The Effects of Authority on Group Decision-Making Performance

by

Bryan Hertweck

Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University in fulfillment of the requirements of the degree of

MASTER OF SCIENCE

in

Industrial and Systems Engineering

Approved:

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(ABSTRACT)

This research studied the effects on performance of differing types of authority within decision-making groups. Assigned leader groups were representative of authority of position (Barnard, 1968). Emergent leader groups were representative of authority of leadership (Barnard). Authority type was not found to have a significant effect on leadership, group, or organizational performance of decision-making groups. Interrelationships of the multiple dependent performance variables were studied. It was found that Sink and Tuttle’s (1989) performance criteria and Campbell’s (1990) leadership tasks could be simplified for the short-term, small group decision-making process. Ranking of and rewards for teams were found to affect the way groups evaluated their own performance. This research successfully studied the elusive concepts of authority and leadership in an applied setting, and should generate further research in the area of authority-performance interaction.
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Table of Contents

Chapter 1 Introduction and Scope of Research ................................................. 1
1.1. Problem Statement ......................................................................................... 1
1.2. Background ................................................................................................. 1
1.3. Research Question ...................................................................................... 3
1.4. Research Purpose ....................................................................................... 3
1.5. Research Objectives ................................................................................... 4
1.6. Premises and Delimitations ....................................................................... 4
1.7. Conceptual Model ...................................................................................... 5
1.8. Sub-Questions ............................................................................................ 8
1.9. Sub-Outputs ............................................................................................... 8
1.10. Research Hypothesis .................................................................................. 9

Chapter 2 Review of the Body of Knowledge ..................................................... 10
2.1. Leadership Research .................................................................................. 10
   2.1.1. Trait Research ...................................................................................... 10
   2.1.2. Style and Behavior Research ............................................................... 11
   2.1.3. Situation Research .............................................................................. 12
   2.1.4. The Missing Link: The Leadership Performance Link .................. 12
2.2. Authority and Leadership ........................................................................ 14
   2.2.1. Leadership Is Rooted in Authority ...................................................... 14
   2.2.2. The Inevitability of Leadership ........................................................... 16
   2.2.3. The Bases for Authority and Leadership ........................................... 17
   2.2.4. Conflicting Bases of Authority and Leadership ............................ 20
2.3. Group Processes ....................................................................................... 21

Chapter 3 Research Methodology ..................................................................... 27
3.1. Research Model ........................................................................................ 27
3.2. Subjects .................................................................................................... 29
3.3. Research Environment ............................................................................ 29
3.4. Data Collection Instruments .................................................................. 32
3.5. Procedure ................................................................................................ 33

Chapter 4 Results ............................................................................................. 38
4.1. Organizational Performance .................................................................... 39
4.2. Group and Leadership Performance ......................................................... 40
   4.2.1. Tests on Original Survey Constructs .............................................. 41
   4.2.2. Reliability Analysis ......................................................................... 42
   4.2.3. Tests on Refined Survey Constructs .............................................. 43
Chapter 1
Introduction and Scope of Research

1.1. Problem Statement

This research sought to identify the effects on performance of differing types of authority within decision-making groups. It focused on the performance of small decision-making groups under both formally assigned and informally emergent authority. The resultant knowledge will enable more effective group decision-making within organizational systems.

1.2. Background

According to Barnard (1968), authority is "the character of a communication (order) in a formal organization by virtue of which it is accepted by a contributor to or 'member' of the organization as governing the action he contributes; that is, as governing or determining what he does or is not to do so far as the organization is concerned" (p. 163). In other words, authority is the property of a communication which gives the communication influence within the group. For instance, declaring an order authoritative implies that it will be followed. Barnard also indicated that people impute authority to their communications on the basis of either superior position or superior ability. He referred to these two bases of authority as "authority of position" and "authority of leadership," respectively (p. 173).

Barnard (1968) also contended that the receiver of a communication is the sole determiner of whether the communication is authoritative. When a communication is
deemed authoritative, the receiver can be described as a "follower." The issuer, that person who imputed authority to the communication, can then be described as a "leader." The leader, therefore, is the source of authoritative communication. More generally, the leader of an organization is its most influential member—the member most likely to be followed.

Barnard (1968) described an organization as "a system of consciously coordinated activities or forces of two or more persons" (p. 73). Fisher (1980) described a group as "a collection of individuals whose communicative behaviors...become interstructured and repetitive" (p.22). According to these descriptions, a decision-making group can be considered to be an organization. Thus, the descriptions of authority and leaders above apply to decision-making groups.

Using groups or teams as part of the infrastructure is a significant part of the response to the challenge of today's highly competitive global marketplace. Weisbord (1987) claimed that "Properly used, groups can only improve decision making and problem solving" (p. 133). Fisher (1980) asserted that group processes enjoy the advantages of resource variety, more information sources, and division of labor over processes performed by an individual. The use of groups can also cause problems terms of decreased decision speed, increased salary and training costs, and resistance and conflict associated with the changeover to a group-oriented environment (Lawler, 1986). In order for groups to be "properly used," knowledge of the effects of differing types authority on decision-making performance is essential.
Three types of performance are important to this study. "Leadership Performance" is a function of seven leadership tasks (vision, management, empowerment, politics, feedback, entrepreneurship, and personal style) deemed crucial to organizations by Campbell (1990). "Group Performance" is a function of the interrelationships among seven criteria: effectiveness, efficiency, productivity, quality, quality of worklife, innovation, and profitability/budgetability (Sink and Tuttle, 1989). In this study, both leadership and group performance are based on subjective data generated by group members. "Organizational Performance" is a function of the success of the organization for which the group provides decisions. In this study, organizational performance is an objective measure provided by the group’s parent organization.

1.3. Research Question

The primary question this research has attempted to answer is: How does the imposition of authority of position (Barnard, 1968) compare to the natural emergence of authority of leadership (Barnard), when measuring the performance of a decision-making group.

1.4. Research Purpose

The purpose of this research was to enable improvement of the performance of decision-making groups by creating a better understanding of the effects of authority type on performance.
1.5. Research Objectives

The objectives of this research were:

1. To determine which type of authority—imposed or emergent—leads to greater leadership, group, and organizational performance.

2. To demonstrate the relationship between authority and the multiple dimensions of performance and leadership within decision-making groups.

3. To describe the interrelationships among the multiple dimensions of performance when applied to decision-making groups.

1.6. Premises and Delimitations

1. A leader is a group member who exhibits authority through influential communication.

2. Leaders exist in all decision-making groups, regardless of whether their existence is formally designated or recognized.

3. Certain tasks are essential to leadership in organizations.

4. As an accumulation of individuals working toward a goal, a decision-making group is an organization.

5. This research did not seek to describe or prescribe methods or strategies for becoming a leader.

6. This research did not seek to identify personal traits, behaviors, or styles which might be predictive of leadership.
1.7. Conceptual Model

The Management System Model (MSM) (Kurstedt, 1994) depicts a management system, its components, and their interrelationships. Figure 1.1 illustrates the MSM.

![Diagram of the Management System Model (MSM)](image)

*Figure 1.1. Management System Model (MSM)  
(Adapted from Kurstedt, 1994, p. 199)*

The MSM can be understood by viewing the model in a clockwise direction, starting at “Who Manages.” A manager makes a decision resulting in action upon the organization. This action causes a change. Measurement is performed to create data which represent the effect of the manager’s action. This data is fed into a management tool which converts innocuous data into meaningful information. The tool portrays the information which the manager subsequently perceives and then the cycle is the repeated. By iterating through the MSM, managers and organizations can learn and continuously improve.
Figure 1.2. The “Who Manages” component of the MSM

This research concentrates on the “Who Manages” component of the MSM. It is important to note that this component represents any decision-making body—it is not limited to an individual manager. Kurstedt (1994) states, “In some organizations, the who manages employs a participative management style, and decisions are made collectively” (p. 471). This research considers “Who Manages” to be a decision-making group; therefore, that MSM component may be better illustrated by Figure 1.2.

Figure 1.3 illustrates the constructs and hypothesized interrelationships to be studied.
The left side of Figure 1.3 represents an input/output model for the decision-making system. Group members are assembled to serve as inputs to a decision-making process. One member becomes the leader through either formal assignment of authority of position or informal emergence of authority of leadership. Inputs to the decision-making process are leadership tasks (provided by the leader) and knowledge, ideas, time, effort, etc. (provided by all group members). The decision-making process leads to decisions and subsequent actions upon the organizational system. The right side of Figure 1.3
shows the outcomes of the decision-making system. Leadership performance is the subjective measure (as determined by individual group members) of the extent to which leadership tasks are performed. Group performance, based on subjective data provided by group members according to Sink and Tuttle’s (1989) seven performance criteria, is the comprehensive measure of the decision-making process. Organizational performance represents the parent organization’s objective measure of its performance as a result of the decision-making process’ outputs.

1.8. Sub-Questions

1. How does the imposition of authority of position compare to the natural emergence of authority of leadership within a decision-making group, when measuring the performance of the organization for which the group makes decisions?

2. How does the imposition of authority of position compare to the natural emergence of authority of leadership, relative to a group’s self-evaluation of performance?

3. How are Sink and Tuttle’s (1989) performance criteria interrelated as indicators of a group decision-making process?

1.9. Sub-Outputs

1. A comparison of the organizational performance results of assigned vs. unassigned leadership in decision-making groups.

2. A comparison of group performance assessments of assigned vs. unassigned leadership in decision-making groups.
3. An assessment of the correlations among the multiple performance dimensions measured by a survey instrument.

1.10. Research Hypothesis

The primary hypothesis for this study was: Groups which are allowed natural leader emergence will perform better (both as evaluated by the group and the parent organization) than teams which are assigned leaders. The null and alternative hypothesis were as follows:

\[ H_0: \mu_A = \mu_E \]
\[ H_1: \mu_A < \mu_E \]

where "\( \mu \)" indicates a mean for a performance indicator, "A" indicates assigned leader groups, and "E" indicates emergent leader groups (groups with no leader assignment).
Chapter 2
Review of the Body of Knowledge

The aim of this research was to enable improvement of the performance of decision-making groups by creating a better understanding of the effects of authority type on performance. This section reviews research in the area of leadership, authority and leadership within groups, and group processes.

2.1. Leadership Research

Much of the research in the area of leadership within groups has been focused on determining what makes a leader stand apart from the remainder of the group. First, a review of the general leadership theories is appropriate.

2.3.1. Trait Research

The trait approach to leadership study focuses on distinguishing leaders from followers through the identification of key personal characteristics. Years of research has attempted to identify physical and personality traits which explain or predict leadership. Fisher (1980) stated, however, that “Virtually no one today considers the traits approach a satisfactory explanation of leadership” (p. 195). He presented three shortcomings of the trait approach. He stated that personality traits are difficult to measure. He also claimed that while traits may be able to predict the attainment of leader status, traits provide no insight into way to maintain that status. Finally, Fisher made the point that the trait approach does not address the level of effectiveness of a leader. Similarly, Napier and Gershenfeld (1993), in discussing leader traits, asserted that “it is impossible to predict
and to use this information in selecting and training leaders” (p. 239). House and Baetz (1990), however, indicated that there is potential to learn more from trait studies. They suggested classifying the numerous past studies according to:

1. Demographics of the population studied;
2. Type of tasks performed;
3. Trait measurement method; and
4. Leadership criterion variables.

Then, secondary analysis could possibly identify traits that are correlated with leadership regardless of measurement technique. Further analysis could also identify traits correlated with leadership for members of specific demographic populations, for particular tasks, and for particular leadership criteria (p. 13).

2.3.2. Style and Behavior Research

Another area of investigation has focused on the manner in which one attempts to lead rather than the traits that tend to be associated with leaders. Early studies in this area sought to identify differences among democratic, authoritarian, and laissez-faire leaders. Subsequent studies have branched out to study differences in levels of participation, amount of supervision, and style of communication. This approach shares one of the challenges of the trait approach—styles and behaviors are difficult to measure. Compounding this problem is the fact that, while many traits may remain relatively constant over time, styles and behaviors may vary significantly from situation to situation.
2.3.3. Situation Research

One answer to the pitfalls of the trait and style approaches is the situation approach. This approach assumes that each situation requires a person with certain traits to exhibit certain styles or behaviors to be a successful leader. As Hersey and Blanchard (1977) stated, "Empirical studies suggest that leadership is a dynamic process, varying from situation to situation with changes in leaders, followers, and situations" (p. 89). Hersey and Blanchard (1975) suggested that the two central dimensions of any leadership situation are concern for production and concern for people. Leadership style can be categorized by the extent to which leaders demonstrate concern in those two dimensions. Leaders must be able to diagnose situations and determine what leadership style is best for the group. Changing leadership styles, however, "is a slow and expensive process which requires creative planning and patience" (Hersey and Blanchard, 1975, p. 150). Even if this approach has practical application, it does little to advance the underlying science of leadership. As Fisher (1980) pointed out, "It depends on the situation'...seems to be little more than a 'cop-out' to explain the inexplicable" (p. 198).

2.3.4. The Missing Link: The Leadership-Performance Link

Traits, behaviors, and styles of leaders have been studied extensively in hopes of creating better ways of selecting and training leaders. The matter of whether or not leaders make a difference seems to be an area of study which is in need of development. House and Baetz (1990, p. 6) quoted Pfeffer (1977, p.105-106) as stating, "literature assessing the effects of leadership seems to be equivocal" and "given the resources that
have been spent studying, selecting and training leaders, one might expect that the question of whether or not leaders matter would have been addressed earlier.” In addition to the research about leaders themselves, it is necessary to study the roots of their authority. It is important to understand how groups respond to different types of authority before seeking understanding of the personality and behavior of the leader.

Goldman and Fraas (1965) studied the effects of four different bases of authority on group performance. In their study, leaders were: (1) elected by the group, (2) selected according to ability by an outsider, (3) selected arbitrarily by an outsider, or (4) not appointed. Goldman and Fraas did conclude that “the method of selecting a leader does make a difference in group performance” (p. 87). They also found that for one performance dimension, “the non-leader groups function better than the leader-appointed groups” (p. 88). The task studied, however, was highly rudimentary—a “twenty questions” guessing game which allowed only short spurts of group interaction. Additionally, the only performance variables studied were time and number of trials to solve the puzzles.

Borg (1957) also studied leader emergence. He studied United States Air Force Officer Candidate School students working in group decision-making situations under various leadership conditions. Borg sought to determine how individual and group performance change when a leader is designated after an natural leader emergence was permitted in previous problems. Additionally, he studied the differences in performance among groups in which a leader emerged, groups in which no leader emerged, and groups
in which two leaders emerged (p. 95). Borg concluded that, "the designation of the wrong individual as leader in a small group situation...tends to suppress the emergence of a more capable leader" (p. 103). Additionally, he stated that "the designation of a competent leader appears to be a major determiner of team effectiveness" (p. 103). The study, however, studied existing groups who practiced under a paradigm of leader emergence; it did not examine leader emergence versus appointment for newly-formed groups.

As work is designed and redesigned utilizing groups and teams, it seems that leader appointment and emergence is an important topic to study. It is important to understand what drives the performance of leaders, their groups, and their organizations. Knowledge of the effects of the different bases of authority and leadership can aid the proper design of workgroups which will make decisions within organizational settings.

2.2. Authority and Leadership

Leadership is consistently viewed as an integral part of virtually any cooperative effort. In order to study the effects of leadership on performance, it is important to see the link between leadership and authority and to understand the different bases for authority.

2.2.1. Leadership Is Rooted in Authority

Barnard (1968) described authority as a characteristic of communication within an organization. A communication described as having authority is likely to be followed or submitted to—the authoritative communication is influential. A communication center (a
person in a decision-making group setting) imputes authority to communications. The influence of the communication makes its receiver a "follower" and its sender a "leader." Barnard approaches leadership from the behavioral perspective. He described leadership as having two aspects—technical and moral. The technical aspect has to do with the demonstration of superior skill and knowledge. Barnard claimed that this aspect is "subject to specific development by conditioning, training, [and] education" (p. 260). The moral aspect has to do with the demonstration of superior determination and courage. Barnard indicated that the moral aspect is demonstrated through decisions and actions which are aligned with organizational values. Leaders demonstrate Barnard's technical and moral aspects through authoritative communication.

Napier and Gershenfeld (1993) stated, "leadership can be defined as the frequency with which an individual influences or directs the behaviors of others within a group" (p. 229). Additionally, they stated that "leaders are those who wear the cloak of authority at each level in the organization" (p. 235). Lindgren (1982) defined leaders as those "who accumulate, possess, use, dispense, and create power"; power, according to Lindgren, is "the faculty of getting others to do things" (p. 57). Therefore, a leader is one who wields authority through influential communication.

Kleiner (1993) contended that communication is a vital process and function in any management system. He asserted that "by having a systematic way to understand communication, a way to assess its effectiveness and methods for continuous improvement, your organizational system and you will be more successful" (p. 20). A
better understanding of authority and resultant leadership can contribute to that systematic understanding of communication.

Three concepts concerning authority are consistent throughout the literature:

1. A system of varying authority, influence, status, or power exists in every cooperative effort.

2. Authority (and accompanying leadership) are rooted in two primary bases, referred to in general as formal and informal.

3. The success of a cooperative effort is dependent on the alignment of the two authority types. Misalignment breeds problems and conflict; alignment facilitates the attainment of goals.

These concepts are expanded upon in the sections below.

2.2.2. The Inevitability of Leadership

Barnard (1968) stated that “everyone must report to someone” and “everyone must subordinate to someone” (p. 176). Similarly, Lindgren (1982) asserted that “leaders are necessary because groups are necessary” (p. 57). As a result, a hierarchy develops with leaders as communication centers and followers as their subordinates. Fisher (1980) asserted that a status hierarchy exists in every social organization. He stated that the ideal of a democracy—where no status distinctions exist—“is not only unrealistic; it is utter nonsense” (p. 191). One’s position in the hierarchy is indicative of one’s capacity to impute authority and become a leader. Bonner (1959) stated that that “in every group individuals exist who will try to dominate the others” (p. 164). If a status hierarchy is
inevitable within every group, it is important to understand what determines an individual’s status. In other words, what is the foundation for the existence of authority?

2.2.3. The Bases for Authority and Leaders

There are two primary bases for authority and leadership. Different authors have provided different names for each; they can be generalized as formal and informal. Table 2.1 summarizes the bases of authority and leadership discussed below.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Formal Basis</th>
<th>Informal Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fayol</td>
<td>Official Authority</td>
<td>Personal Authority</td>
</tr>
<tr>
<td>Barnard</td>
<td>Authority of Position</td>
<td>Authority of Leadership</td>
</tr>
<tr>
<td>Torgersen</td>
<td>Manager</td>
<td>Leader</td>
</tr>
<tr>
<td>Fisher</td>
<td>Ascribed Status</td>
<td>Achieved Status</td>
</tr>
<tr>
<td>Seaman</td>
<td>Appointed Leader</td>
<td>Elected Leader</td>
</tr>
<tr>
<td>House &amp; Baetz</td>
<td>Formal Leader</td>
<td>Emergent Leader</td>
</tr>
<tr>
<td>French &amp; Raven</td>
<td>Reward, Coercive, Legitimate Power</td>
<td>Referent, Expert Power</td>
</tr>
<tr>
<td>Lindgren</td>
<td>Appointed Leader</td>
<td>Elected Leader</td>
</tr>
</tbody>
</table>

Fayol (1949) claimed that “distinction must be made between a manager’s official authority deriving from office and personal authority, compounded of intelligence, experience, moral worth, ability to lead, past services, etc.” (p. 24). Barnard (1968) echoed the notion that authority may exist in two forms—authority of position and authority of leadership. Authority of position is rooted in titles and structures. In fact, Barnard stated that this type of authority “is to a considerable extent independent of the personal ability of the incumbent of the position” (p. 173). Authority of leadership is earned through demonstrated ability. Those who possess authority of leadership have knowledge and understanding which commands respect regardless of the position they
hold. Torgersen (1969) stated that authority of position and authority of leadership are analogous to the titles of manager and leader. A manager exhibits authority of position. His or her orders are followed because the structure of the group or organization dictates a certain hierarchy of authority. A leader, however, is followed because he or she has developed a track record of success. Therefore, the title of manager can be bestowed while the role of leader must be earned.

Fisher (1980) claimed that often two status hierarchies exist simultaneously within organizations—one based on ascribed status, and one on status achieved. A person inherits ascribed status through placement into a certain position. Achieved status, however, is earned by individual striving. “A social group awards status on the basis of a person’s past behaviors in that group” (p. 190). The ascribed and achieved status hierarchies constitute the formal and informal structures of the organization.

Seaman (1981) stated that leaders are either appointed or elected. The appointed leader is granted a position or title. The elected leader is granted authority by followers who have identified in that person “special expertise which can help them reach their goals” (p. 88). Seaman stated that the elected leader is more likely than the appointed leader to succeed because (p. 88):

1. The leader knows the group members, including their ideas, opinions, and feelings.
2. The leader knows the purposes, goals, and tasks which must be accomplished.
3. The group has confidence in and respects the leader (otherwise that individual should not have been elected).
4. By knowing past accomplishments and failures of the group, the leader can avoid many mistakes which would be made by a person not as familiar with group membership.

Lindgren (1982) echoed Seaman's idea of appointed and elected leaders. He asserted that “there are two major ways in which an individual may become an authority figure: he is either designated by some higher authority or he is selected by the group” (p. 129). He referred to these two leader-types as appointed and elected leader, respectively.

House and Baetz (1990) indicated that leaders can be divided into formal leaders and emergent leaders. Formal leaders are those “who are assigned formal or legal authority to direct others” (p. 4). Emergent leaders are those who exhibit certain traits and behaviors which earn voluntary compliance to the leader’s influence. House and Baetz also asserted there are two dimensions to each type of leader: “the degree to which behavior is intended to influence others and the degree to which such influence attempts are viewed as acceptable to the person who is the target of the influence attempt” (p. 4).

French and Raven (1960) identified five bases of social power: reward, coercive, legitimate, referent, and expert. Reward, coercive, and legitimate power can be seen to fall under the umbrella of Barnard’s (1968) concept of authority of position. Reward power is one’s ability to control another’s incentives. Coercive power is one’s ability to mediate another’s punishment. Legitimate power is the demonstration of influence which is one’s right by virtue of his or her formal position within a social structure. Referent and expert power are subsets of Barnard’s notion of authority of leadership. Referent
power is based in a desire to identify with another. One who submits to referent power seeks recognition through association with another who is perceived to have achieved particular prestige or status. Expert power is the ability to influence others through demonstrated knowledge, intelligence, or cognitive ability in a certain area.

There are two primary ways in which authority becomes manifest in groups. Authority is either formally bestowed upon an individual or authority is informally earned by an individual. The imposition of authority yields an assigned leader, or perhaps more appropriately, a manager. Some may consider the only “real” leader type to be emergent. An emergent leader exhibits earned authority. These two bases for authority have implications for the manner in which decision-making groups perform. Study into the impact of each basis is necessary.

2.2.4. Conflicting Bases of Authority and Leadership

It is possible for the two primary bases for authority and leadership to exist in parallel within a group; therefore, the potential for conflict between them exists. Fisher (1980) stated that when the ascribed and achieved hierarchies conflict, “the ascribed status position of the formal structure is often second best” (p. 190). Seaman (1981) identified five reasons for the lack of acceptance of an appointed leader’s authority. His first reason, “The group wants someone else for leader” (p. 88) indicates a conflict between formal and informal establishment of authority and leadership. The second reason is that the leader’s ideas conflict with those of the group, a more indirect indication of conflicting bases of authority. The third and fourth reasons are a lack of understanding of
the group's goals and a lack of desire to meet them. The final reason is that the appointed leader represents the "establishment"—the controlling upper hierarchy of an organization which may be disliked or misunderstood by the remainder of the organization. Lindgren (1982) also presented some problems for appointed leaders. He argued that "the appointed leader must contend with a handicap in the form of hostility or apathy, resulting from the fact that his subordinates have had no voice in his selection and appointment" (p. 141). House and Baetz (1990) also addressed the potential conflict between formal and emergent leaders with the following generalization: "When formally appointed leaders fail to perform the leader behaviors required for group success, an informal leader will emerge and will perform the necessary leader behaviors, provided success is desired by the group members" (p. 19). French and Raven (1960) asserted that multiple bases of power can coexist. They also pointed out that problems arise when those in positions of authority attempt to exert power of a basis outside their domain. Finally, Torgersen (1969) argued for a coalescence of the two bases, stating that "where these two are combined and the manager possesses leadership ability, authority is most likely to be granted" (p. 153). Care must be taken to avoid the potential detriments associated with conflict between formal and informal authority.

2.3. GROUP PROCESSES

Authority and leadership have been talked about within the context of group settings. This section describes the nature of groups and an increasingly popular subset of groups known as teams. As a basic assumption of the field of group dynamics, Cartwright and
Zander (1960, p. 34) asserted that "groups are inevitable and ubiquitous." Varying definitions of "group" exist. Fisher (1980, pp. 16-17) cited various bases for defining "group." He stated that, historically, accumulations of individuals have been defined as a group based on:
1. Shared perception: individuals have a common belief in the existence of a group;
2. Shared goals: individuals seek to move or work toward a common goal;
3. Shared fate: individuals face common repercussions of the outcomes of accumulation;
4. Shared values, norms, laws: individuals work within a single structure of relationships and rules; or
5. Interdependence: individual actions influence and affect other individuals.

Brilhart (1978, pp. 20-21) provided an integrated definition of "group" consisting of five characteristics:
1. A number of people sufficiently small for each to be aware of and have some reaction to each other.
2. A mutually interdependent purpose in which the success of each is contingent upon the success of the others in achieving this goal.
3. Each person has a sense of belonging or membership, identifying himself with the other members of the group.
4. Oral interaction (not all of the interaction will be oral, but a significant characteristic of a discussion group is reciprocal influence exercised by talking.)
5. Behavior based on norms and procedures accepted by all members.

Similarly, Malcolm and Hilda Knowles (1959, pp. 39-40) stated that an accumulation of individuals becomes a group when:

1. Its membership can be defined.

2. It possesses a group consciousness.

3. It possesses a sense of shared purpose.

4. Its members have an interdependence in the satisfaction of their needs.

5. Interaction among the members is evident, and

6. The group is able to act in a unitary manner.

In short, a group is an accumulation of individuals who share a common purpose and must interact in order to develop a shared method to arrive at that purpose. Groups may be consciously formed or may emerge informally. Whether they are inevitable or not, they are widely used in organizations today. Specifically, many organizations are embracing the concept of the “team,” a specific kind of group.

Booth (1994) claimed, “unlike other management ideas that have come and gone, there is good reason to believe that teamwork will be not a brief infatuation but an enduring relationship between employees and their organizations” (p. 10). The distinction between group and team is subtle. Teams fall within the realm of consciously formed groups; they are tool consciously employed by organizations in search of improvement. The term “team” seems to connote more interdependence and cohesion as
opposed to the mere interaction that occurs in “groups.” Lawler (1986) cited the following potential benefits associated with the use of teams:

1. Improvement is likely in work methods and procedures.
2. A gain is likely in attraction and retention.
3. Staffing flexibility increases.
4. Service and product quality usually increase.
5. Rate of output may improve.
6. Staff support level can be reduced.
7. Supervision can be reduced.
8. Decision-making is likely to improve (p. 110).

Lawler also cited accompanying problems:

1. Salary costs will go up.
2. Training costs will go up.
3. Additional support personnel may be needed for training.
4. Unmet expectations for organizational change can occur.
5. Resistance by middle management can be a problem.
6. Resistance by staff support groups can occur.
7. Unmet expectations for personal growth and development can occur.
8. Conflict between participants and nonparticipants can be a significant problem if only a few teams are formed.
9. Time is lost in team meetings, and decisions may be slow (p. 113).
Booth (1994) suggested five generic types of teams: project, problem-solving, process-improvement, self-managed, and self-directed. Project teams work through a complete project-cycle toward explicit goals, typically disbanding after goal-attainment. Problem-solving and process-improvement teams tend to be more permanent and are geared toward specific high-level goals. Problem-solving teams work in a reactive mode, while process-improvement teams are proactive. Self-managed and self-directed teams are also permanent, but deal more with the day-to-day operations of the organization. Self-managed teams are natural work groups which likely do not alter the fundamental way in which work is done; self-directed teams are self-contained units whose role is focused on one complete aspect of the organization’s work.

Sundstrom et.al. (1990) provided a way to classify teams according to their level of integration and differentiation. Integration refers to the extent to which a team must be synchronized, coordinated, or linked with entities from the larger organizational system. Differentiation refers to the degree of specialization, independence, and autonomy of a team. Advice/involvement teams are low in both differentiation and integration. Production/service teams are low in differentiation and high in integration. Project/development teams are high in differentiation and low in integration. Action negotiation teams are high in both differentiation and integration.

The groups of this study can be classified as project teams under the typologies of both Booth (1994) and Sundstrom et.al. (1990). The individuals are brought together with explicit goals to attain, and disband upon attainment. The task of the groups is
specialized and the groups are relatively autonomous. The work of the groups does not require a high degree of synchronization or coordination with outside groups.

The purpose of this study was to gain a better understanding of the manner in which differing bases of authority affect group decision-making performance. This knowledge can be used to aid in the design of decision-making groups and teams.
3.1. Research Model

An experiment studying small decision-making groups was designed and conducted. Half of the groups were assigned leaders who were responsible for certain leadership tasks. The other half of the groups were made aware of the importance of the leadership tasks, but were assigned no leader. Periodically, multiple dimensions of performance were assessed for all groups. Leader emergence was also investigated in the groups which had no leader assigned. Following the study, performance data were analyzed to determine differences between the different group types and correlations among performance dimensions.

Figure 3.1 shows the research model. The independent variable manipulated is the type of authority of the decision-making group. The type of authority present influences the performance of the leadership tasks, the group performance, and the organizational performance. There are also moderating variables at work which, when systematically varied, could affect the relationship between the independent and dependent variables. The heterogeneity of the group with respect to various demographics could affect the influence of a particular authority type. The familiarity of group members with the decision-making process and with each other could have the same effect. Between the manipulation of authority type and the resultant performance measures, groups may receive feedback from their parent organization which affects the way in which they
perceive the performance of their leader or their group process. Finally, there may be some uncertainty inherent in the decision-making process which could affect the relationship between independent and dependent variables.

**Figure 3.1.** The research model shows the relationships among research variables.
3.2 Subjects

The subjects for this study were 92 juniors and seniors enrolled in an Industrial and Systems Engineering course at Virginia Tech. These students participated in a management simulation known as "The Academic Department Game" (Chapman, et.al., 1974). The students were randomly assigned to 20 simulation groups (12 groups of five students; eight groups of four). Ten groups (six of five students, four of four students) were randomly assigned a leader. Uneven group sizes were necessary because the simulation requires that the number of groups participating be a multiple of five. Two students dropped the course during the course of the simulation, creating two groups of three with assigned leaders. Table 3.1 depicts the resulting setup of groups and treatments used.

<table>
<thead>
<tr>
<th>Treatment Designation</th>
<th>Emergent Leader</th>
<th>Assigned Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authority of Simulation Groups (Size)</td>
<td>Leadership</td>
<td>Position</td>
</tr>
<tr>
<td>C1(5), C2(5), C3(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4(4), C5(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1(5), D2(5), D3(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4(4), D5(4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.3 Research Environment

The study took place within the context of an Industrial and Systems Engineering (ISE) course in Virginia Tech's College of Engineering. The course was ISE 4004—A Theory of Organization, taught in the spring semester of 1995. The course was required
for the 80 ISE students enrolled and a technical elective for the remaining 12 students, who were from other engineering disciplines. Its catalog description reads: “A theory of cooperative behavior in formal organizations, including the structure and elements of formal organizations. The executive process and the nature of executive responsibility also are examined.” Part of the typical course content is participation in “The Academic Department Game” (Chapman, et.al., 1974), a game-type simulation of the decision-making process of an academic department head in a university. The simulation is comprised of several American National Standard (ANS) FORTRAN-IV programs. It is run on Virginia Tech’s “VTVM1” IBM mainframe computer.

Decision-making groups are formed to play the role of department head. The groups begin with profiles of their faculty and a profile of the expectations of their Dean. The groups then make weekly sets of decisions over eight weeks, which represent eight semesters (starting with fall and alternating with spring) within the context of the simulation. The simulation provides feedback each week to indicate the effects of the decisions made. Decisions made by the simulation groups are:

- Faculty teaching assignments in each semester,
- Faculty salary increases from a limited departmental pool of monies each spring semester,
- Promotion, tenure, and non-reappointment of faculty each spring semester, and
- New faculty recruitment in each fall semester and hiring in each spring semester.
Groups also receive periodic simulation performance feedback which consists of:

- Reports of the Dean’s satisfaction with department performance before each fall semester,
- Teaching reports for each faculty member before each spring semester,
- Scholarly activity (articles and papers, books, sponsored research, university service, national service, consulting) reports for each faculty member before each spring semester,
- Reports of faculty satisfaction (with salary, rank, teaching load, teaching preference, department reputation, number of graduate students, and overall) before each fall semester, and
- A chart with accumulated teaching and scholarly activity data along with the overall performance rating, deemed “reputation.”

Copies of sample decision forms and feedback reports are in Appendix C.

The goal of each simulation group is to maximize its departmental reputation. Reputation is a weighted average of: the previous year’s reputation, departmental productivity in each area of scholarly activity, and teaching performance of the department. Each faculty member has a baseline productivity rating for each area of scholarly activity. Each faculty member’s yearly productivity is a function of that rating, the number of courses assigned (an indication of time available for other scholarly pursuits), and a random factor. Each faculty member also has a predetermined, constant teaching ability. Departmental teaching performance is a function of the product
of each faculty member's teaching ability and number of courses taught. Faculty
members also have predetermined expectations with respect to teaching load, salary, rank,
and tenure. If a faculty member becomes too dissatisfied he/she will choose to leave the
department. The job of the simulation decision-making groups is to make decisions such
that these interdependent simulation factors maximize their department's reputation. A
grade-reward for the groups the top third of the class (as determined by departmental
reputation) was used as motivator.

3.4. Data Collection Instruments

"The Academic Department Game" (Chapman, et.al., 1974) produces a departmental
reputation score for each participating group. This was used as the objective measure of
organizational performance and the profitability dimension of group performance. To
measure leadership and group performance, a survey was developed. Appendix B
contains a survey copy. This survey was designed to measure both individual and group
performance (as depicted in Figure 1.3). Leadership performance was targeted by
creating survey items to capture the extent to which Campbell's (1990) leadership tasks
were performed. Group performance was targeted with survey items designed to measure
performance according to Sink and Tuttle's (1989) performance criteria (excluding
profitability). The departmental reputation score was used as the profitability dimension
of group performance. Sink and Tuttle described profitability (and budgetability for
public sector organizations) as traditional "bottom line" measures. They subsequently
stated that the true bottom line is "survival, growth, competitiveness, or whatever other
long-term desired outcomes” (p. 186). Reputation was used as the measure of group profitability because it was the “bottom line” for the simulation groups—the indicator for the attainment of their long-term desired outcome.

3.5. Procedure

The first step of this study was the development of the survey instrument used to collect group and leadership performance data from the simulation groups. Thirty-nine original survey items, three for each of six performance criteria (Sink and Tuttle, 1989) and each of seven leadership tasks (Campbell, 1990), were written. Surveys developed by Campbell to measure leadership tasks exist, but could not be used due to economic constraints. No survey instrument existed which measured Sink and Tuttle’s performance criteria. The response set of the developed survey instrument consisted of a five-item Likert-type scale. Survey respondents were given the opportunity to respond “Strongly Agree,” “Agree,” “Neither Agree Nor Disagree,” “Disagree,” or “Strongly Disagree” to each of the thirty-nine statements. Because one of each of the three items aimed at each leadership task was aimed specifically at the group leader, a “Not Applicable” response was added for those who felt that their group had no leader. Additionally, the survey contained a blank on which respondents were to identify their leader or explain why none existed. A copy of the survey items categorized by performance and leadership constructs is in Appendix B. The Microsoft Excel random number generator was used to assign a random number to each survey item in the list of items categorized by construct.
items were then rearranged in ascending random number order and placed along with instructions on an opscan form, which is shown in Appendix B.

Next, the group assignments were made. Ninety-two students were on the ISE 4004 course roll. The Microsoft Excel random number generator was used to assign a random number to each student on that alphabetically-ordered list. The students were then rearranged in ascending random number order. The students were then put in teams in order from that list (the first five were placed on “A1,” second five on “A2,” and so on). During the course of the simulation, two students (one from “A5” and one from “B4”) dropped the course, yielding the breakdown shown in Table 3.1. For the assigned leader groups (“A” and “B”), the first person assigned to each group was assigned the leader role.

The standard instructions for playing “The Academic Department Game” (Chapman, et.al., 1974) are in Appendix D. A supplemental instruction sheet was also developed and added to the back of the standard instructions. This sheet also appears in Appendix D. The supplemental instruction sheet served as the intervention which created the assigned and emergent leader treatments. It outlined the leadership task expectations for the simulation and informed the participants of their group’s leader assignment (or lack thereof).

Next, the ISE 4004 class was introduced to “The Academic Department Game” (Chapman, et.al., 1974) by Bryan Hertweck, a teaching assistant (TA) for the class. One of the class lecture periods was used to prepare the students to participate in the
simulation. The students were given a short background of the fictitious gaming environment and cast of characters. The students were introduced to each type of decision they would make (as described in section 3.3). The students were told that their performance would be evaluated by the simulation and indicated by the reputation number. They were told that the reputation is a function of the various areas of scholarly activity and teaching performance. The were shown sample forms (like those of Appendix C), which demonstrated how to use the decision and performance feedback forms.

They were instructed that their task was to determine how their decisions impacted reputation in order to make subsequent decisions which would maximize their departmental reputation. The students were informed that part, but not all, of their performance was dependent on randomness. They were informed that the simulation was not intended to evaluate them as managers, but to familiarize them with managerial decision-making. The students were, however, made aware that the top third of the groups (as determined by departmental reputation) would 1/3 of a letter grade added to their final course grade (e.g. B- to B, B+ to A-). The students were also introduced to Campbell’s (1990) seven leadership tasks. They were told that the seven tasks were essential for the proper functioning of any group. They were given a brief explanation of each task in the context of the simulation. The students were then given their group assignments. The instructions and initial decision sheets were handed out, and they were told to read the instructions thoroughly before starting the simulation.
Next, the eight-week simulation took place. Groups submitted their decision sheets to the ISE 4004 TAs (Bryan Hertweck and Joachim Ng) each Friday. The TAs then input the decisions on Virginia Tech’s “VTVM1” IBM mainframe computer. The simulation was run and the feedback sheets and subsequent decision sheets were printed. These forms were distributed to the simulation groups in class on the next Monday. After the second, fourth, and sixth weeks, the groups were given a comprehensive performance sheets and surveys. The comprehensive performance sheet (example in Appendix C) contained performance data (including reputation) for all simulation groups. The students were instructed to complete the surveys and turn them in with the next set of decisions.

After the completion of the simulation, a lecture period was used to discuss the results and administer the final survey. The students were given the reputation of each group and told which groups would receive the grade reward. The students were instructed in the manner by which the simulation converted their decisions into performance data. The final survey was given to the students and completed and collected during that lecture period.

After completion of the simulation, data analysis was done. The reputation scores for each group at each time are in Appendix E. Additionally, the opscan surveys were read, yielding the raw survey data also found in Appendix E. Minitab was used to perform t-tests to determine differences in organizational, group, and leadership performance between treatments. SPSS was then used to perform reliability analysis on the constructs of the original survey design in order to identify potential areas for improvement.
Minitab was again used to perform t-tests on treatment differences in group and leadership performance for the refined constructs of improved reliability. Next, analysis was done to identify interrelationships of the performance constructs. Minitab was used to construct the Pearson product-moment correlation matrix for the performance constructs. SPSS was used to perform factor analysis on the survey items to investigate underlying performance constructs and identify possibilities for combining performance constructs. Exploratory analysis was done to determine differences among the top, middle, and bottom finishers as determined by departmental reputation. Minitab was used to perform one-way analysis of variance (ANOVA). Then, post hoc Fisher’s pairwise comparisons were performed with Minitab to determine exactly where significant differences existed. The results of all these statistical analyses are contained in Chapter 4. The responses to the portion of the survey which asked respondents to identify a group leader were also reviewed to further examine treatment effects and to identify any leader emergence. Finally, conclusions were drawn and directions for future study were considered. Chapter 5 contains the discussion of the results and the conclusion.
Chapter 4
Results

Data from “The Academic Department Game” and the accompanying survey instrument were analyzed. Throughout the following report of results, the following notation is employed:

- The “E” subscript indicates the emergent leader treatment; the “A” subscript indicates the assigned leader treatment.
- The simulation ran for eight weeks. The pre-simulation baseline is indicated by “t0.” The points at which measurements were taken during the simulation are denoted by “t1,” “t2,” and “t3.” Measurements taken after the simulation’s completion are denoted by “t4.”

- Table 4.1 shows the abbreviations which are used for group and leadership performance criteria:

Table 4.1. Abbreviations for group and leadership performance variables.

<table>
<thead>
<tr>
<th>Group construct</th>
<th>abbreviation</th>
<th>Leadership construct</th>
<th>abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>effectiveness</td>
<td>effect</td>
<td>vision</td>
<td>vision</td>
</tr>
<tr>
<td>efficiency</td>
<td>effic</td>
<td>management</td>
<td>mgt</td>
</tr>
<tr>
<td>productivity</td>
<td>prod</td>
<td>empowerment</td>
<td>empow</td>
</tr>
<tr>
<td>quality</td>
<td>qual</td>
<td>politics</td>
<td>polit</td>
</tr>
<tr>
<td>quality of worklife</td>
<td>qwl</td>
<td>feedback</td>
<td>fdbck</td>
</tr>
<tr>
<td>innovation</td>
<td>innov</td>
<td>entrepreneurship</td>
<td>eship</td>
</tr>
<tr>
<td>profitability</td>
<td>profit</td>
<td>personal style</td>
<td>pstyle</td>
</tr>
</tbody>
</table>
For all of the statistical analyses, the level of significance used was 5%. This means that there is a 5% chance of rejecting the null hypothesis when the null hypothesis is true (type I error).

4.1. Organizational Performance

This section addresses sub-question/output #1 from sections 1.8 and 1.9. The purpose of this step was to determine treatment effects on organizational performance. "The Academic Department Game" provided a reputation score which represents organizational performance for each participating group. Each group was given the goal of maximizing its reputation score. The groups were provided a baseline reputation at the start of the simulation as well as periodic updates after every other week of decisions. The reputation data are in Appendix E.

The following null and alternative hypotheses for organizational performance were tested:

\[ H_0: \mu_A = \mu_E \]
\[ H_1: \mu_A < \mu_E \]

The null hypothesis states that organizational performance for the assigned leader groups was equal to that of the emergent leader groups. The alternative hypothesis states that organizational performance for the assigned leader groups was less than that of the emergent leader groups. At each time, t-tests were performed to assess treatment effects. T-tests were used instead of analysis of variance (ANOVA) for all tests of treatment effects because only two treatments existed. Thus, the simplest test which would yield
the desired results was chosen. The results of the t-tests for treatment effects on organizational performance appear in Table 4.2.

**Table 4.2. t-test results for treatment effects on organizational performance.**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>t</strong></td>
<td><strong>P</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>0.84</td>
<td></td>
</tr>
</tbody>
</table>

The “t” value is the test statistic, which represents the difference between the assigned and emergent leader treatments transformed to a “t” probability distribution. In this case, the more negative “t” is, the more likely the alternative hypothesis is true. The “P” value represents the probability under the “t” distribution to the left of (less than) the “t” shown in the table. In order to reject the null hypothesis, “P” must be less than the specified level of significance. No “P” value in Table 4.2 is less than 0.05; therefore, these tests did not provide sufficient evidence to reject the null hypothesis at the 5% level.

### 4.2. Group and Leadership Performance

This section addresses sub-question/output #2 from sections 1.8 and 1.9. The purpose of this analysis was to determine treatment effects on group and leadership performance criteria. The survey administered provided data for six group performance constructs and seven leadership performance constructs. Reputation score served as the seventh group performance construct (profitability). Since the above analysis showed no significant differences in reputation, profitability was not included in these tests. Survey data was
acquired at the same times as the organizational performance data previously described. Out of 360 (90 participants x 4 measurement times) surveys distributed over 4 time periods, 234 were returned, corresponding to a 65% return rate, a low rate considering the surveys were presented to the participants as a "required" part of the simulation. The return rate at the first measurement time was 71% (64 out of 90). The rate at the second time was 73% (66 out of 90). The rate at the the third time dropped to 44% (40 out of 90). Finally the post-simulation rate increased to 71% (64 out of 90), with the surveys completed in class (29% of the class was absent).

4.2.1. Tests on Original Survey Constructs

First, performance constructs were analyzed according to the original survey design. The survey and the grouping of items into constructs can be found in Appendix B. Group averages were calculated for each construct at each measurement time. The following null and alternative hypotheses were tested via t-test for each survey construct at each measurement time.

\[ H_0: \mu_A = \mu_E \]
\[ H_1: \mu_A < \mu_E \]

The null hypothesis states that performance (as measured by each group and leadership performance construct) for the assigned leader groups was equal to that of the emergent leader groups. The alternative hypothesis states that performance for the assigned leader groups was less than that of the emergent leader groups. Table 4.3 shows the results of the t-tests.
Table 4.3. t-test results for treatment effects on group and leadership performance

<table>
<thead>
<tr>
<th>Effect</th>
<th>t1</th>
<th>t2</th>
<th>t3</th>
<th>t4</th>
<th>t5</th>
<th>t6</th>
<th>t7</th>
<th>t8</th>
<th>t9</th>
<th>t10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effic</td>
<td>-0.28</td>
<td>0.39</td>
<td>-0.66</td>
<td>0.74</td>
<td>0.42</td>
<td>0.65</td>
<td>1.21</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prod</td>
<td>-0.50</td>
<td>0.31</td>
<td>-0.26</td>
<td>0.40</td>
<td>-0.19</td>
<td>0.43</td>
<td>-0.70</td>
<td>0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qual</td>
<td>-0.93</td>
<td>0.27</td>
<td>1.03</td>
<td>0.84</td>
<td>0.76</td>
<td>0.77</td>
<td>0.06</td>
<td>0.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qwl</td>
<td>1.79</td>
<td>0.96</td>
<td>0.74</td>
<td>0.77</td>
<td>0.77</td>
<td>0.74</td>
<td>0.74</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innov</td>
<td>1.83</td>
<td>0.96</td>
<td>-0.88</td>
<td>0.20</td>
<td>0.40</td>
<td>0.65</td>
<td>0.75</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vision</td>
<td>-0.19</td>
<td>0.43</td>
<td>-0.61</td>
<td>0.27</td>
<td>-0.01</td>
<td>0.49</td>
<td>0.64</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mgt</td>
<td>-1.41</td>
<td>0.09</td>
<td>0.27</td>
<td>0.60</td>
<td>0.08</td>
<td>0.53</td>
<td>1.01</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empow</td>
<td>1.33</td>
<td>0.90</td>
<td>1.64</td>
<td>0.94</td>
<td>1.72</td>
<td>0.95</td>
<td>0.89</td>
<td>0.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polit</td>
<td>0.40</td>
<td>0.65</td>
<td>0.08</td>
<td>0.53</td>
<td>-0.90</td>
<td>0.19</td>
<td>-0.40</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedback</td>
<td>1.32</td>
<td>0.90</td>
<td>-0.11</td>
<td>0.46</td>
<td>-0.46</td>
<td>0.33</td>
<td>0.61</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egship</td>
<td>1.23</td>
<td>0.88</td>
<td>-0.27</td>
<td>0.40</td>
<td>-0.67</td>
<td>0.26</td>
<td>0.47</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pstyle</td>
<td>0.76</td>
<td>0.77</td>
<td>-0.35</td>
<td>0.36</td>
<td>-0.29</td>
<td>0.39</td>
<td>0.76</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The “t” and “P” values here have the same meanings as described previously for Table 4.2. No “P” value in Table 4.3 is less than 0.05; therefore, the data do not support the rejection of the null hypothesis at the 5% level for any construct at any time.

4.2.2. Reliability Analysis

Reliability analysis was performed on the survey item groupings originally assumed to represent the group and leadership performance constructs. Reliability refers to the extent to which survey respondents responded similarly to different items which were intended to measure the same construct. This analysis was done in hopes of identifying ways to better define the group and leadership performance constructs. It was found that reliability could be improved by deleting certain survey items. The results of the reliability analysis are shown in Table 4.4.
### Table 4.4. Reliability Analysis of Survey Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Original Items</th>
<th>$\alpha$</th>
<th>Refined Items</th>
<th>$\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>effect</td>
<td>1,13,22</td>
<td>0.62</td>
<td>13,22</td>
<td>0.66</td>
</tr>
<tr>
<td>effic</td>
<td>2,14,16</td>
<td>0.43</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>prod</td>
<td>11,18,31</td>
<td>0.60</td>
<td>11,31</td>
<td>0.84</td>
</tr>
<tr>
<td>qual</td>
<td>8,23,28</td>
<td>0.54</td>
<td>8,28</td>
<td>0.74</td>
</tr>
<tr>
<td>qwl</td>
<td>5,7,17</td>
<td>0.68</td>
<td>5,7</td>
<td>0.75</td>
</tr>
<tr>
<td>innov</td>
<td>9,33,35</td>
<td>0.35</td>
<td>9</td>
<td>--</td>
</tr>
<tr>
<td>vision</td>
<td>19,29,32</td>
<td>0.61</td>
<td>29,32</td>
<td>0.66</td>
</tr>
<tr>
<td>mgt</td>
<td>4,15,26</td>
<td>0.56</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>empow</td>
<td>20,30,38</td>
<td>0.57</td>
<td>38</td>
<td>--</td>
</tr>
<tr>
<td>polit</td>
<td>27,37,39</td>
<td>0.46</td>
<td>39</td>
<td>--</td>
</tr>
<tr>
<td>feedback</td>
<td>10,12,24</td>
<td>0.70</td>
<td>10,12,24</td>
<td>0.70</td>
</tr>
<tr>
<td>echip</td>
<td>21,25,36</td>
<td>0.60</td>
<td>21,36</td>
<td>0.68</td>
</tr>
<tr>
<td>pstyle</td>
<td>3,6,34</td>
<td>0.60</td>
<td>6</td>
<td>--</td>
</tr>
</tbody>
</table>

The “$\alpha$" value is the indicator of reliability. It can assume values from 0 to 1. The higher this value is, the more consistent were the responses associated with the items shown to the left of the “$\alpha$" value (reliability does not make sense for a construct defined by only one survey item). In other words, a high “$\alpha$" value indicates that the items seems to be targeted at a single construct. Appendix B contains the refined construct groupings.

#### 4.2.3. Tests on Refined Survey Constructs

The refined performance constructs were analyzed next; again, the purpose was to identify treatment effects on group and leadership performance variables. The grouping of items into refined constructs can be found in Appendix B. Group averages were calculated for each refined construct at each measurement time. The following null and
alternative hypotheses were tested via t-test for each survey construct at each measurement time.

\[ H_0: \mu_A = \mu_E \]
\[ H_1: \mu_A < \mu_E \]

The null hypothesis states that performance (as measured by each group and leadership performance construct) for the assigned leader groups was equal to that of the emergent leader groups. The alternative hypothesis states that performance for the assigned leader groups was less than that of the emergent leader groups. Table 4.5 shows the results of the t-tests.

| Table 4.5. t-test results for treatment effects on group and leadership performance |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | t1   | t2   | t3   | t4   | t1   | t2   | t3   | t4   |
| time            | t    | P    | t    | P    | t    | P    | t    | P    |
| effect          | -0.12| 0.45 | 1.15 | 0.87 | 0.39 | 0.65 | 1.17 | 0.87 |
| effic           | -1.62| 0.06 | 0.43 | 0.66 | -0.73| 0.24 | -0.39| 0.35 |
| prod            | -0.72| 0.24 | 0.69 | 0.75 | 0.41 | 0.65 | 0.06 | 0.52 |
| qual            | -1.18| 0.13 | 0.40 | 0.65 | -0.33| 0.37 | 0.71 | 0.76 |
| qwl             | 1.28 | 0.89 | 0.64 | 0.73 | 0.27 | 0.60 | 0.53 | 0.70 |
| innov           | 2.12 | 0.98 | -0.26| 0.40 | -0.24| 0.41 | 0.65 | 0.74 |
| vision          | -0.66| 0.26 | -1.22| 0.12 | -0.41| 0.35 | 0.75 | 0.77 |
| mgt             | -1.39| 0.09 | 0.83 | 0.79 | -0.69| 0.26 | 1.21 | 0.88 |
| empow           | -0.98| 0.17 | 0.01 | 0.51 | -1.18| 0.13 | 1.18 | 0.87 |
| polit           | 0.71 | 0.76 | -0.23| 0.41 | -0.38| 0.35 | 0.03 | 0.51 |
| feedback        | 1.32 | 0.90 | -0.11| 0.46 | -0.46| 0.33 | 0.61 | 0.72 |
| eship           | 1.10 | 0.86 | 0.10 | 0.54 | -0.20| 0.42 | 1.13 | 0.86 |
| pstyle          | 1.48 | 0.92 | 0.07 | 0.53 | 0.08 | 0.53 | 1.14 | 0.87 |

The “t” and “P” values here have the same meanings as described previously for Table 4.2. No “P” value in Table 4.5 is less than 0.05; therefore, the data do not support the rejection of the null hypothesis at the 5% level for any construct at any time.
4.3. Relationship Among Dependent Variables

This section addresses sub-question/output #3 from sections 1.8 and 1.9. The purpose of this step was to identify patterns and interrelationships among the dependent variables.

4.3.1. Correlations of Performance Constructs

Table 4.6 shows the Pearson product-moment correlation coefficients among the fourteen dependent variables.

<table>
<thead>
<tr>
<th></th>
<th>effect</th>
<th>effic</th>
<th>prod</th>
<th>qual</th>
<th>qwl</th>
<th>innov</th>
<th>profit</th>
<th>vision</th>
<th>mgt</th>
<th>empow</th>
<th>polit</th>
<th>fdbck</th>
<th>eship</th>
</tr>
</thead>
<tbody>
<tr>
<td>effic</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>prod</td>
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<td>0.00</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>qual</td>
<td>0.65</td>
<td>-0.02</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>qwl</td>
<td>0.58</td>
<td>0.37</td>
<td>0.50</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>innov</td>
<td>0.40</td>
<td>-0.28</td>
<td>0.32</td>
<td>0.32</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>profit</td>
<td>0.54</td>
<td>0.07</td>
<td>0.59</td>
<td>0.58</td>
<td>0.20</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vision</td>
<td>0.70</td>
<td>0.00</td>
<td>0.68</td>
<td>0.72</td>
<td>0.61</td>
<td>0.45</td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mgt</td>
<td>0.82</td>
<td>0.09</td>
<td>0.60</td>
<td>0.72</td>
<td>0.56</td>
<td>0.48</td>
<td>0.36</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>empow</td>
<td>0.42</td>
<td>0.04</td>
<td>-0.05</td>
<td>0.15</td>
<td>0.23</td>
<td>0.13</td>
<td>0.03</td>
<td>0.32</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>polit</td>
<td>0.71</td>
<td>0.24</td>
<td>0.44</td>
<td>0.48</td>
<td>0.74</td>
<td>0.06</td>
<td>0.33</td>
<td>0.68</td>
<td>0.55</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fdbck</td>
<td>0.77</td>
<td>0.14</td>
<td>0.34</td>
<td>0.45</td>
<td>0.75</td>
<td>0.21</td>
<td>0.29</td>
<td>0.61</td>
<td>0.74</td>
<td>0.46</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eship</td>
<td>0.46</td>
<td>-0.02</td>
<td>0.05</td>
<td>0.26</td>
<td>0.21</td>
<td>0.46</td>
<td>0.01</td>
<td>0.51</td>
<td>0.48</td>
<td>0.70</td>
<td>0.42</td>
<td>0.38</td>
<td></td>
</tr>
<tr>
<td>pstyle</td>
<td>0.61</td>
<td>-0.25</td>
<td>0.54</td>
<td>0.75</td>
<td>0.26</td>
<td>0.10</td>
<td>0.48</td>
<td>0.55</td>
<td>0.62</td>
<td>0.30</td>
<td>0.40</td>
<td>0.44</td>
<td>0.32</td>
</tr>
</tbody>
</table>

The Pearson product-moment correlation coefficient ($r_{xy}$) is a measure of the strength of the relationship between two variables. It can assume values from -1 to 1. Negative values indicate an inverse relationship between the two variables—as one becomes larger the other tends to be smaller. Positive values indicate a direct relationship between the two variables—as one becomes larger the other tends to become larger. The closer the value of the correlation coefficient to -1 or 1, the stronger the relationship.
4.3.2. Factor Analysis of Survey Constructs

Factor analysis was performed on the survey data in order to determine how the survey items might be grouped into constructs apart from those already studied. Two analyses were performed. One analysis was intended to extract factors from the group performance constructs; the other was intended to extract factors from the leadership performance constructs. The extracted factors were then subjected to reliability analysis, just as the original constructs were previously in section 4.2.2. The results are shown in Table 4.7.

Table 4.7. Extracted factors and their reliabilities.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Items</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>group1</td>
<td>13,22,23,5,17,7,9,33</td>
<td>0.83</td>
</tr>
<tr>
<td>group2</td>
<td>1,11,31,28,8</td>
<td>0.85</td>
</tr>
<tr>
<td>group3</td>
<td>2,16,18</td>
<td>0.56</td>
</tr>
<tr>
<td>group4</td>
<td>14,35</td>
<td>0.22</td>
</tr>
<tr>
<td>leaderf1</td>
<td>29,26,20,37,12,36,34</td>
<td>0.90</td>
</tr>
<tr>
<td>leaderf2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>leaderf3</td>
<td>10,3</td>
<td>0.72</td>
</tr>
<tr>
<td>leaderf4</td>
<td>32,19</td>
<td>0.50</td>
</tr>
<tr>
<td>leaderf5</td>
<td>27</td>
<td>—</td>
</tr>
</tbody>
</table>

Groupf1, groupf2, leaderf1, and leaderf3 were selected for further study due to their high reliabilities—an indication of consistent responses across items within each of those factors. The survey item groupings for these factors can be found in Appendix B.
4.3.3. Tests on Factors

The extracted factors were tested next. Group averages were calculated for each factor at each measurement time. The following null and alternative hypotheses were tested via t-test for each survey factor.

\[ H_0: \mu_A = \mu_E \]
\[ H_1: \mu_A < \mu_E \]

The null hypothesis states that performance (as measured by each group and leadership performance factor) for the assigned leader groups was equal to that of the emergent leader groups. The alternative hypothesis states that performance for the assigned leader groups was less than that of the emergent leader groups. Table 4.8 shows the results of the t-tests.

**Table 4.8. t-tests on treatment for group and leadership performance factors**

<table>
<thead>
<tr>
<th>time</th>
<th>t1</th>
<th>t1</th>
<th>t2</th>
<th>t2</th>
<th>t3</th>
<th>t3</th>
<th>t4</th>
<th>t4</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>group1</td>
<td>1.33</td>
<td>0.90</td>
<td>0.58</td>
<td>0.72</td>
<td>0.35</td>
<td>0.63</td>
<td>1.01</td>
<td>0.84</td>
</tr>
<tr>
<td>group2</td>
<td>-0.88</td>
<td>0.20</td>
<td>0.43</td>
<td>0.66</td>
<td>0.08</td>
<td>0.53</td>
<td>0.46</td>
<td>0.67</td>
</tr>
<tr>
<td>leader1</td>
<td>0.13</td>
<td>0.55</td>
<td>-0.13</td>
<td>0.45</td>
<td>-0.21</td>
<td>0.42</td>
<td>0.27</td>
<td>0.60</td>
</tr>
<tr>
<td>leader2</td>
<td>-0.31</td>
<td>0.38</td>
<td>-0.46</td>
<td>0.32</td>
<td>0.07</td>
<td>0.53</td>
<td>0.24</td>
<td>0.59</td>
</tr>
</tbody>
</table>

The “t” and “P” values here have the same meanings as described previously for Table 4.2. No “P” value in Table 4.8 is less than 0.05; therefore, the data do not support the rejection of the null hypothesis at the 5% level for any construct at any time.
4.4. Exploratory Analysis

One-way analysis of variance (ANOVA) was used to examine differences in group and leadership performance variables according to differences in organizational performance. T-tests and ANOVA can both be used to detect differences between 2 experimental groups. T-tests were used in earlier analyses because of their relative simplicity. When examining more than two groups, however, ANOVA is a better method for detection of differences among groups. The following null and alternative hypotheses were tested for each dependent variable at each time:

\[ H_0: \mu_1 = \mu_2 = \mu_3 \]
\[ H_1: \mu_1, \mu_2, \mu_3 \text{ not equal} \]

where \( \mu_1, \mu_2, \mu_3 \) are means for the upper third, middle third, and lower third of the groups when ranked according to their simulation departmental reputation. The null hypothesis states that group and leadership performance were the same across groups defined by their organizational performance ranking. The alternative hypothesis states that at least one pair of the thirds are unequal in performance. The upper third consisted of the top seven groups, which received extrinsic (grade) rewards for their performance. The lower third consisted of the bottom seven groups. The remaining six groups comprised the middle third. Table 4.9 shows the results of the one-way ANOVAs.
### Table 4.9. F- and P-values for one-way ANOVAs

<table>
<thead>
<tr>
<th></th>
<th>t1</th>
<th>t2</th>
<th>t3</th>
<th>t4</th>
<th>t5</th>
<th>t6</th>
<th>t7</th>
<th>t8</th>
<th>t9</th>
<th>t10</th>
<th>t11</th>
<th>t12</th>
<th>t13</th>
<th>t14</th>
<th>t15</th>
<th>t16</th>
</tr>
</thead>
<tbody>
<tr>
<td>effect</td>
<td>0.06</td>
<td>0.95</td>
<td>0.91</td>
<td>0.42</td>
<td>0.33</td>
<td>0.73</td>
<td>4.68</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>effic</td>
<td>0.92</td>
<td>0.42</td>
<td>1.97</td>
<td>0.17</td>
<td>0.16</td>
<td>0.85</td>
<td>0.23</td>
<td>0.80</td>
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<tr>
<td>prod</td>
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<td>7.90</td>
<td>0.01</td>
<td>27.31</td>
<td>0.00</td>
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<td></td>
</tr>
<tr>
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<td>8.03</td>
<td>0.00</td>
<td>5.15</td>
<td>0.02</td>
<td>20.30</td>
<td>0.00</td>
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<td></td>
</tr>
<tr>
<td>qwl</td>
<td>0.83</td>
<td>0.45</td>
<td>1.21</td>
<td>0.32</td>
<td>0.07</td>
<td>0.94</td>
<td>0.89</td>
<td>0.43</td>
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<tr>
<td>innov</td>
<td>2.34</td>
<td>0.13</td>
<td>0.21</td>
<td>0.81</td>
<td>0.04</td>
<td>0.96</td>
<td>0.54</td>
<td>0.59</td>
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</tr>
<tr>
<td>profit</td>
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<td>0.00</td>
<td>36.73</td>
<td>0.00</td>
<td>17.54</td>
<td>0.00</td>
<td>32.16</td>
<td>0.00</td>
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<td></td>
</tr>
<tr>
<td>vision</td>
<td>1.84</td>
<td>0.19</td>
<td>0.66</td>
<td>0.53</td>
<td>0.63</td>
<td>0.55</td>
<td>4.00</td>
<td>0.04</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mgt</td>
<td>1.02</td>
<td>0.38</td>
<td>0.09</td>
<td>0.91</td>
<td>1.58</td>
<td>0.24</td>
<td>2.66</td>
<td>0.10</td>
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<td></td>
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</tr>
<tr>
<td>empow</td>
<td>0.82</td>
<td>0.46</td>
<td>1.03</td>
<td>0.38</td>
<td>0.38</td>
<td>0.69</td>
<td>0.83</td>
<td>0.98</td>
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<td></td>
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<td>0.04</td>
<td>0.96</td>
<td>0.97</td>
<td>0.40</td>
<td>0.40</td>
<td>0.50</td>
<td>2.06</td>
<td>0.16</td>
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<td>0.78</td>
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<td>1.22</td>
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<tr>
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<td>5.31</td>
<td>0.02</td>
<td>0.82</td>
<td>0.46</td>
<td>5.53</td>
<td>0.01</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Profitability was used to partition the groups. There were significant (at the 5% level) differences across the three groupings. The shaded boxes indicate time and variable combinations which yielded significant (at the 5% level) differences among the three thirds.

Significant ANOVA results indicate a differences somewhere among the thirds but do not indicate exactly where differences lie. Bar graphs were constructed to show the nature of those differences. Figures 4.1 through 4.7 illustrate the differences for the constructs which yielded significant ANOVA results at times 1 and 4. Fisher's pairwise comparisons (comparing each possible pair of thirds) were also performed to determine which differences were significant. The Fisher's tests were performed with a 5%
individual error rate. This means that there is a 5% chance that a difference which was determined to be significant really was not. The results of the Fisher’s tests are reported after the sets of graphs for each time.

![Productivity Across thirds at t1](image)

**Figure 4.1.** Productivity Differences Among Reputation Thirds at t1
Figure 4.2. Quality Differences Among Reputation Thirds at t1

All pairwise comparisons (top/bottom, top/middle, middle/bottom) for productivity at time 1 indicated significant differences. For quality at time 1, significant differences were found for the top/bottom and middle/bottom comparisons, but not for the top/middle comparison.
Figure 4.3. Effectiveness Differences Among Reputation Thirds at t4

Figure 4.4. Productivity Differences Among Reputation Thirds at t4
Figure 4.5. Quality Differences Among Reputation Thirds at t4

Figure 4.6. Vision Differences Among Reputation Thirds at t4
Figure 4.7. Personal Style Differences Among Reputation Thirds at t4

At time 4, for each of effectiveness, vision, and personal style, significant differences were found for the top/bottom comparisons but not for the top/middle or middle/bottom comparisons. Both productivity and quality at time 4 had significant differences for the top/middle and top/bottom comparisons but not for the middle/bottom comparisons.

Table 4.10 summarizes the results of the Fisher’s pairwise comparisons.
Table 4.10. Fisher’s Pairwise Comparisons Summary

<table>
<thead>
<tr>
<th>construct</th>
<th>comparison</th>
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<th>t4</th>
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(Shaded boxes indicate the presence of significant differences.)

The key differences to be discussed in Chapter 5 are: (1) the time 4 appearance of top/bottom differences that did not exist at time 1 for effectiveness, vision, and personal style; and, (2) the lack of time 4 middle/bottom differences which had appeared at time 1 for both productivity and quality.
Chapter 5
Discussion and Conclusion

This chapter interprets and presents a discussion of the implications of the results described in Chapter 4. This chapter also summarizes this endeavor and suggests directions for future research.

5.1. Leadership

The emergent leader groups were hypothesized to perform better than the assigned leader treatment. No treatment effects on dependent variables for any level of performance at any time were significant at the 5% level. Therefore, it can be concluded that the assigned and emergent leader groups performed comparably. This lack of significance could be due to one or more of the following factors:

1. There was insufficient time for the treatments to take effect.
2. The uncertainty inherent in the simulation mitigated the treatment effect.
3. The intervention was too weak. It did not create a great enough difference in decision-making processes between treatments.

These factors are expanded upon below.

1. There was insufficient time for the treatments to take effect. According to Fisher (1980), “Leader emergence occurs over a period of time” (p. 208). Fisher described a model for the elimination of contenders and the emergence of a leader. He stated that there are problems which may arise as leaders attempt to emerge. For instance, he stated, “It is often the case that the quarter or semester ends while the classroom group is still in
the process of developing its status hierarchy” (p. 212). The simulation groups in this study likely met only once a week over the course of eight weeks; it is possible that the treatment was never truly permitted to take effect. Intuitively, in organizations, it takes much longer for leaders to be respected and acknowledged as such. The time necessary for leader emergence could have also affected the assigned leader treatment. As discussed in section 2.2.4., one of the problems which can arise in assigned leader groups is conflict between the assigned leader and an emergent leader. Thus, the disadvantage of assigning a leader may take some time to appear. Perhaps if the study required more frequent group interaction or continued for a longer period of time, the treatment would have had the hypothesized effect.

It is also possible that the lack of time could have contributed to leadership treatment differences in the direction opposite that which was hypothesized. The mere presence of a leader, regardless of whether he or she was assigned or emerged, may contribute to a group’s performance. Therefore, in limited-time situations, assigned leader groups may perform better than emergent leader groups due to the advantage of merely having a leader. Given sufficient time for emergence, emergent leader groups might eventually attain and surpass the performance of assigned leader groups.

2. The uncertainty inherent in the simulation mitigated the treatment effect. “The Academic Department Game” (Chapman, et al, 1974) utilizes random factors in an attempt to model the uncertainty involved in real decision-making. Therefore, it is possible that “good” decisions can lead to “bad” outcomes—this uncertainty makes
establishing treatment differences more difficult. The simulation's measures of performance are dependent not only on the group decisions made, but also on a random element. The probabilistic nature of the simulation makes it more difficult to identify the source of performance differences. The simulation introduces differences between groups that are independent of those groups. For example, it is possible for two groups from the same treatment to submit identical input to the simulation and receive different performance feedback. Similarly, it is possible for groups from different treatments to submit different inputs and receive identical performance feedback. Additionally, some of the positive outcomes from good decisions may take a period of time to be realized. If the subjects became frustrated with the lack of determinism (real or perceived) within the simulation, their commitment to the group process would have dropped, lessening treatment effects. Anecdotal evidence exists which indicates frustration with perceived random behavior of the simulation.

A related problem with the manner in which the simulation calculates performance could account for the lack of observed differences. Organizational performance, or reputation, is a weighted average of several performance indicators. The aggregation of indicators may mask differences. There may have been treatment effects on components of reputation which were lost in the aggregation of the comprehensive organizational performance indicator.

3. The intervention was too weak. It did not create a great enough difference in decision-making processes between treatments. It seems possible that the treatment was
not strong enough. The top of the survey contained an area in which groups were to write their leader's name (or a reason why they didn't have one). At time 1, 26 of 33 (78.8%) surveys returned indicated the proper assigned leader. However, 2 of the surveys which indicated the proper leader also indicated that there was no leader because "we all participate equally" and "we work as a team." This indicates that while the intervention was apparent to approximately 3/4 of the assigned leader subjects, it may have been ignored or viewed as unimportant to some. At time 4, only 16 of 34 (47.1%) surveys returned indicated the proper assigned leader. This indicates that the treatment intervention became less of a concern as the simulation progressed.

5.2. Relationship Among Dependent Variables

A correlation matrix (Table 4.6) was constructed for the 14 dependent variables. Figure 5.1 shows the interrelationships of the group performance constructs as asserted by Sink & Tuttle (1989). According to Sink and Tuttle, if an organization is effective and efficient while paying attention to quality, it will very likely be productive. Organizations then must maintain quality of worklife and innovation in order to be profitable and achieve excellence, survival, and growth.
Figure 5.1. The interrelationships of the group performance criteria (adapted from Sink & Tuttle, 1989, p. 187)

The correlations of Table 4.6 can be examined within the context of the model of Figure 5.1. Profitability correlated highly \( r_{xy} > 0.5 \) with effectiveness, productivity, and quality. These are all performance criteria which deal with the decisions made by the group. Profitability was not correlated highly \( r_{xy} < 0.25 \) with efficiency, quality of worklife, or innovation. It is important to note that \( r_{xy} \) represents only correlation. The presence of high correlation is not sufficient to assume causation. Further study is necessary to establish cause-and-effect relationships. The simulation does not consider resources committed to decision-making; it makes its evaluations based on group output only. It also is of limited timespan; therefore, the importance of QWL/innovation in maintaining the link between profitability and productivity is decreased. Sink and Tuttle (1989) stated, "In the longer-term, poor performance in the areas of quality of worklife and innovation usually spell failure for the organization" (p.186). Also, simulation participants go through repetitive decision-making cycles which allow little room for
innovation. Finally, the group members typically only spend a small amount of time per week together as a decision-making body—limiting the role of quality of worklife.

Factor analysis was performed twice on the survey items—once for the group performance items and once for the leadership performance items. Two factors were identified in each performance area. The group performance factors have been denoted “decision confidence” and “decision effectiveness” (see Appendix B). The decision confidence factor contains survey items which address satisfaction with the decisions and decision-making process independent of the simulation’s evaluation of the group. The decision effectiveness factor contains survey items which address the simulation-related outcomes from the group’s decisions. The leadership performance factors have been denoted “leadership” and “group cohesiveness.” The leadership factor contains one item from each of the original seven leadership performance constructs derived from Campbell’s (1990) leadership tasks. This suggests that a single leadership construct may be the simplest level of analysis; perhaps leadership cannot be appropriately subdivided into sub-constructs. It is also possible that the survey instrument was not sensitive enough to detect the differences in those subdivisions of leadership. The second leadership performance factor, group cohesiveness, contains items which target satisfaction with and competence of teammates.

5.3. Exploratory Findings

Analyses were performed to determine differences in group and leadership performance between groups categorized according to organizational performance.
Because the groups which finished in the top third of the class (according to departmental reputation) were given an extrinsic (grade) reward, the simulation groups were divided into top, middle, and bottom third to examine differences in group and leadership performance. At each of the first three measurement times, quality and productivity measures were significantly different across thirds at the 5% level. At the final measurement point, after simulation completion, effectiveness, vision, and personal style showed significant differences at the 5% level, joining quality and productivity. Additionally, the management measure of leadership performance showed significant difference at the 10% level. It could be argued that these group and leadership performance constructs are predictors of organizational performance. In addition, these findings are consistent with leadership attribution theory, a more likely explanation. As Butterfield and Powell (1981) stated, “Subjects’ implicit theories of leadership associate high performance with more leadership behavior, perhaps on the assumption that, since performance is high, the leader must be engaging in behavior that brings the performance about” (p. 137). The same could be said about group performance. Since the departmental reputation was high (or low), the subjects attributed that success (or lack thereof) to performance of the group.

The extrinsic (grade) reward seemed to have some effect on performance in this study. Differences in effectiveness, vision, and personal style which were non-existent when only a potential reward existed appeared after the actual reward was received. Additionally, differences in productivity and quality which originally existed between
middle and bottom (both non-rewarded) performers were non-existent after the reward
was granted. This indicates that productivity and quality attribution may be based on a
continuum of organizational performance while the reward exists only in potential;
however, once the reward is given, attribution becomes based on a binary, reward/no-
reward condition. Groups differentiate between performance levels before a reward is
given, but see only reward vs. lack of reward differences after it is awarded. Grade
rewards based on reputation performance in the simulation have been discontinued in the
Theory of Organization course.

5.4. Conclusion

Decision-making groups were studied under two authority conditions. Authority of
position (Barnard, 1968) was present in assigned leader groups. Authority of leadership
(Barnard) was present in emergent leader groups. Multiple dimensions of performance
were measured over time as the groups participated in “The Academic Department
Game” (Chapman, et.al., 1974), a management simulation. A supplemental instrument
was developed to measure decision-making performance beyond the evaluation of the
simulation. The field study was performed in an applied setting, the classroom. Enough
data was collected to study the effects of authority on group decision-making
performance. Leadership and authority are commonly viewed as “soft” concepts which
are difficult to measure and control in experimental situations. These concepts are,
however, important to the study of management within engineering. Engineering is
focused on design of systems and processes. When designing a work system, both social
and technical aspects are important. Knowledge of effects leadership and authority aids in the design of the social subsystem. This study shows that the practical implications of authority and leadership can be studied in an applied setting.

With respect to section 1.5, significant conclusions could not be drawn with respect to research objectives 1 and 2. There was insufficient evidence to differentiate between imposed and emergent authority at the organizational, group, or leadership performance level. For objective 3, a correlation matrix was constructed and factor analysis was performed on performance variables. In this study, group effectiveness, quality, and productivity were correlated with profitability, but efficiency, quality of worklife, and innovation were not. This finding may indicate that Sink and Tuttle’s (1989) seven performance criteria may not be appropriate for all organizations (the groups were organizations in this study). Sink and Tuttle’s performance criteria may be only appropriate for only large-scale organizations or for only long-term evaluation.

Decision confidence and decision effectiveness emerged as group performance factors, making an important distinction between a group’s output and the outcome of that output. Leadership and group cohesiveness emerged as leadership factors, indicating that either this experiment was not sensitive enough to detect differences in the components of leadership or deconstruction of leadership into multiple tasks (Campbell, 1990) may be inappropriate for decision-making groups.

Finally, group and leadership performance were examined with respect to organizational performance. Differences in group and leadership performance among
groups divided according to their organizational performance ranking indicated that one or both of the following was true. There was evidence that effectiveness, quality, productivity, vision, and personal style were predictors of organizational performance. The same evidence also indicated that groups attributed strong organizational performance to strong group and leadership performance. Similarly, groups attributed weak organizational performance to weak group and leadership performance.

Additionally, the effect of the extrinsic (grade) reward was demonstrated. At the beginning of the simulation, there appeared to be differences between top and middle performing groups and bottom and middle performing groups. At the end of the simulation, after reward distribution was made known, the difference between bottom and middle performing groups seemed to dissipate. The difference between top (rewarded) and middle/bottom (not rewarded) remained distinct. This indicates that attribution occurred on the basis of the extrinsic (grade) reward in addition to attribution solely on the basis of organizational performance. Kohn (1993) stated that “rewards succeed at securing on thing only: temporary compliance” (p. 55). In this short-term study, performance differences did exist under extrinsic reward conditions. “Rewards do not create a lasting commitment. They merely, and temporarily change what we do” (p. 55). The fact that, in this study, some performance differences disappeared when the potential for reward was removed indicates some support for Kohn’s belief in the fleeting and superficial effect of an extrinsic reward.
5.5 Future Research Directions

Further research of similar design to this study can get closer to the core of the differences between imposed and emergent authority. The following should be considered in studies to build on the efforts described above:

- **Conduct a study of greater length.** A study which provides more opportunity for leader emergence may enable performance differences which were not realized in this study.

- **Measure and analyze basic performance indicators.** The aggregation of organizational performance indicators into a comprehensive measure in this study may have masked treatment effects.

- **Institute a stronger intervention which assigns leadership tasks which are specific to the task at hand rather than general and overarching as the Campbell (1990) leadership tasks are.**

- **Provide training which more directly links the Campbell (1990) tasks to the experimental task.**

- **Utilize a less random management simulation.** The uncertainty inherent in “The Academic Department Game” (Chapman, et.al., 1974) may detract from its face validity. Subjects become frustrated because they are unable to see causal links between their decisions and performance.
• Study the face validity of “The Academic Department Game” (Chapman, et.al., 1974). Anecdotal evidence of the perceived randomness of the simulation abounds; scientific study is necessary.

• Utilize a simulation which is more dependent on group decisions—“The Academic Department Game” can be played as easily by an individual as by a group.

• Continue research into the effects of extrinsic rewards. This study provided some insight into short-term reward effects. A long-term study could address Kohn’s (1993) assertion that rewards create only temporary compliance.

• Continue the study of the interrelationships of Sink and Tuttle’s (1989) seven performance criteria. This study identified correlations; further research might move from mere correlation toward establishment of causal links.

• Study differences between groups within leadership treatments. The simple t-tests employed in this study did not permit the study of variation within treatments.

• Use the results of this endeavor to further the development of the new survey instrument. The survey and data used in this study could be used as a pilot study for another similar study.

This research studied the effects on performance of differing types of authority within decision-making groups. Assigned leader groups were representative of authority of position (Barnard, 1968). Emergent leader groups were representative of authority of
leadership (Barnard). Authority type was not found to have a significant effect on leadership, group, or organizational performance of decision-making groups.

Interrelationships of the multiple dependent performance variables were studied. It was found that Sink and Tuttle's (1989) performance criteria and Campbell's (1990) leadership tasks could be simplified for the short-term, small group decision-making process. Ranking of and rewards for teams were found to affect the way groups evaluated their own performance. This research successfully studied the elusive concepts of authority and leadership in an applied setting, and should generate further research in the area of authority-performance interaction.
Appendix A
Operational Definitions

Authority: “The character of a communication (order) in a formal organization by virtue of which it is accepted by a contributor to or ‘member’ of the organization as governing the action he contributes; that is, as governing or determining what he does or is not to do so far as the organization is concerned” (Barnard, 1968, p. 163). Authority is the property of a communication which makes it influential.

Authority of Position: Authority imputed to communication from a superior position, independent of the personal ability of the person in that position (Barnard, 1968).

Authority of position is rooted in the formal, structurally defined status and rank of an individual’s position within an organization.

Authority of Leadership: Authority rooted in an individual’s demonstration of superior ability, knowledge, and understanding without regard to formal position (Barnard, 1968).

Authority of leadership is rooted in the informal relationships of respect and trust within an organization.

Leader: One who exhibits authority in his or her communication within an organization.

Leadership Tasks: Seven crucial, constant, continuing tasks of organizational leaders:

(adapted from Campbell, 1990)

1. Clarification of goals through Vision.

2. Coordinating resources toward goals through Management.

3. Development of subordinate commitment through Empowerment.

4. Creation of coalitions with others through Politics.
5. Listening and reacting to the voices of stakeholders through *Feedback*.

6. Creating desirable change through *Entrepreneurship*.

7. Setting an example of competence, integrity, and optimism through *Personal style*.

**Performance:** As defined by Sink and Tuttle (1989), in general, performance is the interrelationship of seven criteria groups of measures:

1. *Effectiveness* is the extent to which a goal is accomplished.

2. *Efficiency* is the comparison of actual to expected resource use.

3. *Productivity* is the comparison of outputs to inputs.

4. *Quality* is the extent to which outputs satisfy customers.

5. *Quality of Worklife* is the extent to which an individual feels good about being part of a cooperative effort.

6. *Innovation* is the extent to which creative change is a part of a process.

7. *Profitability/Budgetability* is the comparison of revenue to cost or expenditures to allocations.

**Leadership Performance:** As evaluated by decision-making group members, the extent to which Campbell’s (1990) seven leadership tasks are carried out.

**Group Performance:** As evaluated by decision-making group members, the assessment of the decision-making process with respect to Sink and Tuttle’s (1989) performance criteria.

**Organizational Performance:** The measure of the extent to which the organizational system for which the decision-making group makes decisions reaches its goal.
Appendix B
Data Collection Instrument

The first two pages of this appendix show copies of the actual survey administered.

Following the survey are lists of the original and refined group and leadership performance construct groupings. The final pages of Appendix B contain the survey item groupings which correspond to the extracted factors.
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<thead>
<tr>
<th>ID NUMBER</th>
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<th>GROUP</th>
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Leader: ____________________________________________

OR If Not Applicable, Why? ____________________________________________

**ISE 4004 Academic Department Game Survey**

Please complete this survey anonymously and in an open and honest fashion. Your answers will not be used to evaluate or grade you or your team members. Before responding to the statements below, please identify your views by placing the letter designation in the “Yes” area and its number designation in the “Group” area. For each statement, circle the letter representing the most appropriate response. The responses are defined as follows: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree, 6 = Not Applicable. If you choose 6, please use the space directly below or to the right of the statement to explain why it is not applicable.

1. We are accomplishing what we were assigned to accomplish.
2. Our meetings last longer than I expect them to.
3. I have competent, intelligent, and skilled team members.
4. We have a good procedure for making decisions.
5. I feel good about being part of our team.
6. Our team is optimistic about the expected end result of our work together.
7. We have an enjoyable time working together.
8. Our decisions impact our reputation the way we expect them to.
9. We take time to consider ways to improve our decision-making process.
10. My teammates listen to and try to understand my point of view.
11. For the time we spend making decisions, I expect better results.
12. Our leader seeks and values input from all team members.
13. Our team makes good decisions.
14. We spend a lot of meeting time on things unrelated to making game decisions.
15. Our meetings are disorganized and lack direction.
16. Our team converts individual input into a final group decision in a timely manner.
17. My teammates do not care about making good decisions as much as I do.
18. We could make decisions of equal quality in less time.
19. We make decisions according to a certain strategy.
20. Our leader makes it possible for the entire team to be committed to our decisions.
21. We look for opportunities to do things better.
22. Our weekly decisions are consistent with our strategy for reputation improvement.
23. Under the circumstances, our team makes the best decisions we can.
24. We take time to review the feedback we get from the Dean and from the faculty.

[OVER, PLEASE]

72
25. When our decisions don't create expected results, we alter our strategy.

26. When we encounter stagnation or conflict in our meetings, our leader works well toward resolving the problem.

27. When we encounter uncertainty in our decision-making process or in the game procedure, we seek outside help.

28. Our decisions are leading us toward what Dean Wizard would like us to accomplish.

29. Our leader has a clear vision of our goals and how we will attain them.

30. I feel that my input does not carry as much weight as some of my other teammates.

31. Considering the intelligence assembled on our team, we are not getting very good results.

32. We have a good strategy by which we plan to achieve high reputation.

33. Team members have offered creative suggestions to help us reach our goals.

34. Our leader sets an example through competence, integrity, and optimism.

35. Our decision-making process is the same, week after week.

36. Our leader continually works to make our decision-making process better.

37. Our leader has a good relationship with the rest of the team.

38. I feel comfortable disagreeing with other team members.

39. We are truly a team, not merely an accumulation of individuals.
The following is a list of survey items broken into the constructs they were originally intended to measure.

**Effectiveness**

13. Our team makes good decisions.

22. Our weekly decisions are consistent with our strategy for reputation improvement.

  i. We are accomplishing what we were assigned to accomplish.

**Efficiency**

2. Our meetings last longer than I expect them to.

16. Our team converts individual input into a final group decision in a timely manner.

4. We spend a lot of meeting time on things unrelated to the game.

**Productivity**

11. For the time we spend making decisions, I expected better results.

31. Considering the intelligence assembled on our team, we are not getting very good results.

18. We could make decisions of equal quality in less time.

**Quality**

28. Our decisions are leading us toward what Dean Wizard would like us to accomplish.

23. Under the circumstances, our team makes the best decisions we can.

8. Our decisions impact our reputation the way we expect them to.

**Quality of Worklife**

5. I feel good about being part of our team.

17. My teammates do not care about making good decisions as much as I do.

7. We have an enjoyable time working together.
Innovation

9. We take time to consider ways to improve our decision-making process.
33. Team members have offered creative suggestions to help us reach our goals.
35. Our decision-making process is the same, week after week.

Profitability/Budgetability

To be indicated by “Academic Department Game” reputation number

Vision

32. We have a good strategy by which we plan to achieve high reputation
29. Our leader has a clear vision of our goals and how we will attain them.
19. We make decisions according to a certain strategy.

Management

15. Our meetings are disorganized and lack direction.
4. We have a good procedure for making decisions.
26. When we encounter stagnation or conflict in our meetings, our leader works well toward resolving the problem.

Empowerment

38. I feel comfortable disagreeing with other team members.
20. Our leader makes it possible for the entire team to be committed to our decisions.
30. I feel that my input does not carry as much weight as some of my other teammates.

Politics

27. When we encounter uncertainty in our decision-making process or in the game procedure, we seek outside help.
39. We are truly a team, not merely an accumulation of individuals.
37. Our leader has a good relationship with the rest of the team.
Feedback

24. We take time to review the feedback we get from the Dean and from the faculty.

10. My teammates listen to and try to understand my point of view.

12. Our leader seeks and values input from all team members.

Entrepreneurship

21. We look for opportunities to do things better.

36. Our leader continually works to make our decision-making process better.

25. When our decisions don't create expected results, we alter our strategy.

Personal Style

3. I have competent, intelligent, and skilled teammates.

6. Our team is optimistic about the expected end result of our work together.

34. Our leader sets an example through competence, integrity, and optimism.
The following is a list of survey items broken into the redefined constructs determined through reliability analysis.

Effectiveness

13. Our team makes good decisions.

22. Our weekly decisions are consistent with our strategy for reputation improvement.

Efficiency

2. Our meetings last longer than I expect them to.

Productivity

11. For the time we spend making decisions, I expected better results.

31. Considering the intelligence assembled on our team, we are not getting very good results.

Quality

28. Our decisions are leading us toward what Dean Wizard would like us to accomplish.

8. Our decisions impact our reputation the way we expect them to.

Quality of Worklife

5. I feel good about being part of our team.

7. We have an enjoyable time working together.

Innovation

9. We take time to consider ways to improve our decision-making process.

Profitability/Budgetability

To be indicated by “Academic Department Game” reputation number

Vision

32. We have a good strategy by which we plan to achieve high reputation

29. Our leader has a clear vision of our goals and how we will attain them.
Management
4. We have a good procedure for making decisions.

Empowerment
38. I feel comfortable disagreeing with other team members.

Politics
39. We are truly a team, not merely an accumulation of individuals.

Feedback
24. We take time to review the feedback we get from the Dean and from the faculty.
10. My teammates listen to and try to understand my point of view.
12. Our leader seeks and values input from all team members.

Entrepreneurship
21. We look for opportunities to do things better.
36. Our leader continually works to make our decision-making process better.

Personal Style
6. Our team is optimistic about the expected end result of our work together.
The following is a listing of survey items grouped according to factors extracted through factor analysis.

**Group Performance Factors**

**Decision Confidence**

13. Our team makes good decisions.

22. Our weekly decisions are consistent with our strategy for reputation improvement.

23. Under the circumstances, our team makes the best decisions we can.

5. I feel good about being part of our team.

17. My teammates do not care about making good decisions as much as I do.

7. We have an enjoyable time working together.

9. We take time to consider ways to improve our decision-making process.

33. Team members have offered creative suggestions to help us reach our goals.

**Decision Effectiveness**

1. We are accomplishing what we were assigned to accomplish.

11. For the time we spend making decisions, I expected better results.

31. Considering the intelligence assembled on our team, we are not getting very good results.

28. Our decisions are leading us toward what Dean Wizard would like us to accomplish.

8. Our decisions impact our reputation the way we expect them to.
Leadership Factors

Leadership

29. Our leader has a clear vision of our goals and how we will attain them.

26. When we encounter stagnation or conflict in our meetings, our leader works well toward resolving the problem.

20. Our leader makes it possible for the entire team to be committed to our decisions.

37. Our leader has a good relationship with the rest of the team.

12. Our leader seeks and values input from all team members.

36. Our leader continually works to make our decision-making process better.

34. Our leader sets an example through competence, integrity, and optimism.

Group Cohesiveness

10. My teammates listen to and try to understand my point of view.

3. I have competent, intelligent, and skilled teammates.
Appendix C
Sample Game Forms

The following pages contain sample forms from “The Academic Department Game” (Chapman, et.al., 1974). The first page is a sample portion of the decision form completed by participants. The second and third pages show sample feedback in the form of faculty member productivity and satisfaction. The final page of Appendix C is a sample of the comprehensive performance data sheet which game groups received after each two weeks of play.
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SCHOLARLY PRODUCTIVITY FOR CALENDAR YEAR ENDING DECEMBER 31, 19X1

ARTICLES AND PAPERS PRESENTED OR PUBLISHED:

OPTIMAL SYMMETRICAL DOUBLE SAMPLING SCHEMES FOR TESTING THE ANTIGENICITY OF VACCINES
BIOMETRICS

THE USE OF MAGIC SQUARES FOR BALANCING AND ASSESSING ORDER EFFECTS IN SOME ANALYSIS OF VARIANCE DESIGNS
APPLIED STATISTICS

USING A SCORING SYSTEM DEVELOPED FROM OLD RECORDS TO REDUCE THE SIZE OF A CONTROLLED CLINICAL TRIAL
APPLIED STATISTICS

THE HYPOTHESIS THAT CAN BE TESTED WHEN THERE ARE INTERACTIONS IN AN ANALYSIS OF VARIANCE MODEL
BIOMETRICS

BOOKS PUBLISHED:  1

SPONSORED RESEARCH:  NO GRANT RECEIVED

UNIVERSITY SERVICE:  1 MAN-HOURS PER WEEK

NATIONAL SERVICE:  6 MAN-DAYS PER YEAR

CONSULTING ACTIVITY:  0 MAN-DAYS PER YEAR

TEACHING REPORTS FOR PERIOD ENDING DECEMBER 31, 19X1:  POOR

SALARY INCREASE RECOMMENDATION:

CURRENT SALARY  $ 20800.00  RECOMMENDED INCREASE $________

NUMBER OF GRADUATE STUDENTS BEING SUPERVISED = 4

SPONSORED RESEARCH IN EFFECT (% TIME) = 25.00

TEACHING ASSIGNMENT FOR THE SPRING SEMESTER 19X2

NUMBER OF COURSES ASSIGNED = __________

COURSE NUMBERS:  __________, __________, __________, __________
PROF. BRIGHTSON (T)  
IDENTIFICATION NUMBER = 14

TOTAL YEARS IN TEACHING = 14

FACULTY SATISFACTIONS REPORTED FOR ACADEMIC YEAR ENDING JUNE 31, 19X3

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Appendix D
Game Instructions

The following 11 pages show the standard instructions which are given to participants of "The Academic Department Game" (Chapman, et.al., 1974).
THE ACADEMIC DEPARTMENT GAME

Instructions to Participants

CONGRATULATIONS!

You have been offered the position of chair of the Department of Statistics at the State University of Id. This is your first administrative position and while you may have some reservations about your aptitude and/or ability to succeed, you have decided to accept the challenge of a four-year appointment. You will serve in this capacity through the mechanism of a management game.

You are assuming the leadership position in a department that is established but which is not one of the better departments within the institution. Your objective is to move it into this latter category. The Dean of the College of Arts and Sciences has promised support through assistance in recruiting and in the allotment of resources to your department. The rest is up to you. Your objective will have to be accomplished through the demonstrated and potential talents of your present faculty along with any additional faculty that may be added. Their collective efforts will reflect upon your administrative abilities.

The State University of Id is a typical land-grant institution. In addition to the basic obligation of providing appropriate educational opportunities for the qualified youth who seek admission, the university has a commitment to research - both fundamental and applied, and professional service. The Department of Statistics has a complement of eight faculty in different ranks. The number of authorized faculty positions in the department may increase over the next four-year period, depending in a large measure upon the success of faculty in securing outside research funding and the enrollment of students in the graduate program.

THE DECISIONS

The critical decisions in this simulation exercise will revolve around the recruitment and retention of faculty, the assignment of workloads, and the allotment of salary increases. The university operates on a semester basis (two semesters constitute an academic year). You will make two decisions each "year" for a total of eight decisions over a four-"year" gaming period. The first decision will be made just prior to the start of the fall semester, the second decision will be made just prior to the start of the spring
semester, the third decision will then be made prior to the start of the fall semester of the second academic year, and so forth.

You will make these decisions on a weekly basis. That is, you will hand in your decisions on Friday; we will input your decisions, run the program, and give you the results on Monday. You will then review the results and turn in your next set of decisions on Friday.

At the beginning of the game you will be provided with a "profile" of each faculty member. In addition to a personal sketch of the individual, information concerning professional interests and abilities can also be gleaned from this information. Similarly, in the recruitment of potential faculty, an indication of an individual's personal and professional outlook will be provided. In the case of existing faculty, this is the type of information a new department chair would ordinarily obtain from personnel folders and discussions with the Dean and the Dean's staff. In the case of potential faculty, the information would be available from references, friends and colleagues at other institutions who are acquainted with the individual in question.

Teaching Assignments

The department has a teaching obligation at both the undergraduate and the graduate level. Service and introductory courses - 200 level, are taught to sophomores. Beyond this, junior - 300 level, senior - 400 level, graduate - 500 level, and advanced graduate - 600 level courses are taught in each of three areas: (1) Stochastic Processes, (2) Design and Analysis of Experiments, and (3) Non Parametric Statistics. The number of courses offered each semester will be fixed.

In addition to a teaching workload, some faculty engage in sponsored research and a portion of their salary is funded accordingly. This activity is assumed to be out of the immediate control of the department chair (you). However, you can certainly attempt to encourage or discourage this sort of activity. You may be able to encourage research funding through "release time" or reduced teaching loads in order to generate proposals, and a reward system (salary increases) that encourages securing outside funding. You should realize that increased research funding may lead to the opportunity to secure additional faculty positions. That decision to add new positions will be made by the Dean (not you).

You should assign specific courses to faculty, recognizing that different faculty members have different subject matter interests and preferences for teaching different level courses. A full teaching - research load consists of twelve hours plus some service to the
department, the university and/or the profession. However, it is not uncommon for less than twelve hours of equivalent course work to constitute a full-time workload.

The size of the department is assumed initially to be eight faculty. As stated, the size can be increased through the securing of additional research funding and/or additional graduate student enrollment.

**Salary Increase Recommendations**

You will make a decision just prior to the start of each spring semester, regarding the allocation of available salary increase monies. The recommended increases then become effective with the beginning of the next academic year (fall semester).

To assist you (the dept. chair) in making salary increases, a report of faculty productivity through the previous calendar year will be provided. You will have some indication of individual teaching effectiveness, and will also be able to record research activity in terms of time allotted to research projects. You will receive a flat sum of money that may be distributed across those members of the faculty teaching during the current spring semester, and who are anticipated to be on hand through the next academic year. Faculty leaving and new recruits are obviously not considered.

The allotments can be in equal dollars to each faculty member, in equal percentage increases, or on some merit system calibrated to reward those faculty that have achieved a higher level of productivity. We recommend the latter choice. Remember that faculty satisfaction with salary increases will be reported prior to the next decision requirement. Extreme dissatisfaction with an individual's salary increase may be followed by that individual's resignation.

One method of allotting salary increases is to sum the total salaries of returning faculty, and divide the amount of available salary increase monies by this amount. This would give you an average available percentage increase. Then, if you decide to work with a merit increase system, some faculty may be awarded greater than average increases and some less than average increases. You may assume that no faculty member is entitled to an increase unless it has been earned and zero increases are permitted. However, salary reductions are not permitted.

**Recruiting**

You are limited to the following proportions of faculty by rank: no more than approximately one-third can be in the full professor rank, and no more than two-thirds should be in the full and associate professor ranks. While these proportions may appear to be arbitrary, they are not unrealistic in that some limitations in salary and budget for the
department will likely be felt. For purposes of this game, with eight faculty positions available, no more than three may be filled by full professors and no more than six by full and associate professors. If the departmental size were to increase to ten, these numbers would be four and seven respectively. If the size were to increase to eleven, the numbers would remain four and seven respectively.

With each pre-fall semester decision form, you will be notified of the number of faculty positions available during the following academic year (the year after the forthcoming academic year). You will then be able to ascertain whether or not it will be necessary to recruit faculty during the current academic year in order to fill vacancies or expanded positions for the succeeding year. You will consider the following: (1) whether or not any current faculty have submitted resignations effective at the end of the coming academic year; (2) intentions not to reappoint any untenured professors, associate professors and assistant professors; and (3) anticipation of a decision during the current year not to reappoint any instructors.

When recruiting new faculty, remember the earlier mentioned rank restrictions, and consider the need for interest and expertise in the three separate areas of statistics. In the decision form for the fall semester, you will specify the rank you are seeking within the area of interest.

At the beginning of the spring semester, you will be provided with a specific resume for those faculty who desire to be considered for the vacant positions. Two interviews will be scheduled for each vacancy. You will then indicate a recruiting preference in rank order (faculty member that would be a first choice, a second choice, and so forth). The salary levels for the new recruits are established by the Dean (not you), and these are assumed to be competitive with other institutions. The Dean also extends the offer of employment.

The results of this recruiting effort, including the indication of recruiting preferences, become known with the beginning of the next fall semester. The request for faculty candidates (by rank and area of interest) is made prior to the fall semester, the expressions of interest are received prior to the spring semester, and a recruiting preference is reported by you at that time. The results of the process are then made known prior to making teaching assignments for the next fall semester.

Non-Reappointments

The State University of Id has a tradition of academic freedom. It accepts fully the "1940 Statement of Principles of Academic Freedom and Tenure" of the AAUP as a working basis for assuring the rights and responsibilities of its faculty members. When a
faculty member joins the university, he or she does so on a probationary basis. Tenure normally follows the probationary period of employment, and the probationary periods are as follows:

Professor - three years
Associate Professor - four years
Assistant Professor - seven years
Instructor - seven years

Service at other universities is credited against the above maximum time limits for the probationary period in the following manner:

Professor - usually no credit
Associate Professor - usually no credit
Assistant Professor - year-for-year credit up to a maximum of three years' credit
Instructor - year-for-year credit up to a maximum of three years' credit

When a faculty member is not granted tenure, he or she must be notified at least one year preceding the end of the probationary period. That is, the decision to deny tenure should be reported just prior to the start of the fall semester one year preceding his/her last year of appointment. Tenured faculty are denoted by a "T" after their names on the game forms. A faculty member into his/her last year of probationary employment (one who will be earning tenure unless notified to the contrary) will be entering a period of defacto tenure denoted by "DT".

Instructors are appointed on a yearly basis. As a result, it will not be necessary to provide the one year notification in the termination of instructors. A decision to reappoint an instructor can be made in the fall semester for the next academic year. In summary then, termination of non-tenured professors, associate professors, and assistant professors must be made with the spring semester decision and prior to the individual's last academic year of service. The termination of an Instructor can be made with the fall semester in the last year of that individual's appointment.

Within a university, tenure decisions are ordinarily initiated by the department chair after consultation with the senior tenured faculty of the department. For this exercise, your recommendation will carry the concurrence of this faculty advisory group. In some instances, however, positive tenure recommendations may be reversed at a level higher than that of the department chair. Negative recommendations will not be reversed.
Promotions

You will make recommendations for promotions at the beginning of the spring semester. Promotions should be on the basis of merit and would include the teaching effectiveness of the individual faculty member, research activity, level of scholarly achievement, and professional service in addition to the length of service in the present rank.

The restrictions on the number of faculty in senior ranks described earlier, apply to this promotion process. As a result, promotion recommendations should be made with care as with the allotment of any scarce resource or incentive. Faculty dissatisfaction with the promotion process may result in the resignation of certain faculty (e.g. one who believes he/she should be promoted and that does not happen). In some cases the department chair's recommendation may not be adequate to insure promotion.

THE CAST OF CHARACTERS:
The Dean

Dean Harry B. Wizard believes that an academic department should establish and maintain a balanced objective that includes effective teaching, scholarship and a service component. First, a department must emphasize quality instruction. It should also contribute to the forefront of knowledge through research and be able to attract graduate students by publishing the results of their work in both papers and books. Finally, Dean Wizard would suggest that faculty has a commitment to university service and professional service at the local, regional, and national level. When queried regarding the relative significance of each of these three components, he would respond with the suggestion that a good department is able to achieve a measure of success across all three dimensions.

The Faculty:

*Dr. John Ubelski* (#3) has taught for fifteen years and is currently a full professor. He is 40 years old and has taught undergraduate courses in all areas of statistics. While originally trained in stochastic processes at Cornell, he also is interested in experimental design and statistics. While not inherently bright, he is considered a "plugger" who tends to be quite soft and yielding to student demands in class. His vita shows a below average output of six articles and a few additional publications have appeared in non-refereed journals. He is quiet and resents being pressured. In general, his thin skinned personality causes him to withdraw from any social contact that he perceives as threatening.
Dr. Peter Low (#4) is 33 years old, an associate professor and has taught for seven years. His specialty is experimental design with a minor interest in non-parametric statistics and he prefers to teach in these two areas. While he has expressed major interest in teaching graduate courses, he will, if required, teach undergraduate courses. It is reported that he is a poor teacher. He received his Ph.D. from Columbia where he was considered one of the finest prospects they had ever turned out. He has published his dissertation and one other article of lesser consequence. As of yet, he has not "blossomed" as a researcher. He has, however, expressed a liking for committee work. As of the present, he has not directed a thesis. He is friendly, quite disorganized, and not respected by a majority of his peers.

Dr. Janis Feldman (#23) received her Ph.D. from CUNY in non-parametric statistics. Her publication record (two articles) is below what would be expected of an assistant professor with five years of experience. It is reported, however, that she is a clear and systematic lecturer with a high degree of interest in committee work. Her colleagues feel that she will probably be never nationally prominent through her publications. This is also reflected by the paucity of graduate students who take their thesis under her. Personally she is a quiet person who is friendly, gracious, but quite reserved.

Dr. Wilson Dingel (#11) is 42 years old and has served as a professor of statistics at Antioch. He has been teaching for the past 14 years and has not published many articles (two) in his specialty of non-parametrics. His teaching ability has recently been assessed as outstanding and he tends to avoid courses in stochastic processes. The students report that he is one of the few teachers who treats them as friends and spends much time with them. Reports from the faculty relate that he is quite protective of his advisees and generally possesses an anti-research attitude. As faculty advisor to the campus Gay Liberation Group, he is constantly active in the acceptance of the homosexual. Within the department, however, he is friendly and well liked by his colleagues.

Dr. John Steele (#27) has been teaching for eight years, three of which were spent in a community college. He is 38 years old and is currently an assistant professor. His reputation is one of mediocrity in all phases. A nervous person, he spends most of his spare time at home working odd jobs around the house. He prefers to teach service courses. His Ph.D. was received from the University of South Carolina where his professors felt he would be marginal in the teaching profession. He is extremely sensitive to the fact that he will soon quit teaching unless he progresses quickly in promotions.
Herbert Warren (#9) has held a research chair at Iowa State University where he was usually surrounded by some fifteen graduate students. A full professor, he received his Ph.D. from Stanford University and has been teaching for the past 20 years. His students and colleagues have glowing praise for his breadth of knowledge and ability to organize and retain numerous journal articles. It has been reported that he is currently writing a three-volume work on stochastic processes. Dr. Warren prefers to teach graduate courses and a light load; he refuses to become involved in administrative duties. He does not like to become involved in department politics and therefore remains aloof from other faculty members. He has remarried and has two children from his previous marriage. His only liability is that he is a stutterer.

Dr. Milton McHose (#42) is currently an assistant professor. He is 28 years old and received his Ph.D. from Colorado in non-parametric statistics. He has been teaching for two years and has had only his dissertation published. He is currently preparing a grant proposal. The students report that he is an average teacher. He is married and has no children.

Dr. Albert Kelly (#8) is 37 years old and received his Ph.D. from West Virginia University. He took a two-year post-doctoral fellowship to study stochastic processes at Rockefeller University and has been an assistant professor for the past two years. He is one of the more conscientious teachers but has a definite preference for stochastic processes and is also a most careful researcher. His articles are few (four) but of outstanding quality. He has had two grants and has contributed steadily to the growth of the department. He is well liked by both students and faculty and has been nominated as a representative to the faculty senate. He did not start college until he was 25 years old. As a consequence, he tends to be more worldly than most professors. He is married and has two children.
GAME RULES:
(1) Turn in the completed Decision Data Sheet section of the handout every Friday at the beginning of class. Fill out and keep the top section for your records.

(2) Do not separate the pages of the Decision Data Sheet (i.e. don't separate and staple together).

(3) Proof read your Decision Data Sheet before turning it in:
   * Mistakes made by the team because of failure to proof read (i.e. assigning the wrong course number, not giving a promotion when one was intended, etc.) will not be corrected.
   * Mistakes I make in inputting decisions will be corrected and I will re-run the program.

Please go over the results as soon as they are handed out and bring any mistakes to my attention immediately.

MORE FACTS ABOUT THE GAME
General:
(1) You can give a teacher no (zero) classes.

(2) You don't have to give all the teachers raises.

(3) Spend all the allotted money for pay increases, as it does not accumulate year to year.

(4) Over-allotting pay increases (spending more than you have) will result in all pay increases being cut by an equal amount.

(5) Pay increases are rounded to the nearest dollar.

(6) The number of courses are fixed. If you don't assign all the classes the program will randomly assign them.
Recruiting:

(7) You will get two resumes per open position. Do NOT put the number of resumes in the "no. of positions to be available" blank space.

(8) Make sure you get the right position type and area of concentration when you hire.

E.g.:  

<table>
<thead>
<tr>
<th>No. of positions to be available</th>
<th>St. Proc: Asst; Assoc; Full</th>
<th>Design: Asst; Assoc; Full</th>
<th>Non-P: Asst; Assoc; Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

This indicates that the team wants to hire 3 faculty members. Two of these new members are to be assistant professors in Stochastic Processes. The other member is to be a full professor in Design of Experiments. The team will get six resumes total: four for an assistant professor in Stochastic Processes, and two for a full professor in Experimental Design.

Offers of employment:

(9) You can make two conditional offers per open position. You might want to do so since the first offer may or may not be accepted. If it is accepted, the second will not be extended.

(10) When filling out the "Employment offers" section, first enter as a complete set, your first choices for all open positions. The teachers will be hired in the order in which they are listed. After listing the first choices, list the secondary choices to whom you wish to make offers.

(11) All teachers are identified by a two-digit number that will be on the resume. The ranks are identified by the following numbers:

- Instructor 1.
- Asst. Professor 2.
- Assoc. Professor 3.
- Full Professor 4.
E.g.: (Continued from previous example)

<table>
<thead>
<tr>
<th>No. Employment Offers</th>
<th>5</th>
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<tbody>
<tr>
<td>I.D.; Rank Offered</td>
<td>0</td>
</tr>
<tr>
<td>I.D.; Rank Offered</td>
<td>0</td>
</tr>
<tr>
<td>I.D.; Rank Offered</td>
<td>4</td>
</tr>
<tr>
<td>I.D.; Rank Offered</td>
<td>0</td>
</tr>
<tr>
<td>I.D.; Rank Offered</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Even though there are only three 3 open positions, I extended 5 offers of employment in case a few were not accepted.

(12) Determine your priorities based on the "Dean's Review of Departmental Productivity" (at the beginning of your team's printout). This review gives the areas evaluated in determining the departments' ranking.

(13) One aspect of reality modelled in this game is individual differences in characters of teachers. Some will spend more time working on other projects (e.g. research, service) when their teaching load is lightened, but some other teachers may thrive under pressure and will produce more when given a heavy academic load. Also, the amount of salary raise required to make a teacher happy varies between teachers.

Remember your priorities and experiment with your decisions. Ascertain which factors are most important in the overall department evaluation. Try to understand the characteristics of the individual teachers. However, you may also use your instincts and take action before you develop a thorough understanding of each faculty.

Enjoy playing the Academic Department Game.
The following pages show reproductions of the instructions created as a supplement to the standard “Academic Department Game” (Chapman, et. al., 1974) instructions. The first reproduction shown was given to teams with assigned leaders.
To: Statistics Department Head Team

From: Dean Harry B. Wizard

Subject: Leadership Task Expectations

Leadership is an element inherent in every decision-making team. I have decided to name [randomly assigned student] as your team leader. I expect that to be a successful team, your leader will have to introduce certain tasks to your decision-making process. I have listed these below for your consideration.

Vision: I have put your team in place with the hope of enhancing the reputation of the Statistics Department. Having vision means that your team must see how its actions work toward my expectations. Your vision is the strategy by which your team will attain high reputation. This vision should be the driver for all the decisions you make.

Management: Once your vision is in place, you must coordinate team effort into final decisions. Your team must meet and work together to exchange knowledge and ideas. You must develop a process by which you can efficiently convert multiple inputs into a single output. You must be able to manage the process through problems such as stagnation and conflict.

Empowerment: Your managed process should take place in an empowered environment. The team must create and maintain member commitment to its vision. Each member should feel that he/she is a valuable part of the decision-making process. A trusting environment, in which conflict is used as an opportunity rather than an obstacle, should be fostered.

Politics: You have resources to consult in times of uncertainty. You are organized as a team so that you may develop relationships and use each other as resources. You have been given instructions about the decisions you have to make. You also have a decision administrator, Bryan Hertweck, who may be able to answer questions which arise.

Feedback: Listening is important to the team decision-making process. Pay attention to the feedback you get from my office and from your faculty. Also, listen within the group. In addition to asserting your own ideas and positions, seek to hear and understand those of teammates.

Entrepreneurship: Don't feel tied to traditional means. Consider creative and different ways to work as a team. Look for opportunities to improve your decision-making process. In a dynamic environment, doing what you have always done will put you behind.

Personal Style: Part of leadership is its demonstration through example. Those who exhibit leadership set a tone of competence, integrity, and optimism.
The following paragraph was substituted for the first paragraph of the supplemental instructions for the control groups:

Leadership is an element inherent in every decision-making team. I do not feel that it is my place to assign you a leader; however, I expect that to be a successful team, you will have to perform certain tasks in your decision-making process. I have listed these below for your consideration.
Appendix E
Raw Data

The table below shows the reputation scores for each game group at each measurement time.

<table>
<thead>
<tr>
<th>Group</th>
<th>t0</th>
<th>t1</th>
<th>t2</th>
<th>t3</th>
<th>t4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
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<td>16.27</td>
<td>15.88</td>
<td>20.84</td>
<td>22.02</td>
</tr>
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<td>A3</td>
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<td>18.62</td>
<td>20.47</td>
<td>17.87</td>
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<tr>
<td>A5</td>
<td>16.93</td>
<td>17.34</td>
<td>17.17</td>
<td>20.06</td>
<td>23.24</td>
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<tr>
<td>B1</td>
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<td>15.69</td>
<td>20.79</td>
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</tr>
<tr>
<td>B2</td>
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<td>17.80</td>
<td>22.05</td>
<td>23.69</td>
</tr>
<tr>
<td>B3</td>
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<td>16.43</td>
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</tr>
<tr>
<td>B4</td>
<td>16.93</td>
<td>16.17</td>
<td>17.07</td>
<td>18.71</td>
<td>20.39</td>
</tr>
<tr>
<td>B5</td>
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<td>17.23</td>
<td>16.92</td>
<td>23.63</td>
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</tr>
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</tr>
<tr>
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<td>17.75</td>
<td>18.79</td>
<td>22.38</td>
</tr>
<tr>
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<td>16.08</td>
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<td>20.82</td>
</tr>
<tr>
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<tr>
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<td>17.82</td>
<td>17.70</td>
<td>20.38</td>
<td>20.00</td>
</tr>
</tbody>
</table>
The following four pages show the raw survey data for measurement times 1, 2, 3, and 4. Responses are shown for each survey item, designated “i1” through “i39.” The responses are 1=Strongly Agree, 2=Agree, 3=Neither Agree Nor Disagree, 4=Disagree, 5=Strongly Disagree. A blank indicates that either “Not Applicable” or no answer was given.
Reference List


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EDUCATION

M.S., Industrial and Systems Engineering, December 1995
Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, VA
Concentration: Management Systems Engineering
Thesis: The Effects of Authority on Group Decision-Making
Advisor: Dr. Brian Kleiner

B.S., Aerospace Engineering, May 1993
Virginia Tech, Blacksburg, VA
Minor: Mathematics

HONORS

Pratt Fellowship, 1994-95
National Merit Scholarship, 1989-93
Gilbert and Lucille Seay Scholarship, 1990-91
Omicron Delta Kappa, 1992-93

PUBLICATION


TEACHING EXPERIENCE

Graduate Teaching Assistant, Virginia Tech, Blacksburg, VA

Co-Instructor for EF 1004, “Technology and Productivity,” Fall 1995
• Taught concepts within areas such as quality management, performance improvement, and performance measurement to 200 freshmen engineering students
• Performed grading and other administrative duties

• Coordinated course activities for two professors and Graded exams and term papers for their classes of 50-100 students
• Directed computerized management simulation, “The Academic Department Game”

OTHER EXPERIENCE

Admissions Advisor, Virginia Tech, Blacksburg, VA, Summer 1995 and 1994, Fall 1993
• Planned and Managed a ten-week recruiting travel schedule consisting of visits to 120 high schools and 25 college fairs
• Communicated with thousands of prospective Virginia Tech students and their families through personal meetings, campus tours, admissions information sessions, and special speaking engagements with groups as large as 2000

[Signature]