehouse	19.4	5	40
Redesigning or planning changes to the warehouse	23.9	10	30
Implementing the team's design for change	14.4	5	30
Evaluating/assessing the implemented design or changes	7.8	0	20

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**76.5**	**40**	**90**
Customer and stakeholder satisfaction, internal or external	65	30	95
Quality of team deliverables (plans, reports, etc.)	69	30	80
Managing costs (e.g., staying within budget)	70	20	100
Timeliness of team deliverables, e.g., meeting deadlines	71	30	90
Utilization of key skills of team members	71.5	30	90
Improving business results in the warehouse (13)	74.5	35	90
Quality of team decisions and solutions	74	40	90

Sponsor expectations on deliverables (question 66)

- a plan to improve the warehouse and an implementation plan (3)
- effective measurement system
- progress updates to sponsors

Sponsor expectations for improving results in the warehouse (question 67)

- safety; improve safety (5)
- improve quality (4)
- decrease costs (3)
- improve sanitation (2)
- informed workforce (2)
- on-time arrivals (2)
- decrease turnover; stabilization of workforce (2)
- customer satisfaction; improve customer satisfaction (2)
- to attain all great expectations by the end of 1996; to meet all great expectations by 1996 (2)
- reduce absenteeism (2)

Results achieved by the team (question 68)

- safety improved dramatically; improved safety (4)
- quality is improving and becoming more consistent; increased quality (3)
- on-time arrivals improving (3)
- new training program; better training to inform new hires (3)
- more involvement
- shifts asking for specific measures

- stability - less turnover
- we have stabilized the key indicators in our warehouse, results are predictable
- we all have a common vision and are working very hard towards that vision
- improved communication
- team spirit
- pre-shift meetings (a way of communicating)

Contributors to team effectiveness (question 69)
- enthusiasm of membership; team inspiration; team commitment (5)
- team skill; experience at jobs in the warehouse (2)
- the support from all levels of management; support from all levels (2)
- understanding the vision
- team leader
- representation from all shifts
- bootcamp
- ability of group to express/communicate
- a respect for everybody's ideas and inputs

Obstacles to team effectiveness (question 70)
- change in team membership (3)
- employee distrust, resentment and disinterest; lack of respect for the team (3)
- relaying the message to the workforce i.e., vision, commitment, attitude (2)
- daily work responsibilities outside the team; time (2)
- self-confidence
- old paradigms
- training and skills
- promoting customer commitment and buy-in
- lack of some members' commitment

Additional information (question 71)
- the team has had a shaky start with current conditions and roadblocks they have faced, in spite of it all they have chartered PATs which have accomplishments.
- important to understand that warehouse has experienced tremendous change in last year; it has been difficult for group to remain focused during operation chaos.
- the thing that strikes me the most is the respect shown to each other (no stripes).
- as a team we have made great gains by learning from our mistakes and there is no doubt in my mind that we will succeed.

Time spent on survey (question 72)
- Average time spent on DLTS was 61 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Retail System

Received responses from 100% of the team.

Clarity in Team Roles (question 11)

- Responses on roles used: 4 team members responded that there is a team leader, 4 said there is a convener, all 9 said there is a recorder, all 9 said there is a facilitator, and 3 said there is a reporter.
- Some disagreement on whether roles are rotated; for example, 6 people said the facilitator is permanent while 3 said the facilitated is rotated weekly.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **communication and listening** (avg 1.9), **technical skills in my area** (avg 1.9), and **knowledge about the store** (avg 1.9).
- **Lowest** self-scored skills, for the team overall, were: **group process and facilitation** (avg 2.6), **computer skills** (avg 2.6), and **organizational redesign** (avg 2.6).

Note: there is not much difference between the highest and lowest self-scored skills. (1.9 to 2.6).

- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - computer skills (2)
  - time management (2)
  - holding effective meetings (2)
  - writing reports and plans (2)
  - project management
  - review process
  - time management
  - conflict resolution
  - facilitation
  - short-term focusing
  - developing standards
  - making presentations
  - core competencies

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **41 days.** Ranged from 10 to 120 days.

Time Spent on Team Activities (question 18):

- **Average percent of time** spent on team meetings and team activities is **32.5%**. Ranged from 18 % to 60%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	12.8	5	20
Education/training to develop team's knowledge/skills	31.7	15	50
Analyzing and collecting data on the target system	12.8	10	30
Redesigning or planning changes to the target system	20.6	10	40
Implementing the team's design for change	12.8	10	10
Evaluating/assessing the implemented design or changes	9.4	5	20

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**80**	**60**	**98**
Managing costs (e.g., staying within budget)	73	50	90
Timeliness of team deliverables, e.g., meeting deadlines	73	50	90
Improving business results in the target system (12)	73	50	90
Quality of team deliverables (plans, reports, etc.)	75	60	90
Utilization of key skills of team members	77	50	95
Customer and stakeholder satisfaction, internal or external	77	50	95
Quality of team decisions and solutions	80	70	90

Sponsor expectations on deliverables (question 66)

- improving and documenting processes: (5)
- progress updates (3)
- roll-outs; take-aways to roll out (2)
- key targets (financial)
- a sustainable process to continuously improve operations

Sponsor expectations for improving results in the target system (question 67)

- 20-30% improvement in breakthrough indicators (4)
- improve profitability (3)
- improve customer satisfaction (2)
- key targets
- improve quality in all aspects as much as possible
- improve morale

Results achieved by the team (question 68)

- development and implementation of new process (6)
- establishment of a VMS system
- establishment of a plan and review mechanism for team
- development of skills of team members
- improved management and communication skills
- more empowered employees, i.e., grass root involvement in decisions and redesign of processes
- slight improvement on profitability
- we measure a lot; we talk a lot; we are on the verge of doing a lot.

Contributors to team effectiveness (question 69)
- team member enthusiasm and commitment (3)
- training and retraining (2)
- Team convener (2)
- practicing ground rules/intention pieces
- strong surviving members
- open communication
- good group bonding
- team participation
- a well put together plan on various processes
- trust from National Grocers
- staff input

Obstacles to team effectiveness (question 70)
- high turnover (3)
- freeing up time to work on improvements outside of team meetings (2)
- lack of integration of A and B structures
- lack of understanding that "improvement" efforts are part of the "real" work
- no clear objectives at start - up to 2 months ago
- talking at too much at once
- members losing focus
- communication - we are still not able to have "crystal conversations" with other team members on a consistent basis - leads to certain degree of mistrust
- expectations of quick results

Additional information (question 71)
- would have been helpful if expectations of sponsors were more clearly defined at the outset.
- I know we are going in the right direction and we will reach our vision as long as all levels of the organization has the same mind set regarding time it takes to implement the change.
- I feel we need to slow down and concentrate more on the "A"; at this point managers need to spend more time on the job, sharing the learnings.

Time spent on survey (question 72)
- Average time spent on DLTS was 58 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Administrative Process

Received responses from 100% of team.

Clarity in Team Roles (question 11)

- Responses on roles used: 8 team members responded that there is a team leader, 1 said there is a convener, and 2 said there is a facilitator.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **technical skills in my area** (avg. 1.56), **knowledge about the target process** (avg. 2.12), **problem-solving skills** (avg. 2.12), and **computer skills** (avg. 2.25)
- **Lowest** self-scored skills, for the team overall, were: **quality tools** (avg. 4.12), **measurement and data collection** (avg. 4.12), and **large-scale organizational change** (avg. 3.87).
- Areas recommended for additional education and training:
  - more in-depth training and software supplied
  - managing change

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **8.9 days**. Ranged from 3 to 15 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team meetings and team activities is **56.2%**. Ranged from 5 to 95%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	9.6	2	15
Education/training to develop team's knowledge/skills	5.4	0	10
Analyzing and collecting data on the target system	13.6	5	20
Redesigning or planning changes to the target system	24.3	20	30
Implementing the team's design for change	36.1	20	50
Evaluating/assessing the implemented design or changes	11.0	2	20

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**81.3**	70	90
Customer and stakeholder satisfaction - internal or external	65.0	30	80
Quality of team deliverables (plans, reports, etc.)	67.5	50	90
Timeliness of team deliverables, e.g., meeting deadlines	71.3	70	100
Improving business results in the target system (11)	72.9	60	80
Quality of team decisions and solutions	79.4	70	90
Utilization of key skills of team members	89.9	80	100
Managing costs, e.g., staying within budget	92.1	75	100

Sponsor expectations on deliverables (question 66)

- to design and implement a plan for the process.(6)
- changes to existing processes (3)

Sponsor expectations for improving results in target system (question 67)

- improve customer satisfaction (4)
- reduce paperwork (2)
- reduction in turnaround time and greater control of the process (2)
- At this point, I think that their expectation is to get processes working. Once processes are in place I think they will begin to look for "measurable" savings.
- ? (unknown)

Results achieved by the team (question 68)

- implementation of process (6)

Contributors to team effectiveness (question 69)

- conscientiousness of individuals on team to make the new process a success; the commitment to make this project work (4)
- functional knowledge of team members; the knowledge brought to the group by the individuals in the group (2)
- good group leader
- feeling by team members that new initiative will be improvement for all when working smoothly.
- team members felt comfortable in expressing opinions openly and without criticism from other team members.
- cooperation

Obstacles to team effectiveness (question 70)

Time and resources (3)

- Not enough staff to handle work load; lack of equipment; trying to change too much given the complexities of the problem, and the small number of people to do the changes.

Others:

- situations still arise which bring out the "turf" mentality
- team is scattered across campus which minimizes opportunity for informal communications to easily take place.
- not enough planning time before implementing new processes

- not putting blame on someone for things that don't work.

Additional information (question 71)
- I feel we did not have complete support of higher management which resulted in delays and also did not provide staffing needed to implement within the time frame we were given.
- This team was given a task without the equipment and support that it needed to make this project a success.

Time spent on survey (question 72)
- Average time spent on DLTS was 49 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Administrative Process

Received responses from 100% of the team.

Clarity in Team Roles (question 11)

- There was perfect agreement on the use of team roles: all 6 team members responded that there is a team leader and all 6 said there is a recorder.
- Everyone responded that the team leader is permanent, and 5 people said the recorder is permanent (1 person it was rotated but with no fixed schedule).

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 1.7), **technical skills in my area** (avg 1.7), and **knowledge about the target process** (avg 1.7).
- **Lowest** self-scored skills, for the team overall, were: **large scale organizational change** (avg 3.0) and **quality tools** (avg 3.0).
- Areas recommended for additional education and training:
  - process analysis tools

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **10.7 days**. Ranged from 2 to 25 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team meetings and team activities is **14.5%**. Ranged from 5% to 35%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	17.5	5	40
Education/training to develop team's knowledge/skills	2	0	10
Analyzing and collecting data on the target system	17.5	10	25
Redesigning or planning changes to the target system	45.8	15	70
Implementing the team's design for change	10	0	40
Evaluating/assessing the implemented design or changes	5.8	0	25

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**84.8**	**70**	**99**
Timeliness of team deliverables, e.g., meeting deadlines	71.7	50	100
Customer and stakeholder satisfaction - internal or external	78.3	60	100
Quality of team deliverables (plans, reports, etc.)	80.1	50	100
Quality of team decisions and solutions	88.3	70	100
Utilization of key skills of team members	89.2	70	100
Improving business results in the target system (14)	90	80	100
Managing costs, e.g., staying within budget	100	100	100

Sponsor expectations on deliverables (question 66)

- Plan/report (5): final report with clear principles for the new system and requests for system modifications; report including description of new process
- a scenario for developing a new process using BANNER software and other enhancements
- negotiated agreement on new process among senior management

Sponsor expectations for improving results in the target system(question 67)

- improve quality and customer satisfaction by 100%
- reduce paper flow; reduce cycle time
- more flexible system
- substantially improved information for decision making and management

Results achieved by the team (question 68)

- report and plan, requirements modifications to the existing software (3)
- gotten buy-in on key enhancements needed; acceptance of model (2)
- produced requirements for a new system
- gain the endorsement for our plan of our sponsors, and other stakeholders

Contributors to team effectiveness (question 69)

- skills and commitment of team members; members' skill, experience (4)
- ability to understand the customer needs and communicate them to upper management
- team chemistry and leadership

Obstacles to team effectiveness (question 70)

- lack of clear expectations and requirements from sponsors (2)
- convincing leadership to agree to our conception of the problem and how to address it
- unwillingness of sponsors and others to devote time to this task
- lack of management buy-in to new concepts

Additional information (question 71)

- Team leader and sponsor were outstanding; this team could be used on other projects very effectively.
- clearer instructions on support to make changes in system were needed

Time spent on survey (question 72)

- Average time spent on DLTS was 37 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Administrative Process

Received responses from 100% of team.

Clarity in Team Roles (question 11)

- 9 team members responded that there is a team leader; 2 people said there is a convener, 9 people said there is a recorder; 8 people said there is a facilitator; 6 people said there is a reporter; 7 people said there is a timekeeper and a judge/gatekeeper.
- Some disagreement within the team on whether the team roles are rotated or permanent.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 2.1), **communication and listening** (avg 1.9), and **technical skills in my area** (avg 1.8).
- **Lowest** self-scored skills, for the team overall, were: **knowledge about personality styles** (avg 3.8).
- Areas recommended for additional education and training:
  - team member responsibilities
  - importance of teamwork
  - team leader training
  - establishing goals
  - business process redesign

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **7.4 days**. Ranged from 0 to 20 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team is **6.6%**. Ranged from 2% to 15%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	6.7	0	20
Education/training to develop team's knowledge/skills	6.8	0	10
Analyzing and collecting data on the target system	15.6	0	30
Redesigning or planning changes to the target system	53.8	25	79
Implementing the team's design for change	7.8	0	20
Evaluating/assessing the implemented design or changes	9.4	0	35

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**74.4**	50	100
Customer and stakeholder satisfaction - internal or external	63.1	20	95
Timeliness of team deliverables, e.g., meeting deadlines	63.1	40	90
Quality of team deliverables (plans, reports, etc.)	69.4	30	95
Utilization of key skills of team members	73.8	30	100
Improving business results in the target system (9)	74.4	50	100
Quality of team decisions and solutions	75	50	100
Managing costs, e.g., staying within budget	89	70	100

Sponsor expectations on deliverables (question 66)
- design new process (7)
- high level technical specs (2)
- documentation guidelines for process
- risk analysis report

Sponsor expectations for improving results in the wage time entry process (question 67)
- improve efficiency (4)
- reduce errors; improve quality 25% (2)
- interface to or reduce the need for shadow systems
- maintain at least current functionality
- unknown
- successfully integrate process with new Banner system

Results achieved by the team (question 68)
- an improved more effective process (7)
- partial risk analysis (2)
- ready to present to auditor and sponsors

Contributors to team effectiveness (question 69)
- knowledge of the system as it is today and what needs to be changed
- team leaders' knowledge/skills/experience
- ability of individual members
- regular meetings
- active members of team taking increased responsibility of leading team discussion

Obstacles to team effectiveness (question 70)
- lack of regular attendance by several members; poor attendance (3)
- commitment; lack of enthusiasm and ownership; apathy or disinterest (3)
- long drawn out discussions that lead to nowhere
- not working as a team
- lack of understanding of process design

Additional information (question 71)
- have not been an effective member of this team due to time constraints/demands of my job
- a solid methodology and a group consensus of purpose is critical to success

Time spent on survey (question 72)
- Average time spent on DLTS was 43 minutes.

Summary Information from the Design and Leadership Team Survey
Design Team for Administrative Process

Received responses from 100% of the team.

Clarity in Team Roles (question 11)

- 7 team members responded that there is a team leader; 6 people said there is a recorder; 4 people said there is a facilitator; and 4 people said there is a reporter.
- Some disagreement within the team on whether the recorder, facilitator and reporter roles are rotated or permanent.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 2.0), **computer skills** (avg 1.7), **communication and listening** (avg 2.0), and **technical skills in my area** (avg 2.0).
- **Lowest** self-scored skills, for the team overall, were: **knowledge about personality styles** (avg 3.1) and **measurement and data collection** (avg 3.3).
- Areas recommended for additional education and training:
  - process redesign (2)
  - problem solving and decision making (2)
  - organizational redesign

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **12.7 days**. Ranged from 1 to 25 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team meetings and team activities is **13.9%**. Ranged from 8% to 20%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	7.4	2	15
Education/training to develop team's knowledge/skills	4.1	2	5
Analyzing and collecting data on target system	38.4	20	60
Redesigning or planning changes to target system	35.1	20	50
Implementing the team's design for change	5.3	0	25
Evaluating/assessing the implemented design or changes	6.2	0	15

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**93.6**	90	98
Timeliness of team deliverables, e.g., meeting deadlines	76.4	50	95
Utilization of key skills of team members	87.9	80	100
Customer and stakeholder satisfaction - internal or external	87.9	80	100
Quality of team deliverables (plans, reports, etc.)	89.3	80	100
Improving business results in target system (6)	92.1	80	100
Quality of team decisions and solutions	93.9	90	100
Managing costs, e.g., staying within budget	98.6	90	100

Sponsor expectations on deliverables (question 66)

- a new process or structure which is most efficient and involves the fewest steps
- buy-in to the model for business processes
- report describing: recommended models for implementing and designing processes; guidelines for design of processes; basic principles for design of processes; documentation requirements for processes; and consistent framework and well-defined terminology for redesign.
- a strategy for streamlining processes.
- identification of risks, controls, and issues associated with the processes.
- redesigned concepts to improve actions; this includes identifying if workflow is required and making recommendations for streamlining these actions.

Sponsor expectations for improving results in target system (question 67)

- model for other process teams to reduce cycle time, improve customer satisfaction. (2)
- defining a process, method or structure which can be used by subsequent process improvement teams in order to reduce their time to achieve their goals.
- to facilitate process redesign in the context of new "client-server" solutions.
- reduce paper flow, speed up processes, clarify accountability.

Results achieved by the team (question 68)

- we have established guidelines for other process improvement teams representing the new models.
- "buy-in" on conceptual basis for new process design and old process redesign
- team is finished, produced what charter required, i.e., a detailed analysis of risks and controls of high volume and high impact actions.
- senior management agreement to concept.
- completed report and briefings for other process teams.
- "buy-in" from Internal Audit.

Contributors to team effectiveness (question 69)

- willingness of all team members to work; hard-working team members (2)
- clear charter; charter (kept us focused) (2)
- understanding of goals for the team and buy-in by team members that those goals are worthwhile.
- knowledge of team members; team members with the right skills; [team members] expert on various topics (3)
- interest in developing a common framework for describing the problem domain.
- ability to accept new and abstract concepts.

- empowered to make decisions.
- everybody committed enough time to the team.
- also, team members were highly motivated, reliable
- team synergy.
- team ground rules.

Obstacles to team effectiveness (question 70)
- the global nature of our goals; it was hard to grasp the "big picture" of what we were trying to accomplish
- getting senior management buy-in; not sure of our direction initially.
- other duties.
- over-extended lifetime of team leading to reduced motivation.
- no immediate way to implement the redesigned procedures.
- we had to define our purpose, charter ourselves and educate all levels of management above us once we educated ourselves about the needs, university culture, management styles, technical capabilities, etc.; once they were educated, we had their support.
- our team in my opinion had no obstacles.

Additional information (question 71)
- this was a good group of people who were willing to work together; everyone was willing to acknowledge and value the personalities of the other team members.
- was a good team that worked well together.
- this was the *only* effective team I have been on in this organization.
- results are likely to be misunderstood or ignored by most people.
- this team was a winner. Also because we arrived at an answer that everybody liked (sponsors, customers, stakeholders).
- this team is an excellent example of a team that "empowered" itself when it saw a need and was effective in getting support from higher levels.
- this team was one of the most satisfying work experiences I've had in the last 2-4 years.

Time spent on survey (question 72)
- Average time spent on DLTS was 42 minutes.

Summary Information from the Design and Leadership Team Survey
Support/Steering Team

Received responses from 100% of team

Clarity in Team Roles (question 11)

- 7 team members responded that there is a team leader; 1 person said there is a convener; 7 people said there is a recorder; 7 people said there is a facilitator; 1 person said there is a reporter; 4 people said there is a timekeeper, and 4 people said there is a gatekeeper.
- All team members responded that the team leader and facilitator are permanent, but there was disagreement about whether the recorder role is rotated or permanent.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 2.0), **technical skills in my area** (avg 1.4), and **knowledge about the team's target processes** (avg 2.0).
- **Lowest** self-scored skills, for the team overall, were: **quality tools** (avg 2.8) and **measurement and data collection** (avg 3).
- Areas recommended for additional education and training:
  - facilitators training
  - group decision making tools
  - organizational redesign

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **20.4 days**. Ranged from 6 to 50 days.

Time Spent on Team Activities (question 18)

- The **average percent of time** spent on team meetings and team activities is **9%**. Ranged from 4% to 15%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	**Avg % Team Time**	**MIN Team Time**	**MAX Team Time**
Scoping the team's task	17.8	5	40
Education/training to develop team's knowledge/skills	4.3	0	10
Analyzing and collecting data on target system	47.9	15	70
Redesigning or planning changes to target system	22.1	0	70
Implementing the team's design for change	7.1	0	30
Evaluating/assessing the implemented design or changes	.7	0	5

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**71.9**	20	98
Improving business results in target system (10)	64.6	0	98
Customer and stakeholder satisfaction - internal or external	65.4	20	98
Timeliness of team deliverables, e.g., meeting deadlines	69.7	20	98
Quality of team deliverables (plans, reports, etc.)	76.1	30	100
Utilization of key skills of team members	76.9	10	98
Quality of team decisions and solutions	80.4	50	98
Managing costs, e.g., staying within budget	82.5	50	100

Sponsor expectations on deliverables (question 66)

- BPR plan; identification of key functions in a human resource system and prioritization of those functions for implementation (6)
- unsure
- develop process for assigning and coordinating resources for redesign
- originally was to be an implementation plan for improving various business processes; there now seems to be some indecision about what our charter entails.

Sponsor expectations for improving results in target system (question 67)

- improve customer satisfaction (2)
- improve system/function integration
- unsure
- this team coordinates, prioritizes the actual redesign teams
- streamline, use less paper

Results achieved by the team (question 68)

- draft plan; identified candidates for redesign and prioritized (5)
- adopted a methodology
- description of major processes and issues
- focus group reports
- 50% done: developing process for assigning and coordinating resources for redesign; and with defining model for resolving issues

Contributors to team effectiveness (question 69)

- broad and detailed knowledge of team members; skilled, competent team members; expertise of team members; skills and capabilities of the people (4)
- commitment of team members; willingness to work in a team; willingness to work together (3)
- team membership and leadership
- good facilitation
- the active participation of each member

Obstacles to team effectiveness (question 70)

- lack of coherent and consistent commitment to quality initiatives and process redesign at organization level; culture of organization not prepared and resisting change (2)

- team members missing meetings due to other priorities taking precedence; team members actual job responsibilities preventing timely involvement (2)
- team effectiveness depends on 2 primary ingredients: a good team leader and people who are willing to function as a team
- lack of concrete, tangible objectives
- cross-sections of the organization are involved but seem to place different priority on the project
- the indecision as to what changes we can implement - too much turf-protecting is going on

Additional information (question 71)
- I have found this group to be collectively the most knowledgeable and congenial group I have ever worked with and expect to be more successful than most.
- In spite of some frustrations the team has been able to identify critical issues because of its cross-functional perspectives.

Time spent on survey (question 72)
- Average time spent on DLTS was 53 minutes.

Summary Information from the Design and Leadership Team Survey
Support/Steering Team

Received responses from 100% of the team.

Clarity in Team Roles (question 11)

- 4 out of 5 team members said there were two team roles used: team leader and recorder. 1 team member circled facilitator as well. Overall, good clarity on the team roles used.

Team Skills/Training (questions 13 and 17)

- **Highest** self-scored skills, for the team overall, were: **problem-solving and decision-making** (avg 1.6) and **computer skills** (avg 1.6) (scale of 1 to 6: excellent, good, slightly above average slightly below average, poor, and none).
- **Lowest** self-scored skills, for the team overall, were: **making presentations** (avg 2.8), **personality style** (avg 3.0), and **measurement and data collection** (avg 2.8).
- Areas recommended for additional education and training: writing skills (2), technical skills for WWW/managing WWW servers (2), time management, team management, problem solving tools and techniques, large scale organizational change, and measurement and data collection.

Time Spent on Team Activities (question 18)

- Four team members responded to this question; **average percent of time** spent on team meetings and team activities is **89%**. Ranged from 80% to 100%.

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area	Avg	Min	Max
Quality of team decisions and solutions	83	75	100
Quality of team deliverables (plans, reports, etc.)	78	50	100
Timeliness of team deliverables, e.g., meeting deadlines	79	50	95
Managing costs (e.g., staying within budget)	94	85	100
Utilization of key skills of team members	93	80	100
Customer and stakeholder satisfaction, internal and external	71	50	90
Improving business results in target system (3)	71	60	90
Overall performance of the team	91	82.5	100

Sponsor expectations on deliverables (question 66)

- Strong public relations, coordination - internal and external (3)
- administrative support for the project and teams (3)
- providing educational/training opportunities (3)
- project plan
- progress updates to all sponsors, key stakeholders and customers
- provide necessary tools and equipment within the project

Sponsor expectations for improving results in target system (question 67)

- come up with ways to improve the way to do their jobs, to help downsize the time, make their jobs more enjoyable and efficient

- provide necessary support to the operational teams to help them succeed
- communicate project objectives and achievements
- improve customer satisfaction inside and outside the project
- schedule/organize training for project members

Results achieved by the team (question 68)
- good administrative support, including technical
- level of respect from other teams
- improved skills
- a strong team environment for the team

Contributors to team effectiveness (question 69)
- ability to work together - no big egos
- we have to continue to work together as a team; we also have to try to get others to do the same
- we like each other
- we each have a different area of expertise
- individual competencies and enthusiasm as team members

Obstacles to team effectiveness (question 70)
- getting things done on time
- being able to communicate and get people to understand what the project is all about
- history
- unclear/vacillating leadership from outside the team

Additional information (question 71)
- we need to narrow our focus and be better at doing some of the key tasks
- enjoy working with people on the team; have learned a lot and accomplished a lot; it's not easy getting people to communicate and work with you on the project but as a team we are doing our best
- we need to step back and re-evaluate, re-assess our direction and results more often
- another obstacle which challenges us is old baggage; in the past, the organizational community's expectations have been excited but not satisfied with tangible results

Time spent on survey (question 72)
- Average time spent on DLTS was 49 minutes.

Summary Information from the Design and Leadership Team Survey
Support/Steering Team

Received responses from 100% of team.

Clarity in Team Roles (question 11)

- Responses on roles used: 6 team members responded that there is a team leader, 4 said there is a convener, 3 said there is a recorder, 2 said there is a facilitator, and 2 said there is a reporter.
- For the roles used by the team, everyone responded that team roles are permanent.

Team Skills/Training (questions 13 and 17)

- Scale of 1 to 6: 1=excellent, 2=good, 3=slightly above average, 4=slightly below average, 5=poor, and 6=none.
- **Highest** self-scored skills, for the team overall, were: **communication and listening** (avg 1.83), and **technical skills in my area** (avg 1.67).
- **Lowest** self-scored skills, for the team overall, were: **quality tools** (avg 3), and **measurement and data collection** (avg 2.83).
- Areas recommended for additional education and training (numbers in parentheses represents the number of people who listed this area):
  - large scale change
  - self-managing/self-directed work teams
  - organization benchmarking

Days Spent in Education/Training (question 16):

- **Average number days spent in education/training** the last 12 months is **11.3 days**. Ranged from 0 to 40 days.

Time Spent on Team Activities (question 18):

- **Average percent of time** spent on team meetings and team activities is **37.5%**. Ranged from 5% to 100%.

Percent of Time Spent in Steps of Change/Redesign Process (question 19):

- The average of the responses for percent of team time spent in each step of the change/redesign process is listed, as well as the minimum and maximum percent of team time that any team member identified.

Change/Redesign Process Steps	Avg % Team Time	MIN Team Time	MAX Team Time
Scoping the team's task	15	0	25
Education/training to develop team's knowledge/skills	3	0	10
Analyzing and collecting data on the warehouse	19	10	25
Designing the target system	18	0	30
Implementing the team's design for change	21	5	40
Evaluating/assessing the implemented design or changes	24	10	75

Assessment of Team Performance (questions 57-64)

- Assessment given in percent effectiveness, where 100% is the most effective possible. As in the previous question, the average percent effectiveness of all team member responses is listed, as well as the minimum and maximum percent effectiveness identified by any team member.

Performance Area (in increasing order)	Avg	Min	Max
Overall performance of the team	**86.7**	**80**	**95**
Quality of team deliverables (plans, reports, etc.)	83.3	80	90
Creating business results in the target system (15)	84.2	80	90
Timeliness of team deliverables, e.g., meeting deadlines	84.2	80	95
Quality of team decisions and solutions	85	70	90
Managing costs (e.g., staying within budget)	85	70	95
Customer and stakeholder satisfaction, internal or external	85.8	80	90
Utilization of key skills of team members	89.2	80	95

Sponsor expectations on deliverables (question 66)

- design/plan for the warehouse (4)
- regular communication on all aspects of the project; status updates (4)
- implementation plan (3)
- highlight key information to the business that arises throughout the project (2)

Sponsor expectations for creating results in the warehouse question 67)

- reduce costs (5)
- improve service level to customers (4)
- reduced inventory of cycle time
- increased warehouse effectiveness and realize handling efficiencies
- ?

Results achieved by the team (question 68)

- successful implementation of stage one
- high level of communication to the business throughout the process
- involvement of key stakeholders in the process to achieve ownership in key areas
- performance has been an overall success (minor problems)
- well planned implementation
- ETD of all customers
- successful transition of first phase
- a cohesive network for future success
- we have implemented the plan for on schedule and effectively

Contributors to team effectiveness (question 69)

- effective communication (4)
- good skill sets of team members (3)
- strong motivation; commitment to the results; motivation to see the project be successful (3)
- effective planning; planning abilities (2)
- high energy levels
- strong leadership on the part of the team leader

Obstacles to team effectiveness (question 70)

- communication traditionally difficult across the organization; communication to the many areas of the business affected (2)

- skepticism from customer base over ability to implement successfully
- differing needs of a diverse customer base
- not a complete understanding of new and/or current systems

Additional information (question 71)
- great effort; well-focused

Time spent on survey (question 72)
- Average time spent on DLTS was 61 minutes.

F.2. Learnings About Contributors and Obstacles to Team Effectiveness

This section of the appendix contains the themes that were used to cluster the responses to two questions from the Design and Leadership Team Survey (DLTS) (What are the most significant things contributing to team effectiveness? and What are the biggest obstacles to team effectiveness?). These themes were presented in Chapter 4 Results, in a more condensed form than presented here.

These themes were extracted in the following way. First, all comments to each separate question were combined into themes (for example, commitment to the team, internal team leadership, etc.). The same themes were used for both contributors and obstacles to team effectiveness, after it was observed that the same clusters (i.e., the same themes) were emerging from the comments. These themes are identified in Table F.1, which also includes each individual comment that clustered within a theme.

The themes were then ranked using the product of two numbers: the number of individual comments made representing that theme and the number of teams the comments came from. For example, under "knowledge, skills, abilities, experience of team members", there were a total of 30 comments that came from 11 different teams. These two numbers were multiplied to get a number that represents both the *frequency* of this theme and the extent to which the theme was *dispersed* over the teams in the research sample. Alternatively, the number of comments made could have been used as the only ranking criteria. However, this method would not use important information about whether a theme was present in only a few teams vs. present across many teams. Each theme has a ranking arrived at for that theme as a contributor to team effectiveness (in the left column of the table) *and* as an obstacle to team effectiveness (in the right column of the table).

These themes were also presented in Chapter 4, but not all comments were included. Instead, only illustrative comments were included in Chapter 4 to provide specific examples of what team members said and how the comments clustered into themes.

A last summary question that was included in the Design and Leadership Team Survey, asked team members if they would like to share any additional information about their team. These responses are summarized in Table F.2.

Table F.1. Learnings about Contributors and Obstacles to Team Effectiveness

Contributors to Team Effectiveness	Obstacles to Team Effectiveness
*Team Composition - 8 comments from 6 teams: 8*6=**48** (3.9% of all comments)* ***Rank: #8 (tie)*** • The right people are involved (they are committed and have authority to change the Division)-2 • Smaller, restructured team-8 • A small team-8 • New distribution manager, change agent-8 • Team membership and leadership-10 • Strong surviving members-12 • Representation from all shifts-13 • Viewpoints (from a broad base) -14	*Team Composition- 10 comments from 4 teams: 10*4=**40** (4.7% of all comments)* ***Rank: #11*** • Team members on off shifts-8 • The small number of people to do the changes-11 • Not enough staff to handle work load, also not enough systems support staff-11 • Team is scattered across campus which minimizes opportunity for informal communications to easily take place-11 • High turnover (including facilitator)-12 • Replacement members-12 • Turnover-12 • Turnover of committee members-13 • Change over of members-13 • Change in team membership-13
*Knowledge, Skills, Abilities, & Experience of Team Members - 30*11=**330** (14.6%)* ***Rank: #2*** • Strong individual abilities-1 • Great ability of team for conceptual thought-2 • Individual competence and knowledge-2 • High percentage of group members easily grasp theoretical concepts-2 • We each have a different area of expertise-3 • Individual competencies-3 • Wide range of skill in group-5 • Knowledge of team members-6 • Team members with the right skills-6 • (Team members were) expert on various topics-6 • Ability to accept new and abstract concepts-6 • Specific members' knowledge and drive to attain a product-9 • Knowledge of the wage time card entry system as it is today and what needs to be changed-9 • Ability of individual members-9 • Broad and detailed knowledge of team members-10 • Skilled, competent team members-10 • Expertise of team members-10 • Skills and capabilities of the people-10 • Functional knowledge of team members-11 • The knowledge brought to the group by the individuals in the group -11 • Team skill-13 • Experience at jobs in the warehouse-13 • Skills and (of team members)-14 • Members' skill, experience-14	*Knowledge, Skills, Abilities, & Experience of Team Members - 9*6=**54** (4.2%)* ***Rank: #9*** • Capability of some members-1 • Risk taking capabilities of team members-1 • Skill requirements - clearly the members of this group are not equipped with the knowledge/skill/ability to drive organization change-5 • Lack of experience-7 • Skill set-7 • Lack of experienced programmers-11 • Training and skills-13 • Not a complete understanding of new and/or current systems-15 • Not completely understanding the total consequences of the process-15

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

Knowledge, Skills, Abilities, & Experience of Team Members (cont'd)	*Knowledge, Skills, Abilities, & Experience of Team Members (cont'd)*
• Skills of team members-14 • Skills from broad base-14 • Good skill sets of team members-15 • The members are serious and experienced in what they are individually skilled at-15 • Skill set -15 • Planning abilities-15	
*Purpose, Direction, and Scope of Team - 8*5=**40** (3.9%)* ***Rank: #10 (tie)*** • Larger feeling of a common purpose-1 • Shared purpose-1 • Clear charter-6 • Charter (kept us focused)-6 • Understanding of goals for the team and buy-in by team members that those goals are worthwhile-6 • Defined plan and sense of direction-8 • Vision-12 • Understanding the vision-13	*Purpose, Direction, and Scope of Team - 25*11=**275** (11.6%)* ***Rank: #3*** • Perhaps taken on a few too many PATs-1 • Prioritize our issues so we can better focus our energies-1 • Ability to stay focused on what's important-1 • Sustained focus-1 • Too little focus on true decision-making-1 • Setting priorities-1 • Too many initiatives-2 • Direction change each 6 months-2 • Not having clarity of our specific expectations-5 • Not clear understanding of what or how-5 • No clarity in roles and responsibilities-5 • Team objective not clearly defined or understood-5 • The global nature of our goals; it was hard to grasp the "big picture" of what we were trying to accomplish-6 • Over-extended lifetime of team leading to reduced motivation-6 • Lack of direction-8 • Lack of concrete, tangible objectives-10 • Trying to change too much given the complexities of the problem-11 • No clear objectives at start - up to 2 months ago-12 • Members losing focus-12 • Focus-13 • Poor direction from higher administration-14 • Lack of clear expectations and requirements from sponsors-14 • Knowing external limitations-14
Role of Team in Improvement Infrastructure	*Role of Team in Improvement Infrastructure - 3*3=**9** (1.4%)* ***Rank: #15*** • Senior management team vs. DDT line blurred-2 • Lack of integration of A and B structures-12 • Members are more aligned to serving customers than participating on the team-1

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

*Change/Redesign Methodology and Processes Used by Team - 8*6=**48** (3.9%) **Rank: #8 (tie)*** • Planning process-1 • The GSS method-5 • IMPROVE -7 • IMPROVE -7 • IMPROVE -7 • A well put together plan on various processes-12 • Knowing the current state and results we want and then mapping how to achieve them-13 • Effective planning-15	*Change/Redesign Methodology and Processes Used by Team - 8*7=**56** (3.7%) **Rank: #8*** • Lack of a "cohesive" approach to deliverables/tasks (i.e., Gap analysis, activity plans, etc.)-2 • Keeping approaches and processes simple-2 • Lack of consistency in approach-4 • Wrong use of tools (ineffective application of GSS)-5 • No immediate way to implement the redesigned procedures-6 • Lack of understanding of process design-9 • Not enough planning time before implementing new processes-11 • Biggest obstacle - no overall plan or method of different types of training - hard to gain part-timer's interest-12
*Commitment, Attitude, Willingness Within Team - 58*14=**812** (28.3%) **Rank: #1*** • Willingness to change -1 • Desire for success, attitude-1 • More positive attitude-1 • Commitment to improve the Division-1 • Certain members of the team driving forward-1 • Team members are hard working-1 • Commitment and attitude -1 • Commitment and attitude-1 • Determination to succeed-2 • Everyone tries hard-2 • Commitment-2 • Desire to improve-2 • Desire to improve Division performance-2 • Enthusiasm as team members-3 • Common commitment to improving Division effectiveness-4 • Belief that change MUST happen-4 • Intention-4 • Strong desire to improve the processes that exist-4 • Attitude of team members (positive)-4 • Willingness to learn and share-4 • Our commitment to be the best and think outside the box-5 • Willingness of all team members to work-6 • Hard-working team members-6 • Everybody committed enough time to the team-6 • Also, team members were highly motivated, reliable-6 • Interest in developing a common framework for describing the problem domain-6 • Willingness to learn-7 • Willingness to learn-7 • Willingness to participate-7 • A desire to make it work-7	*Commitment, Attitude, Willingness Within Team - 16*9=**144** (7.4%) **Rank: #4*** • (Lack of) commitment-4 • Not all team members committed to team or process-5 • Lack of commitment-5 • Attitudes-7 • Closed minds-7 • Lack of commitment by all team members-7 • (Lack of) commitment-8 • Commitment-9 • Lack of enthusiasm and ownership-9 • Apathy or disinterest-9 • (Team effectiveness depends on) people who are willing to function as a team-10 • Lack of commitment from technical computer support-11 • Different levels of commitment from members-12 • Commitment to the deadlines and deliverables-13 • Lack of some members' commitment-13 • Saboteurs on the team-13

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

Commitment, Attitude, Willingness Within Team (cont'd)	*Commitment, Attitude, Willingness Within Team (cont'd)*
• Drive for change and improvement-7 • Committed employees and team leaders-8 • Desire to improve-8 • Continue to maintain the energy level that the members have-8 • Necessity to succeed-8 • Commitment of team members-10 • Willingness to work in a team-10 • Willingness to work together-10 • Conscientiousness of individuals on team to make direct lending a success-11 • The commitment to make this project work-11 • Team member dedication, the team leader-11 • Hard work by individuals on the team-11 • Feeling by team members that new initiative will be improvement for all when working smoothly-11 • Team member enthusiasm and commitment-12 • Overall dedication and commitment to doing the job right and taking failures as learning experiences-12 • High team commitment -12 • Team effort and support-12 • Enthusiasm of membership-13 • Team inspiration-13 • Desire to achieve our goals-13 • Team commitment-13 • Team's desire to meet objectives-13 • Commitment of team members-14 • (Members') dedication-14 • Strong motivation-15 • Commitment to the results-15 • Motivation to see the project be successful -15 • High energy levels-15	
*Teamwork & Ability to Work as a Team - 22*10=220 (10.7%)* ***Rank: #3*** • Good teamwork and supportive environment-1 • Working as a team, working together to resolve differences-1 • Teamwork and following our 7 principles learned at bootcamp-1 • Great teamwork and support for each other-1 • Ability to work together - no big egos-3 • We have to continue to work together as a team; we also have to try to get others to do the same-3 • We like each other-3 • Team synergy-6 • Team ground rules-6 • As a team we work well together-7 • Well-rounded team we work well together-7	*Teamwork & Ability to Work as a Team - 16*7=112 (7.4%)* ***Rank: #6*** • Not following our 7 principles-1 • Lack of acceptance of need for structured approach to decision making-1 • New members undermining-2 • Need to work as a team to improve together and share-2 • Closing conversations and arriving at a decision-2 • Transition from concept to tactical difficult for this team-2 • Different agendas-5 • Too much work being done individually not enough collective results-5 • Not total cooperation-7 • Lack of working as a team - the forceful takeover by two of the team members-8 • The lack of supervisors working together; to work AS a team-8

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

Teamwork & Ability to Work as a Team (cont'd) • Work well together-7 • Work well together-7 • We respect one another and we value each other's opinion-7 • Total cooperation and input from everyone-7 • The ability to work together-8 • Learning the team process-10 • Cooperation-11 • Good group bonding-12 • Practicing ground rules/intention pieces-12 • A respect for everybody's ideas and inputs-13 • Team chemistry-14	*Teamwork & Ability to Work as a Team (cont'd)* • (Lack of) cooperation-8 • Personal agendas-8 • Not working as a team-9 • Situations still arise which bring out the "turf" mentality -11 • Not putting blame on someone for things that don't work-11
*Participation Within the Team - 8*5=**40** (3.9%)* ***Rank: #10 (tie)*** • We meet regularly (or used to)-2 • Participative-4 • Regular meetings-9 • Active members of team taking increased responsibility of leading team discussion-9 • Participation by everyone-9 • The active participation of each member-10 • Team participation-12 • Leadership roles taken by key members-12	*Participation Within the Team - 6*4=**24** (2.8%)* ***Rank: #12*** • Better understanding of roles we may play as a team member-4 • Attendance-7 • Lack of regular attendance by several members-9 • Poor attendance-9 • Some people don't attend regularly-9 • Self-confidence-13
*Communication and Trust Within Team - 12*7=**84** (5.9%)* ***Rank: #5*** • Many team members quite outspoken and articulate-2 • Open and honest-4 • Regular communication-4 • Communication-8 • Communication-8 • Team members felt comfortable in expressing opinions openly and without criticism from other team members-11 • Open communication-12 • Ability of group to express/communicate-13 • Effective communication-15 • Good communication within the team-15 • Being part of the loop - communication-15 • Communication -15	*Communication and Trust Within Team - 16*8=**128** (7.4%)* ***Rank: #5*** • Specialized information not shared-1 • Open and honest communication still not practiced (afraid to hurt each other), affecting trust-1 • Not communicating and trusting each other-1 • Improving level of trust with each other-1 • Lack of open and honest dialogue-1 • Lack of trust-2 • Communication-2 • Lack of trust-5 • Lack of trust-5 • The biggest obstacle would be trust-7 • (Lack of) communication-8 • Sometimes get hung up by one person, confuses other members-9 • Long drawn out discussions that lead to nowhere-9 • Talking at too much at once-12 • Communication - we are still not able to have "crystal conversations" with other team members on a consistent basis - leads to certain degree of mistrust-12 • Communication not consistent-13

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

*Internal Team Leadership - 16*9=**144** (7.8%)* ***Rank: #4*** • Convener did good job of preparing and guiding meetings-2 • Leader's energy-5 • Good leadership-7 • Team leaders' knowledge/skills/experience-9 • Team leader is a good leader-9 • Good group leader-11 • Convener-12 • Convener-12 • Excellent project leader with good facilitation skills-12 • Project managers - focus-12 • Dedication from the team's facilitator-12 • Team leader-13 • Change agent-13 • Change agents expertise and drive-13 • (Team) leadership-14 • Strong leadership on the part of the team leader-15	*Internal Team Leadership - 4*4=**16** (1.9%)* ***Rank: #13*** • Team leader sends mixed messages by saying one thing and doing another-1 • The management team's ability to accept their new roles and be able to lead the warehouse employees through the change process-8 • The distribution manager sometimes negatively impacted the team's performance-8 • Team effectiveness depends on a good team leader-10
*Resources for Team (Training & Facilitation) - 11*7=77 (5.4%)* ***Rank: #6*** • Bootcamp to learn and intent and commitment-1 • Bootcamp experience-1 • Team building exercises-1 • Outside facilitation and guidance from external facilitators-4 • Facilitation-5 • Outside facilitation-5 • Continued education/development of team members-8 • Good facilitation-10 • Training and retraining - CPI methodology, bootcamp-12 • Good training (bootcamp really set the stage)-12 • Bootcamp-13	*Resources for Team (Training & Facilitation) - 2*2=**4** (0.9%)* ***Rank: #16*** • Not finished learning the IMPROVE process-7 • Lack of education-8
*Guidance and Support from Team Sponsor(s) - 4*3=**12** (2.0%)* ***Rank: #12*** • Sponsor focus/commitment-1 • Excellent support from HRIS sponsor and Provost and EVP in providing framework for discussion with Deans/VPs-6 • Continued support from the sponsor-8 • Strong vision of sponsors which rolls down to business plans for warehouse-8	*Guidance and Support from Team Sponsor(s) - 7*6=**42** (3.3%)* ***Rank: #10*** • Sponsor managing the political front more effectively-1 • Unclear/vacillating leadership from sponsors, as characterized by their difficulty in articulating goals, objectives-3 • Lack of leadership and direction from sponsors-5 • Getting senior management buy-in; not sure of our direction initially-6

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

Guidance and Support from Team Sponsor(s) (contd)	*Guidance and Support from Team Sponsor(s) (contd)* • We had to define our purpose, charter ourselves and educate all levels of management above us once we educated ourselves about the needs, university culture, management styles, technical capabilities, etc.; once they were educated, we had their support-6 • Continued pressure from sponsors to close the warehouse if objectives are not met-8 • The indecision by the policy board as to what changes we can implement - too much turf-protecting is going on-10 • Sponsors making decisions not supported by team members-11 • Unwillingness of sponsors and others to devote time to this task-14
*Boundary Management with Stakeholders (Employees, Customers, Upper Management/Leadership) - 3*3=9 (1.5%)* ***Rank: #13*** • Staff input-12 • More associate input-13 • Team leader and sponsor's ability to understand the customer needs and communicate them to upper management-14	*Boundary Management with Stakeholders (Employees, Customers, Upper Management/Leadership) - 13*7=91 (6.0%)* ***Rank: #7*** • Cooperation from other NG divisions-1 • Operators don't buy-in to the Division's initiative-1 • Team customers (staff) are out of touch with activities-2 • Being able to communicate and get people to understand what Project ENABLE is all about-3 • Coordination with other PATs-7 • We have to convince the employees that this is not just another flavor of the month idea-7 • We have to work on building their trust-7 • Relaying the message to the workforce i.e., vision, commitment, attitude-13 • Promoting customer commitment and buy-in -13 • Convincing EVP and CBO to agree to our conception of the problem and how to address it-14 • Communication traditionally difficult across the NG organization-15 • Communication to the many areas of the business affected, the stores (over 600 affected), to ensure the information reaches those who need it (e.g., night crews, clerks, etc.)-15 • Differing needs of a diverse customer base-15

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

*Organizational Context and Culture - 10*7=70 (4.9%)* ***Rank: #7***	*Organizational Context and Culture - 41*11=451 (19.1%)* ***Rank: #1***
• Leadership-1 • Willing to invest in strategic initiative-1 • We are supported by senior management-2 • Empowered to make decisions-6 • Atmosphere/support from management-7 • Employees willingness to accept change-8 • Employee buy-in-8 • Trust from National Grocers-12 • The support from all levels of management-13 • Support from all levels-13	• What's recognized/rewarded, time spent on initiatives or "regular job"-1 • Business culture --> bottom line-1 • Politics of other parts of the organization in not using strategic approach-1 • Going to the old way-1 • Resource allocation-1 • Internal silos-2 • History-3 • Fear of failure-5 • Resistance to change-7 • Collective agreement-7 • Collective agreement-7 • Union negotiations-7 • Union management relationships-7 • On-site management's commitment (low)-7 • History is difficult to ignore-7 • Old baggage, old habits-7 • History, paradigms-7 • Stuck in the past-7 • Contract negotiations-8 • Lack of support from management-8 • Supervision and management - not commitment or leadership-8 • Attitudes and lack of support-8 • Abandonment of team philosophy, by lack of support for rep's by management, e.g., supervisors not playing the role of coach-8 • No trust or support from warehouse employees-8 • Not all employees buying in-8 • Employee cooperation or buy-in-8 • Lack of coherent and consistent commitment to quality initiatives and process redesign at a university level-10 • Culture of university not prepared and resisting change-10 • Cross-sections of the university are involved but seem to place different priority on the project-10 • Lack of understanding that "improvement" efforts are part of the "real" work of the store-12 • Resistance to change-12 • Not walking the talk - key in-store influences-12 • Expectations of quick results-12 • Lack of "out of the box" thinking-12 • Old paradigms-13 • Employee distrust, resentment and disinterest-13 • Employees feel we are not effective-13 • Lack of respect for the team-13 • Lack of management buy-in to new concepts - although team leader and sponsor made good progress here-14 • Poor commitment to consistent and effective management principles-14

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

Organizational Context and Culture (cont'd)	*Organizational Context and Culture (cont'd)* • Skepticism from customer base over ability of NG to implement successfully-15
*Making Time for the Team - 1*1=1 (0.5%)* ***Rank: #14*** • Time-13	*Making Time for the Team - 26*11=**286** (12.1%)* ***Rank: #2*** • Demands/expectations from our customers (external to Finance) who have different priorities-1 • Lots of workload-1 • Time commitments-1 • Operators' issues come first-1 • Conflicting demands on time-1 • Time-2 • Getting things done on time-3 • Time-4 • We lack time to focus and communicate on what we are doing and what others are doing-4 • (Lack of) time-4 • Balancing of business priorities and time to allow proper focus and dedication to the team's responsibilities and initiatives is extremely difficult-4 • Other duties-6 • Volume of actions to be analyzed-6 • Time management between "A" and "B" work-7 • Difficulty in managing time commitments-7 • Timing-7 • Getting time from "A" work to have meetings-7 • Time-7 • Too many other things on the go-8 • Team members missing meetings due to other priorities taking precedence-10 • Team members actual job responsibilities preventing timely involvement-10 • Freeing up time to work on improvements outside of team meetings-12 • Managing time and taking time to apply the tools-12 • Daily work responsibilities outside team-13 • Time-13 • The team was organized later in the entire project; the sub-team commitments made time allocation difficult-15
*Technical Content-Related Issues - 1*1=1 (0.5%)* ***Rank: #14*** • Loading PAT - participation and wanting to improve how loading is done-7	*Technical Content-Related Issues - 6*3=**18** (2.8%)* ***Rank: #14*** • Executing effective systems solution-1 • Confusion of new system and what it will effect-8 • (Lack of) equipment-11 • Delay in software from Department of Education-11 • Bugs in software and network system-11 • Mismatch of structure between PC based system and mainframe-11

Table F.1 (cont'd). Learnings about Contributors and Obstacles to Team Effectiveness

*Comments Not Categorized - 5*3 (2.4%)* • Can't comment on the team's effectiveness due to the clear lack of achieving results-5 • Job security-7 • Satisfaction gained from improvements-7 • Right now, nothing - present team is a dinosaur (past 6 months)-8 • Cannot at this time consider this team effective-8	*Comments Not Categorized - 7*4 (3.3%)* • DDT-1 • Uncertainty of individuals' future (security, promotion)-1 • Team has no room to invest now for future benefits-1 • Shifting from theoretical to objectively analyze success in practice-2 • I, as a member, have been out of the loop for several months and feel unaware of what is going on-2 • Our team in my opinion had no obstacles-6 • Don't want to cut jobs-7
Total Number of Individual Comments: 205	Total Number of Individual Comments: 215

Table F.2. Additional Information from Design and Leadership Team Survey

- Formal planning process is key-1
- Buy-in or commitment from senior people in division is required for success-1
- The team does not spend enough time on the long-term, and using the wall as our planning document. Rotating conveners is only good at building capability if they have some training at facilitation to go with it; the team should be driving communication to our customers-1
- We need to understand the outcome of our decisions, need to appreciate the total picture of the organization as it affects all of us-1
- The team is improving each day and we as a team are learning new ideas and strategies that will lead to great success in the future-1
- We tend to look for the perfect solution before implementing; this tends to stall progress and momentum-1
- It's a continual process of plan-do-study-act; today's solutions are tomorrow's problems; resolve issues so next month's problems are different-1

- Clarity of purpose is a big issue-2
- We spend too much time talking about "nothing" - where the goal of the discussion is not clear to all therefore we appear to get nowhere-2
- The feedback from customers of the team (Division staff in general) indicated that they viewed the team as a senior management team and often mistook initiatives by this team as management initiatives, although I believed we were quite open on motives and where initiatives came from-2
- I think the team is improving/growing-2
- We are currently in a temporary transitional phase and I believe my role will be clarified in the next month-2
- Overall, we're doing the right things and this team is worthwhile-2
- Ultimately, we will achieve our goals and carry NG to a higher performance-2
- The team has been on a hiatus for approximately three months during which time the Division has undergone significant organizational change; the responses to this survey are based on the team prior to the changes taking place-2
- Need to understand the restructuring initiatives/roles and responsibilities before taking on more improvement initiatives-2

- We need to narrow our focus and be better at doing some of the key tasks-3
- Enjoy working with people on the team; have learned a lot and accomplished a lot; it's not easy getting people to communicate and work with you on the Project but as a team we are doing our best-3
- We need to step back and re-evaluate, re-assess our direction and results more often-3
- Another obstacle which challenges us is old baggage; in the past, the university community's expectations have been excited but not satisfied with tangible results-3

- We certainly need guidance and experience to help us along - our collective skills for this type of work could be of a higher level to be effective-4

- I believe that the major cause for poor/no results in this team was the lack of a clear vision for Distribution, and a clear and concise charter for the team-5
- The additional team really never had an opportunity to get off the ground. The commitment needed to be successful was never clearly defined-5

- This was a good group of people who were willing to work together; everyone was willing to acknowledge and value the personalities of the other team members-6
- Was a good team that worked well together-6
- This was the *only* effective team I have been on in this organization-6
- Results are likely to be misunderstood or ignored by most people-6
- This team was a winner because of the things above, in previous question. Also because we arrived at an answer that everybody liked (sponsors, customers, stakeholders)-6
- This team is an excellent example of a team that "empowered" itself when it saw a need and was effective in getting support from higher levels-6
- This team was one of the most satisfying work experiences I've had at Virginia Tech in the last 2-4 years-6

Table F.2. Additional Information from Design and Leadership Team Survey

- We are all learning a lot about the business and the improve process is a good tool to learn-7
- IMPROVE CPI system consumes a lot of time-7
- The team is losing speed quickly, not as motivated as in the beginning, need to get re-focused-7
- More coaching, establish a roadmap, set goals, I'm not sure everyone realizes the task/consequence-7
- It is like anything else, I would like to change things overnight but we all know that this is impossible, so we have to work hard at what we do and be patient-7
- The CPI process has been challenging but not too hard, should have had more training -7

- If upper management does not buy in, give up! -8
- This team is full of energy and desire; the team members must be chosen more carefully and more detailed education is needed-8
- The team must plan better and concentrate on areas that will push us forward-8
- Interpersonal squabbles have essentially halted all activity at this point-8
- The DSOTF or any other start-up group or warehouse will be in jeopardy unless you have strong leadership (committed) to the project to help and steer any team in the right direction and help educate each and every member-8
- At present, the doubts and fears of fellow employees - the lack of trust-8
- Some give it all (110%), others think it is flavour of the month-8
- It's nice to see a new team, a new start; the old team did many good things but started to fall behind on new ideas; need more action-8
- Enjoyed role on the team and fell that we had made progress but not to the level sponsors felt we should be at. -8

- I have not been an effective member of this team due to time constraints/demands of my job at Virginia Tech-9
- A solid methodology and a group consensus of purpose is critical to success-9
- Sometimes wish I was not on the team, it takes me away from my work too much at times-9

- I have found this group to be collectively the most knowledgeable and congenial group I have ever worked with at Tech and expect to be more successful than most-10
- In spite of some frustrations the team has been able to identify critical issues because of its cross-functional perspectives-10
- This team is not the same as process redesign team, thus making survey difficult to answer-10

- I feel we did not have complete support of higher administration which resulted in delays in obtaining necessary equipment and also did not provide staffing needed to implement program within the time frame we were given-11
- This team was given a task without the equipment and support that it needed to make this project a success-11
- We need additional buy-in from upper management so they'll provide necessary support to make this process work-11
- We needed more lead time to interface the two systems; we also had to spend too much time defending the recommended platform for the PC side-11

- Our team is a very proud hard-working group of people, not everyone understands or shows interest, but we will continue to work hard every day for what we believe in, while trying to gain their interest and respect; I am very proud to have worked with these people-12
- Would have been helpful if expectations of sponsors were more clearly defined at the outset-12
- I am very proud of the team's efforts to date to make the program a success-12
- I know we are going in the right direction and we will reach our vision as long as all levels of the organization in and out of the store has the same mind set regarding time it takes to implement the change-12
- Time to change was not put into the calculations or the "best" players for the initial team-12
- I feel we need to slow down and concentrate more on the "A"; at this point managers need to spend more time on the job, sharing the learnings-12

Table F.2. Additional Information from Design and Leadership Team Survey

- The team has had a shaky start with current conditions and roadblocks they have faced, in spite of it all they have chartered PATs which have accomplishments. We will arrive at a CPI launch soon; stability is our current priority. -13
- Important to understand that the warehouse has experienced tremendous change in last year; it has been difficult for group to remain focused during operation chaos-13
- Team members joining and leaving the team has a negative effect on performance; 20/80 rule is a reality, 20% of members contribute 80% of the effort-13
- The thing that strikes me the most is the respect shown to each other (no stripes)-13
- As a team we have made great gains by learning from our mistakes and there is no doubt in my mind that we will succeed-13
- We have made progress to many areas; we are committed to continue as a team to attain our goals-13
- The team has worked hard at implementing the DSOTF; I feel that we will be successful leaders in time; our planning and organization methods are good, this will help us be successful-13

- The team leader and sponsor were outstanding; this team could be used on other projects very effectively-14
- Clearer instructions on support to make changes in system were needed-14

- Great effort; well-focused-15

Appendix G Post-Hoc Analysis

This appendix contains results and SPSS output from post-hoc analysis, discussed in Chapter 5 (Conclusions and Interpretations). The first section in this appendix contains the SPSS output from a one-way ANOVA comparing all fifteen teams on the variable "team skills" in order to be able to identify "high-skill" and "low-skill" teams. Next, the SPSS output is shown from a series of one-way ANOVAs of "high-skill" teams compared to "low-skill" teams on specific skills. And lastly, the one-way ANOVA to compare teams having a charter vs. those that do not on clarity in sponsor expectations is shown.

The second section of this appendix contains the Within and Between Analysis results to compare the three dependent variables (team performance-1, team performance-2, and team satisfaction).

The third section of this appendix contains boxplots to demonstrate graphically the differences between teams on the key variables which emerged from data analysis (team skills, clarity in sponsor expectations, team self-assessment) in addition to dependent variables (team performance-1, team performance-2, and team satisfaction). Also in this section are scatterplots portraying the relationship between specific skills and the variable team skills, which was discussed in Chapter 5.

G.1. Analysis of Variance for Post-Hoc Analysis

Variable **TMSKLS** Team Skills
By Variable TM_NO Team number

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	14	37.9463	2.7104	4.5984	.0000
Within Groups	115	67.7842	.5894		
Total	129	105.7305			

Bonferroni's Multiple Range Test
Variable **TMSKLS** Team Skills
By Variable TM_NO Team number

Multiple Range Tests: Modified LSD (Bonferroni) test with significance level .05

(*) Indicates significant differences which are shown in the lower triangle.
Number in parentheses is the team number.

Mean	TM_NO	Tm 8	Tm 5	Tm 4	Tm 9	Tm 2	Tm 11	Tm 7	Tm 1	Tm 13	Tm 12	Tm 3	Tm 10	Tm 15	Tm 6	Tm 14
3.3967	PLT (8)															
3.6444	DSOTF DDT (5)															
3.6500	IPCF DDT (4)															
4.1333	TELT (9)															
4.1500	ISD DDT (2)															
4.1500	DLT (11)															
4.2667	OLT (7)															
4.2833	Fin SMT (1)															
4.3200	SRLT (13)															
4.5111	CFLT (12)															
4.8000	SST (3)															
4.8571	BPR Pln (10)	*														
4.9333	SMW Str (15)	*														
5.2286	DET (6)	*	*													
5.4000	RA Team (14)	*	*													

Variable DT13A **Problem solving and decision making**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.0380	.0380	.1565	.6938
Within Groups	61	14.8191	.2429		
Total	62	14.8571			

Variable DT13B **Meeting management**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.4881	.4881	.6649	.4180
Within Groups	61	44.7817	.7341		
Total	62	45.2698			

Variable DT13C **Group process and facilitation**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	1.7867	1.7867	2.2287	.1407
Within Groups	60	48.1004	.8017		
Total	61	49.8871			

Variable DT13D **Computer skills** (word processing, spreadsheets, electronic mail)
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	13.4543	13.4543	8.8682	.0042
Within Groups	61	92.5457	1.5171		
Total	62	106.0000			

Variable DT13E **Communication and listening**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sumn of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	1.7214	1.7214	4.2528	.0435
Within Groups	61	24.6913	.4048		
Total	62	26.4127			

Variable DT13F **Making presentations**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.4492	.4492	.4958	.4840
Within Groups	61	55.2651	.9060		
Total	62	55.7143			

Variable DT13G **Systems thinking and perspective**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	1.0943	1.0943	1.4394	.2350
Within Groups	60	45.6154	.7603		
Total	61	46.7097			

Variable DT13H **Organizational redesign**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	3.5831	3.5831	4.1749	.0454
Within Groups	61	52.3534	.8583		
Total	62	55.9365			

Variable DT13I **Large-scale organizational change**
By Variable SKLCLS

Analysis of Variance

		Sum of	Mean	F	F	
Source	D.F.	Squares	Squares	Ratio	Prob.	
Between	Groups	1	.8729	.8729	.6751	.4145
Within	Groups	61	78.8732	1.2930		
Total	62	79.7460				

Variable DT13J **Writing reports and plans**
By Variable SKLCLS

Analysis of Variance

		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	1	6.4453	6.4453	6.3545	.0143
Within Groups	61	61.8721	1.0143		
Total	62	68.3175			

Variable DT13K **Managing change**
By Variable SKLCLS

Analysis of Variance

		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	1	.3517	.3517	.5540	.4596
Within Groups	61	38.7277	.6349		
Total	62	39.0794			

Variable DT13L **Leading groups or teams**
By Variable SKLCLS

Analysis of Variance

		Sum of	Mean	F	F
Source	D.F.	Squares	Squares	Ratio	Prob.
Between Groups	1	.1850	.1850	.2467	.6212
Within Groups	60	44.9924	.7499		
Total	61	45.1774			

Variable DT13M **Self-managing/self-directed work teams**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.8353	.8353	1.0186	.3168
Within Groups	61	50.0218	.8200		
Total	62	50.8571			

Variable DT13N **Personality style (e.g., Myers-Briggs)**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	3.3518	3.3518	2.2905	.1365
Within Groups	50	73.1674	1.4633		
Total	51	76.5192			

Variable DT13O **Technical, job-related skills in my area**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.9823	.9823	2.0361	.1587
Within Groups	61	29.4304	.4825		
Total	62	30.4127			

Variable DT13P **Knowledge about the *target system*** (output/products, customers, work processes, etc.)
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.1427	.1427	.1376	.7120
Within Groups	61	63.2859	1.0375		
Total	62	63.4286			

Variable DT13Q **Improvement methodologies** (Continuous Process Improvement, Business Process Redesign, etc.)
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	1.2562	1.2562	1.5965	.2113
Within Groups	60	47.2115	.7869		
Total	61	48.4677			

Variable DT13R **Quality tools** (flowchart, cause-and-effect, Pareto, etc.)
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.3097	.3097	.2793	.5991
Within Groups	61	67.6268	1.1086		
Total	62	67.9365			

Variable DT13S **Measurement and data collection**
By Variable SKLCLS

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.6905	.6905	.6078	.4387
Within Groups	60	68.1643	1.1361		
Total	61	68.8548			

Variable CLRSPNEX **Clarity Sponsor Expectations**
By Variable CHRTYSN Presence of team charter (yes/no)

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	3.6627	3.6627	3.9093	.0502
Within Groups	128	119.9242	.9369		
Total	129	123.5869			

G.2. Post-Hoc Within and Between Analysis on Dependent Variables

This section contains the results from Within and Between Analysis on the three dependent variables. The two team performance measures (team performance-1 and team performance-2) are compared, as well as team performance measures with team satisfaction (team performance-1 and team satisfaction, team performance-2 and team satisfaction) (see tables below).

Group Level WABA Results for Team Performance-1 and Team Performance-2.

Team Performance-1 (TMPERF1) and Team Performance-2 (TMPERF2)	**Induction**
Covariance Equation: (.6663)*** = (.7837)***(.5619)***(.9134)*** + (.6212)(.8272)(.5140)***	
WABA I Tests: TMPERF1: F = 13.07, p<.0001 TMPERF2: F=3.79, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.9134, p<.005 Difference between r_b and r_w: Z'= 3.19, p=.0007	WHOLES
COMPONENTS: Between: .4022 Within: .2641	WHOLES
FINAL Induction	WHOLES (Category I)

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Performance-1 and Team Satisfaction

Team Performance-1 (TMPERF1) and Team Satisfaction (TMSATF)	**Induction**
Covariance Equation: (.5824)*** = (.7837)***(.5747)***(.7218)*** + (.6212)(.8184)(.5063)***	
WABA I Tests: TMPERF1: F = 13.07, p<.0001 TMSATF: F=4.05, p<.0001	WHOLES
WABA II Tests: Magnitude of r_b: r_b=.7218, p<.005 Difference between r_b and r_w: Z'= 1.15, p=.1251	EQUIVOCAL
COMPONENTS: Between: .3251 Within: .2574	WHOLES
FINAL Induction	NONE

*p<.05, **p<.01, ***p<.005

Group Level WABA Results for Team Performance-2 and Team Satisfaction

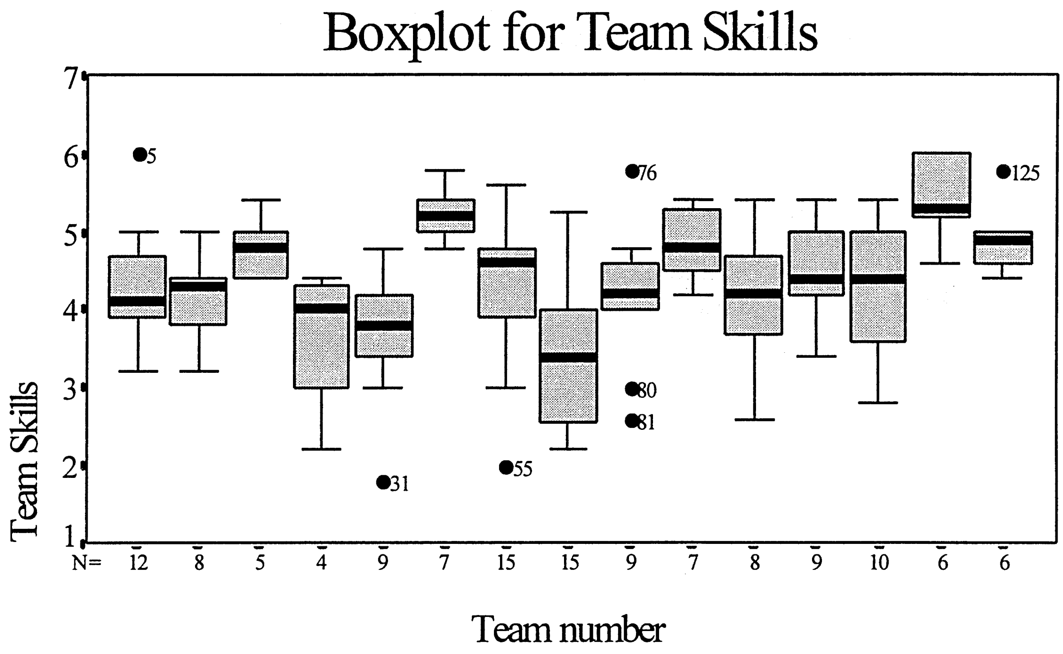
Team Performance-2 (TMPERF2) and Team Satisfaction (TMSATF)	Induction
Covariance Equation: (.4774)*** = (.5619)***(.5747)***(.6266)** + (.8272)(.8184)(.4062)***	
WABA I Tests: TMPERF1: $F = 3.79$, $p<.0001$ TMSATF: $F=4.05$, $p<.0001$	WHOLES
WABA II Tests: Magnitude of r_b: $r_b=.6266$, $.005<p<.01$ Difference between r_b and r_w: $Z' = 0.99$, $p=.1611$	EQUIVOCAL
COMPONENTS: Between: .2023 Within: .2750	PARTS
FINAL Induction	NONE

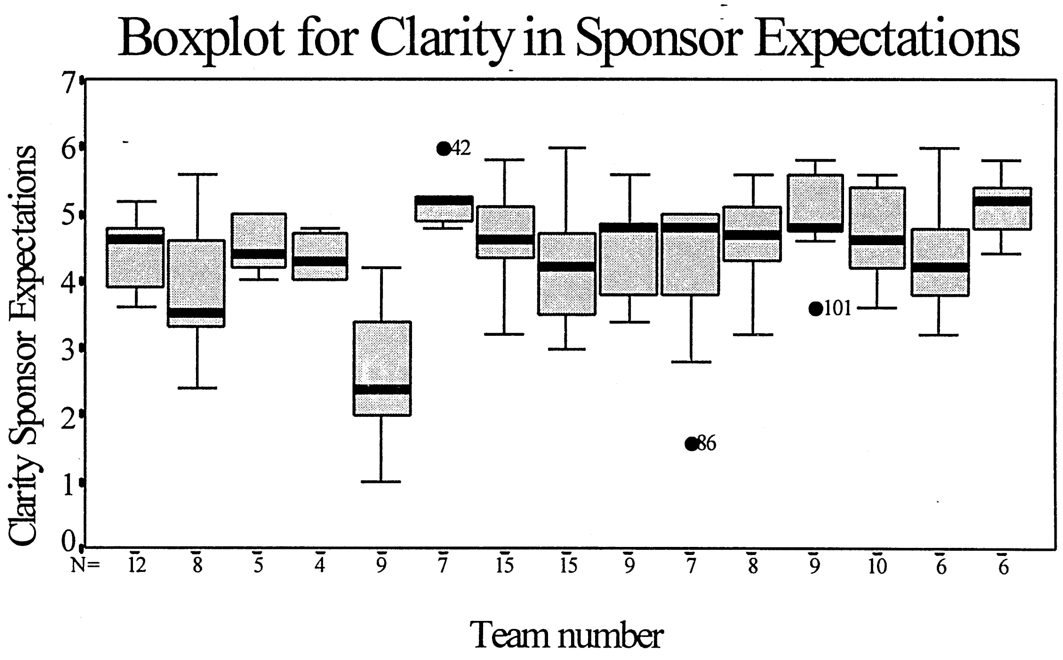
*p<.05, **p<.01, ***p<.005

G.3. Graphics of Key Design Features Related to Team Effectiveness

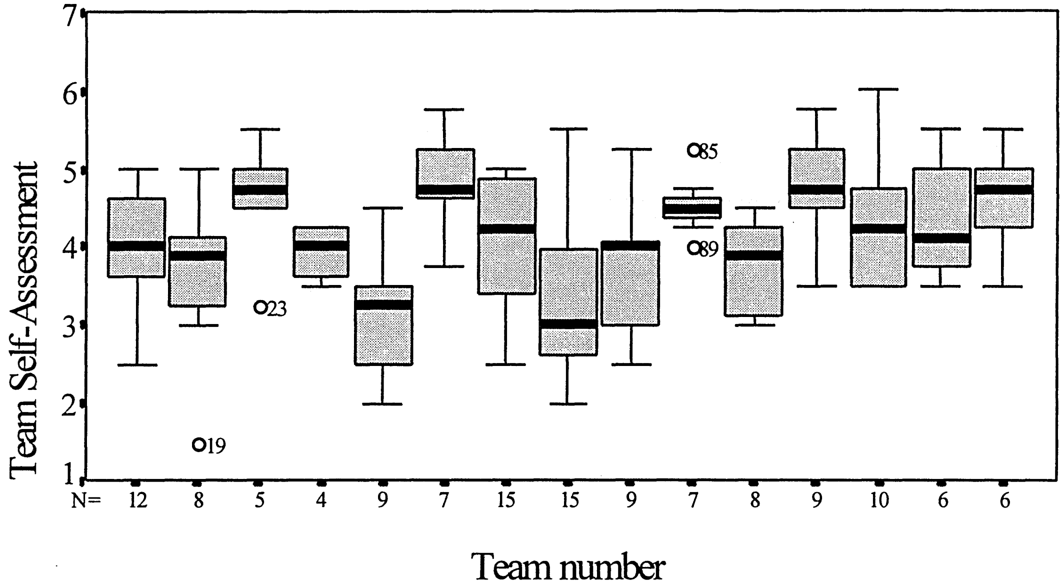
As discussed in Chapter 5, the key variables (design features) which emerged from data analysis which were significantly related to team effectiveness were: team skills and clarity in sponsor expectations (related to team performance) and team self-assessment (related to team satisfaction). In this section, boxplots of these variables are presented in this section. These boxplots represent a graphical portrayal of the differences between teams on a given variable. For each of these three variables, previous analysis indicated that there were significant differences between teams. As a comparison, a boxplot is shown for a variable for which there was not significant differences between teams ("percent meeting attendance"). In addition, boxplots for the three dependent variables are presented (team performance-1, team performance-2, and team satisfaction).

Following the boxplots, scatterplots are presented to portray the relationship between four specific skills (communication and listening, computer skills, organizational redesign, and writing skills) and the variable team skills. These four skills were reported significantly more by "high-skill" teams than by "low-skill" teams, as discussed in Chapter 5.

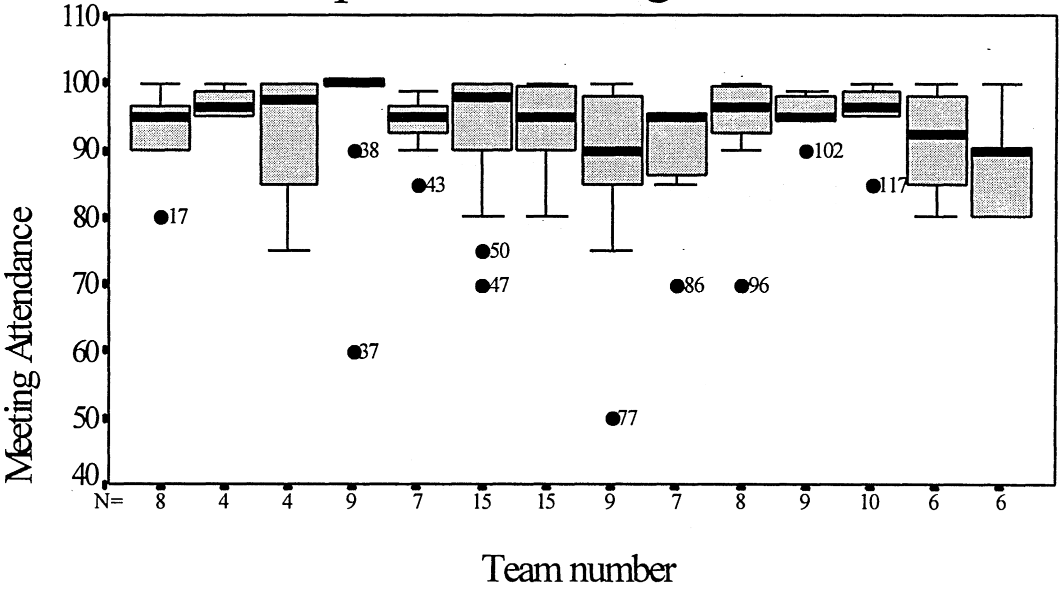

Boxplot for Team Skills
Team Skills
7
6
5
4
3
2
1
5
76
125
80
81
55
31
N=
12
8
5
4
9
7
15
15
9
7
8
9
10
6
6
Team number

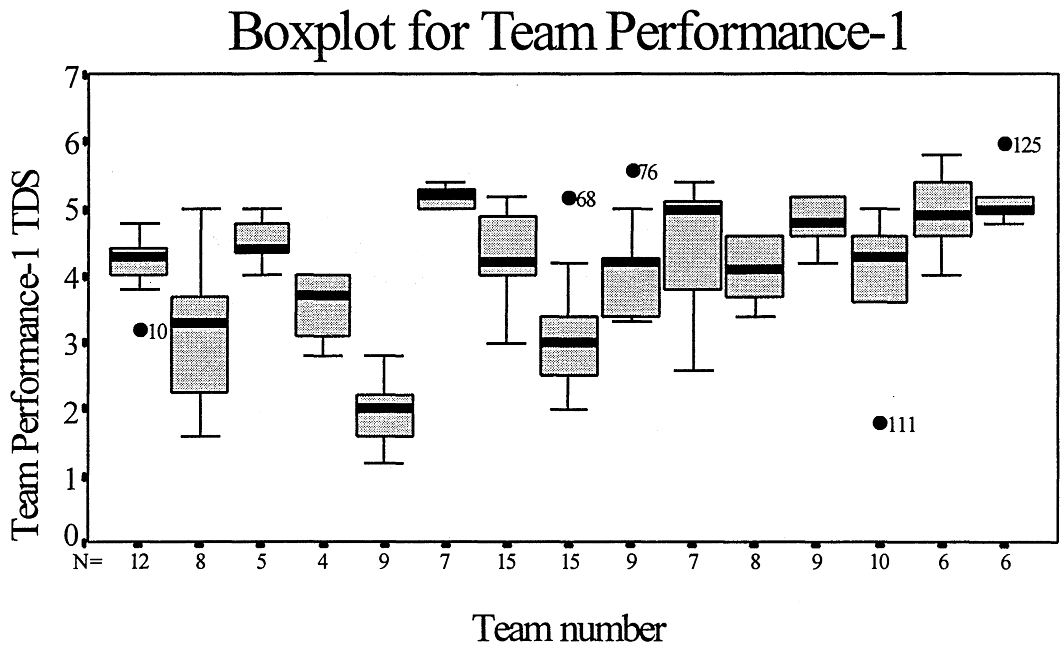

Boxplot for Clarity in Sponsor Expectations
Clarity Sponsor Expectations
7
6
5
4
3
2
1
0
42
101
86
N=
12
8
5
4
9
7
15
15
9
7
8
9
10
6
6
Team number

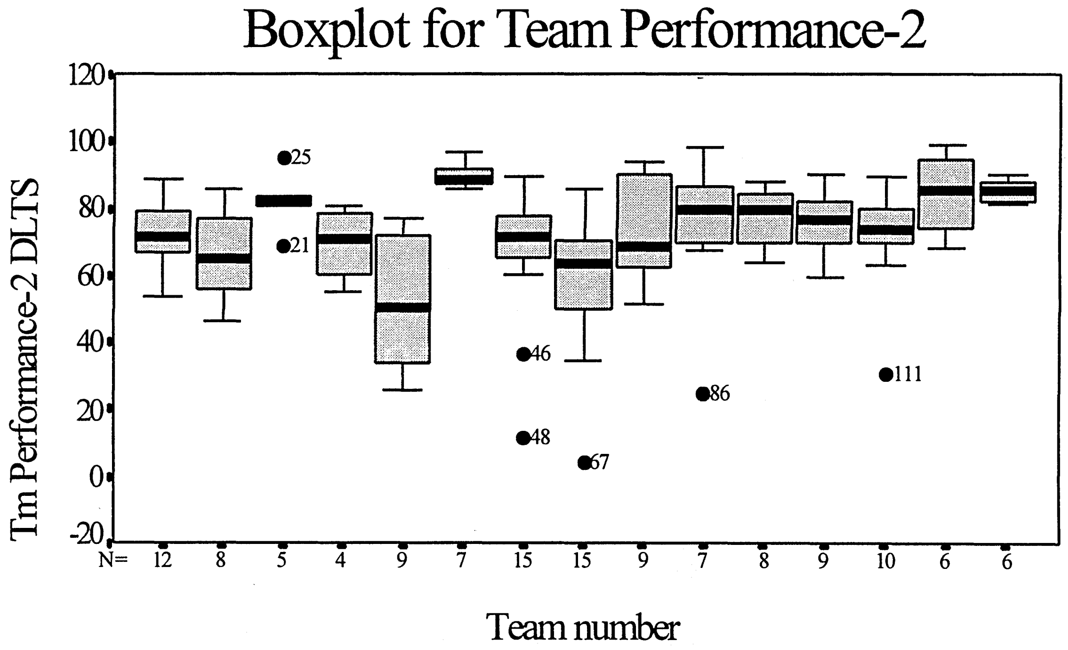
Boxplot for Team Self-Assessment



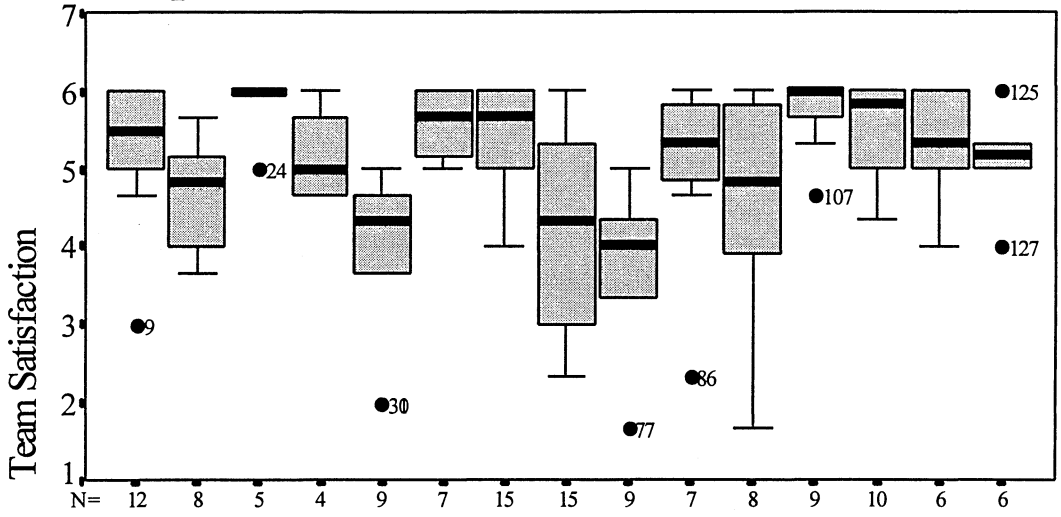
Boxplot for Meeting Attendance

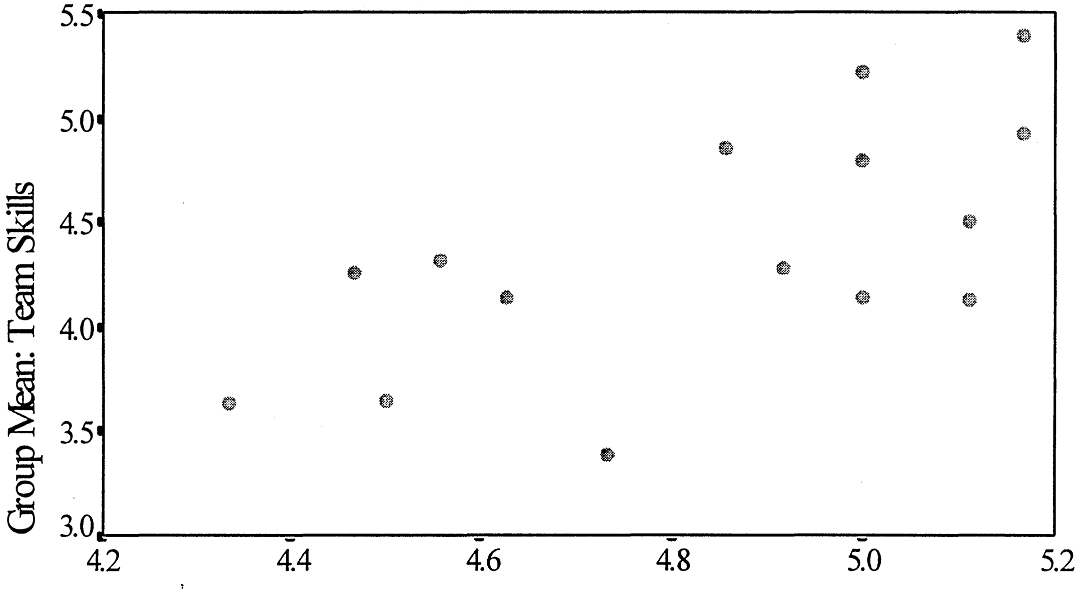



Boxplot for Team Performance-1
Team Performance-1 TDS
7
6
5
4
3
2
1
0
N= 12 8 5 4 9 7 15 15 9 7 8 9 10 6 6
10
68
76
111
125
Team number

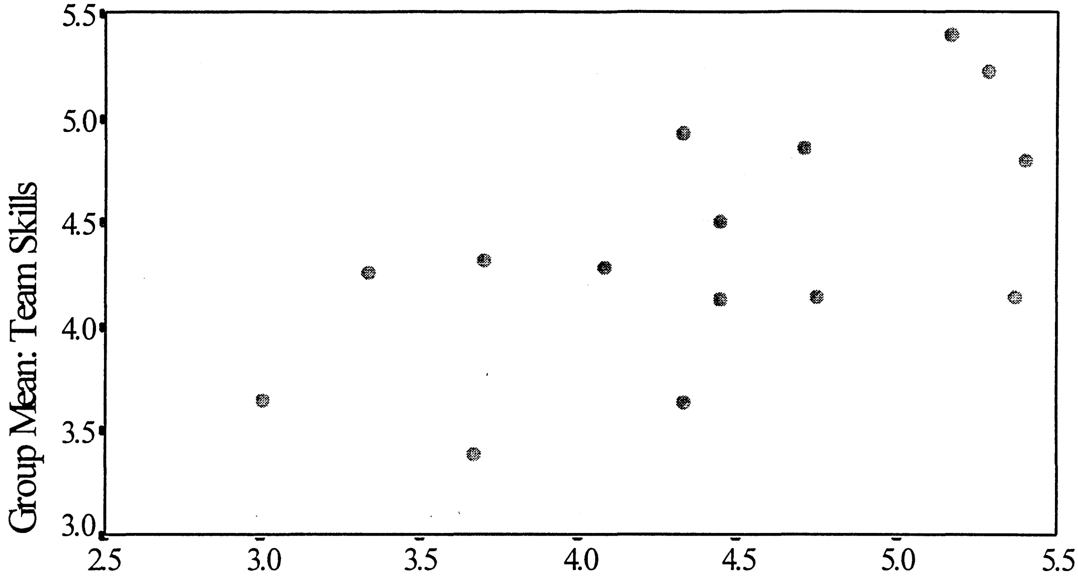

Boxplot for Team Performance-2
Tm Performance-2 DLTS
120
100
80
60
40
20
0
-20
N= 12 8 5 4 9 7 15 15 9 7 8 9 10 6 6
25
21
46
48
67
86
111
Team number

Boxplot for Team Satisfaction

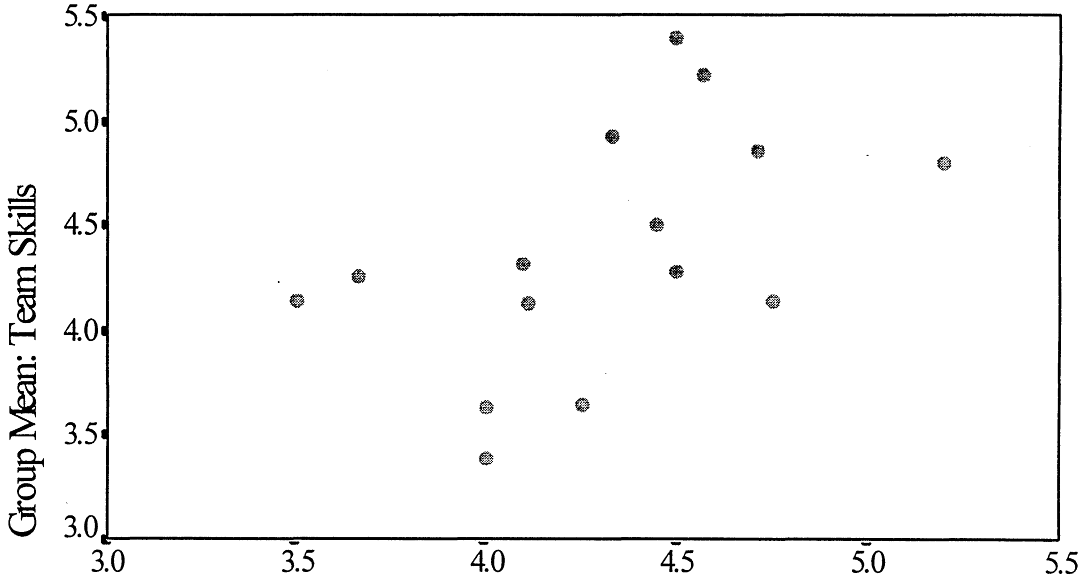




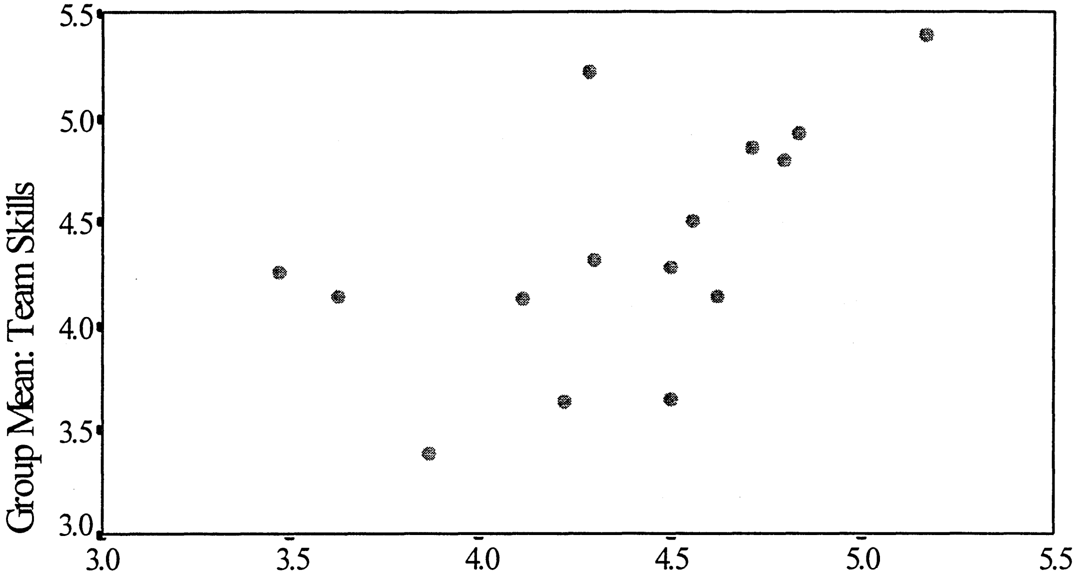
Group Mean: Communication and listening, r=.56, p<.01



Group Mean: Computer skills, r=.56, p<.01



Group Mean: Organization Redesign, r=.49, p<.025



Group Mean: Writing reports and plans, r=.55, p<.01

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