USING A PRODUCTIVITY MEASUREMENT MODEL TO DRIVE GAINSHARING

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(ABSTRACT)

This research shows how a state-of-the-art, plant and firm level, productivity measurement model, the Total Factor Productivity Measurement Model (TFPMM) can be used to drive an organization's gainsharing effort. The TFPMM uses accounting data from actual operations to isolate the dollar effects on profits due to changes in productivity and price recovery. Two case study examples are used. The first case study involves a manufacturing firm and evaluates how the TFPMM can be used in that organization for gainsharing. The second case study involves a service firm and describes how that organization plans to use the TFPMM to drive its gainsharing effort.

This research also examines the role of gainsharing in the performance management process and in performance management efforts. The critical interrelationships between gainsharing and other components of an organization's management system and compensation system are explored. Various gainsharing approaches are reviewed and presented with an emphasis placed on design variables associated with a gainsharing effort. A methodology for TFPMM implementation and for gainsharing system design, development and implementation is presented and described. The research balances rigor with relevance to assist managers and practitioners with the design and development of measurement and reward systems.

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Many thanks are in order for my wise teacher, coach, and advisor, Dr. D. Scott Sink, who has provided me the opportunity to participate in his work and research and, by example, taught me important lessons I will carry with me through life:

> Winning is the most misunderstood phenomenon today. Winning is not important, it is preparing to win that is and the will to prepare to win. Human nature is to give less than we have to give. It is our biggest enemy relative to progress. It causes us to do less than we can in fact do. Praise, too much, makes us lazy. You don't want to play the game my way, you don't want to prepare to win, you don't have the will to prepare to win...Go somewhere else!
>
> - Bobby Knight, Head Basketball Coach, Indiana University

> Champions once sat where you're sitting. The Football Hall of Fame (and every other Hall of Fame) is filled with the names of people who sat, week after week, without getting a spot of mud on their well-laundered uniforms. Generals, Senators, Surgeons, Novelists, Professors, Executives, started on the end of the bench too. Don't sit and study your shoe tops. Keep your eye on the game, watch for defensive lapses. Look for offensive opportunities. If you don't think you're in a great spot, wait until you see how many people would like to take it away next spring practice. What you do from the bench this season could put you on the field next season as a player, or back in the grandstand as a spectator.

This kid on the bench will always be grateful to the many lessons learned under your teaching and guidance and will "pay forward" to others. "One can never pay in gratitude, one can only pay 'in kind' somewhere else in life." Hi

Thanks are in order to the other members of my committee, Mr. Walter G. Cox, Dr. Harold A. Kurstedt, Dr. C. Patrick Koelling, and Dr. Kent F. Murrmann, who gave generously of their time and talents. A special thanks to

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They provided friendship and support, spent many hours as a sounding board for ideas, provided an exciting place to learn and to work, and who, on occasion, at Friday night happy hours, showed they never learned that an hour was 60 minutes long and no longer.

To my parents, who set me out on the right roads, and sacrificed a great deal so I'd have the opportunity to discover paths that interested and challenged me. Buckminster Fuller once said, "We were deliberately designed to learn only by trial and error. We're brought up, unfortunately, to think that nobody should make mistakes. Most children get *de-geniused* by the love and fear of their parents -- that they might make a mistake. But all my advances were made by mistakes. You uncover what is when you get rid of what isn't." Thanks for teaching me that failing isn't getting knocked down, it's staying down. You have taught me the value of hard work, responsibility, and perserverance in pursuing any endeavor, no matter how great or small.

Finally, my deepest thanks to my wife and best friend, , for her patience, love and understanding.

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OBJECTIVES

To state the purpose for and desired outcomes of this research.

To review current measurement practices in gainsharing.

To present and discuss, in a succinct fashion, the Total Factor Productivity Measurement Model.

To discuss the advantages of and potential drawbacks to Total Factor Productivity Measurement Model based gainsharing.

To communicate how the research was conducted.

To convince the reader of the relevance and importance of this research.

To introduce the chapters of this thesis.

Sharing the gains of improved productivity through gainsharing has been around for some forty years. The original, and perhaps best known, form of gainsharing is the Scanlon Plan. Other popular approaches to gainsharing are the Rucker Plan and Improshare. Many organizations also design custom gainsharing plans to meet their specific needs. The General Accounting Office concluded in their 1981 study of gainsharing that gainsharing plans "warrant serious consideration by firms as a means of stimulating productivity performance, enhancing their competitive advantage, increasing monetary benefits to their employees, and reducing inflationary pressures." While no one knows the exact number of U.S. companies using gainsharing, interest in and the use of gainsharing has increased tremendously in recent years. A 1982 study by the New York Stock Exchange reported that gainsharing was one of the six fastest growing human resource activities in U.S. companies with 500 or more employees. The study also reported 15 percent of U.S. companies with 500 or more employees were using some form of gainsharing. More recently, a study sponsored by the American Productivity Center and American Compensation Association (O'Dell, 1987) reported that almost 73 percent of existing gainsharing systems have been implemented since 1980. The study also stated that the number of companies planning to implement gainsharing in the near future will result in a 68 percent increase in the number of companies using gainsharing.

There has been a considerable amount of empirical research on gainsharing. Quite a bit is known about its benefits (e.g., Bullock and Bullock, 1982; Bullock and Lawler, 1984; Lawler, 1981; O'Dell, 1987); causes of and conditions favoring success (e.g., Lawler, 1981; White, 1979); the

organizational and situational factors that favor gainsharing (Lawler, 1981); and, how to design gainsharing systems (e.g., Doyle, 1983; Moore and Ross, 1978; Ringham, 1984; Ross and Ross, 1984). However, there are a number of theoretical and research questions that remain unanswered about the workings of gainsharing and gainsharing systems. An area where this is most evident involves the measurement component of gainsharing.

1.1 PURPOSE AND DESIRED OUTCOMES

A lot of theoretical and applied research has been done over the last 30 years on firm and plant level productivity measurement (American Productivity Center, 1978; Britney and Kudar, 1987a, 1987b; Cosgrove, 1986-87; Davis, 1955; Gollop, 1986; Kendrick and Creamer, 1965; Kendrick, 1984; Miller, 1984; Sumanth, 1984; Sink, 1985; van Loggerenberg and Cucchiaro, 1982). This research and experience, however, has not been incorporated into the field of gainsharing. A major cause of this is that most organizations can't even get these state-of-the-art plant and firm level measurement models up and running, much less integrate them with gainsharing (Sink, 1987, personal conversation). This lack of expertise with plant and firm level productivity measurement continues on the part of academicians, consultants, and practitioners despite the fact that many of the roadblocks which cause gainsharing to be less effective than it could/should be involve measurement related issues (Lawler, 1981, 1985; Moore and Ross, 1978; Ross and Ross, 1984; Thor, 1987). In addition, many of the conventional and newer approaches to gainsharing measurement do not provide systematic insight into productivity change and its associated financial impacts (Britney and Kudar, 1987a).

Therefore, research is needed that integrates state-of-the-art firm and plant level productivity measurement models and techniques with gainsharing. Research to date has shown how this can be done conceptually (see Davis, 1955; Sink, 1985); the task of this research was to show how this can be done operationally.

Specifically, this research aimed:

To provide the reader with an improved understanding of gainsharing's role in the performance management process;

To highlight the role of gainsharing in the compensation management process;

To succinctly review both traditional and newer approaches to gainsharing and present an approach for evaluating various gainsharing approaches;

To present a planning process for improved reward systems and gainsharing systems;

To communicate how two organizations, one manufacturing, one white collar, designed a Total Factor Productivity Measurement Model (TFPMM) application;

To compare and contrast a manufacturing organization's Scanlon Plan calculation with the TFPMM;

To evaluate an application of how the TFPMM could be used, in one manufacturing organization, to support an existing Scanlon Plan.

To communicate how a white collar organization plans to use the TFPMM to drive gainsharing.

To present and discuss a methodology for TFPMM implementation.

To assist managers and practitioners with the development of measurement and reward systems.

The major aim of this research was to evaluate case study applications of a state-of-the-art productivity measurement model, the TFPMM, for

gainsharing. The TFPMM is a dynamic, aggregated, indexed, and computerized approach to measuring productivity at the corporate, firm, division, and plant level. Figure 1-1 depicts the conceptual framework for the model. Using accounting data from actual operations, the TFPMM separates out the effects of productivity from the effects of price recovery for each particular input factor. The TFPMM provides information on quantity and price weighted change ratios, cost drivers, percent change in performance indexes (e.g., productivity and price recovery), and the dollar effects on profits due to changes in productivity and price recovery.

Kaplan (1983) cited the lack of interaction between accounting systems and measurement systems as an area where great potential exists for developing plant-level reward systems but one where relatively little attention has been given. The TFPMM is a productivity measurement model that could potentially fill this void. In fact, Davis (1955) discusses using the TFPMM to measure the distribution of productivity savings and losses with implications for gainsharing. Sink and Keats (1983) have identified gainsharing as one of several highly promising areas to use the TFPMM to evaluate the impact of productivity improvement interventions. Aldrich (1987) used the TFPMM in a paper mill to tie management performancebonuses to productivity improvement. Senior management saw this as a way to focus on manageable results and to minimize the influence of uncontrollable factors such as commodity prices and costs of certain inputs.

The remainder of this chapter focuses on the role of measurement in gainsharing and how the TFPMM could strengthen it. First, the measurement component of gainsharing is reviewed. Next, the potential benefits of TFPMM

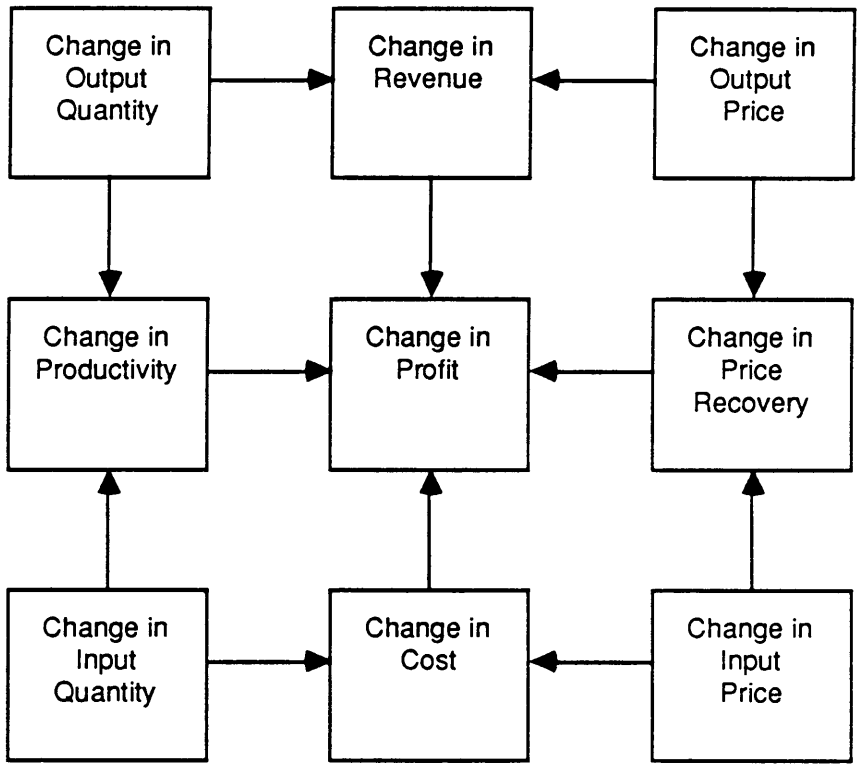

Figure 1-1. Conceptual Framework for the TFPMM
(Source: van Loggerenberg and Cucchiaro, 1981-82)

based gainsharing are discussed. Last, the research approach is presented.

1.2 THE ABSENCE OF STATE-OF-THE-ART MEASUREMENT MODELS

Measurement is a critical component of gainsharing. First, you cannot manage what you cannot measure (Sink, 1985). Second, to establish and communicate a strong link between rewards and performance, the measure(s) used for gainsharing must capture and reflect all the variables, factors, relationships, etc. people have control over. Third, if a company is basing rewards on performance improvement, it should be able to verify whether the improvement has, in fact, actually occurred (Virginia Productivity Center, 1986). Fourth, properly designed measurement systems motivate, promote, and encourage proactive performance improvement interventions (Sink, 1985). Last, measurement is needed to control improvement interventions and ensure effective and efficient execution of performance improvements (Sink, 1985). For gainsharing to be fully integrated in the overall performance management process of planning, measurement and evaluation, control, and improvement, sound performance measurement must be incorporated.

Since most gainsharing is based on productivity improvement, one of the most critical elements in the initial design, development, and ongoing maintenance of a gainsharing effort is how to measure productivity gains and how to relate these gains to bottom-line, financial results (Ringham, 1984). Both traditional and many of the newer, custom gainsharing formulas are based on one or more of the conventional approaches to productivity

measurement (Table 1-1). Conventional approaches to productivity measurement such as partial factor productivity measures, total factor productivity index numbers, value-added indexes, inflation accounting, and/or standard cost accounting often do not provide systematic insight into the financial impacts of productivity change on the bottom line (Britney and Kudar, 1987a; van Loggerenberg and Cucchiaro, 1981-82). Because of this, the measures often used for gainsharing can obscure and even alter the details of productivity improvement.

In addition to the conventional approaches to gainsharing, an increasing popular approach is the family of measures approach (Belcher, 1986; Thor, 1987). The family of measures approach is designed to focus efforts on multiple performance criteria, attributes, and sub-attributes with separate measures or formulas for each. Each measure is translated to a dollar amount tied into a gainsharing fund. Examples of this approach are found at Motorola, Mobay Chemical's New Martinsville Plant in West Virginia, and Knoll International (Table 1-2). However, the family of measures as used by Motorola, Mobay, Knoll and others are not measures of performance as needed for gainsharing (Doyle, 1983). A problem with this approach is that often the unit of analysis as used for gainsharing and the unit of analysis for the measures are different. Performance measures tend to focus narrowly on a single process, function, or department; this tends to drive improvement in a particular area regardless of the impact on overall performance. In addition, the use of these measures to provide line of sight to all participants in the gainsharing effort is limited because of the differing units of analysis. The family of measures approach would be more applicable to small group

Table 1-1. Common Gainsharing Measures
(Source: Ross and Hauck, 1983)

OUTPUT	Sales	Net Sales	Net Sales by Product	Net Sales	Value Added
INPUT	Personnel Costs	Personnel Costs	Personnel Costs by Product	Total or multi costs	Personnel Costs
OUTPUT	Total Standard Costs	Total Standard Hours Earned	Total Direct Labor Hours Earned		
INPUT	Personnel Costs	Wages and Salaries	Direct and Indirect Labor Time		

Table 1-2. Family of Measures
Approach to Gainsharing

Company	Family of Measures	Source
Motorola	Production Cost Quality Delivery Inventory Safety Other measures for administration and technical	APC (1986) Belcher (1986)
Mobay	Tool and Safety Supply Usage Salvage and Reuse Savings Energy Usage Savings General Supply Usage Iron Oxide Reactor Time Saving Iron Oxide Milling Recycle Reduction Wastewater Treatment Cost Environmental Control Solid Waste Disposal Polyurethane Area Error Reduction Composite Performance Index for Polyurethane Area	APC (1987)
Knoll	Monthly Shipments Returns Inventory Turns On-time deliveries Factory Performance Employee Participation Suggestions	APC (1986)

gainsharing and then integrated with the more macro, group gainsharing effort.

1.2.1 Explaining the Measurement Lag

There are three reasons why gainsharing has failed to incorporate developments in the field of productivity measurement. First, most of the gainsharing experience to date has been in the hands of consultants who are proponents of different formulas and formula construction. As a result theory and research are almost completely lacking in the gainsharing literature as to how an organization should go about designing and developing the measurement component of gainsharing (Lawler, 1985). Most of the literature on gainsharing is anecdotal in nature, usually documenting "one-shot," successful case studies (Moore and Ross, 1983). The specific tools and techniques needed to take the measurement component of gainsharing to the next stage of evolution have not been communicated. Practitioners in the field are left to be "cooks" and not "chefs," copying and/or adapting measures used in the traditional gainsharing plans, and/or dependent on third party consultants when designing and developing measures. This is a serious void in the gainsharing literature since a majority of gainsharing efforts now involve measures designed by the organization itself (O'Dell, 1987).

Second, the lack of attention to the measurement component of gainsharing is due, in part, to the fact that gainsharing itself is viewed as a management system and not as a component of a management system (see Kurstedt, 1985, for a discussion of management systems). What has happened is that the management philosophy and principles on which gainsharing is based have been confused with the actual management tool of gainsharing.

Evidence of gainsharing being defined and treated as a management system is pervasive throughout the literature on gainsharing (see for example, Doyle, 1983; O'Dell, 1981; Thor, 1987). Even individuals who define gainsharing as a specific improvement tool or technique fail to treat it outside the context of the system it is a part of. The end result is a set of assumptions about what gainsharing, and the management system it is a part of, should look like. For example, the majority of Scanlon Plans being implemented today look the same in terms of participative management practices as they did forty years ago! Are the suggestion systems that accompany Scanlon Plans the most effective form of participation that has evolved over the last forty years? Certainly not! Due to this "paradigm paralysis," many gainsharing efforts are not improved upon and developments in related fields are not employed (see Kuhn, 1970, for a discussion of paradigm paralysis)..

Third, the use of state-of-the-art productivity measurement models and techniques is not widespread. Sumanth (1984) reports that less than three percent of U.S. firms measure total factor productivity (total output/total input). A survey of productivity measurement practices in U.S. defense contractors by the Army Procurement Research Office found no evidence of total factor productivity measurement (APRO June 1984 Report).

There are three reasons why industry, in general, is not taking full advantage of state-of-the art productivity measurement techniques (Sink, Tuttle, DeVries, and Swaim, 1983). First, knowledge of state-of-the-art productivity measurement techniques is not widespread. The body of industrial engineers, accountants, productivity managers, and other individuals interested in productivity measurement is growing; however,

discussion of productivity measurement models and techniques outside this relatively small group is rather limited to the general category of input and output. Second, the perception on the part of many managers is that these models and techniques are complex and difficult to implement. The fact is that these models and techniques are less complex than they appear; however, they do require substantial effort and considerable expertise to implement. Third, some of the macro-measurement and surrogate techniques may be adequate for an individual manager's information needs. Small, single-product, low-volume organizations and similar less complex organizations do not require the elaborate measurement techniques that a large, complex, multi-product, high volume organization requires to measure performance.

1.3 THE ADVANTAGES OF TFPMM-BASED GAINSHARING

The use of the TFPMM for gainsharing is appealing for several reasons. First, the model ties gainsharing directly to a productivity measurement model that can be and is being utilized (Sink, 1985):

(1) to obtain an overall, integrated measure of productivity for the firm;

(2) to audit past performance;

(3) for budget planning, development, and control;

(4) to assess and evaluate the bottom-line impact on profitability as a result of productivity shifts;

(5) to track the results of specific productivity improvement interventions;

(6) to measure initial distributions among input factors of benefits flowing from gains and/or losses in the productivity of the firm; and,

(7) to assist with setting productivity goals and objectives and general strategic planning with regard to capacity utilization, marketing efforts, cost management, pricing strategies, staffing, and so forth.

There are two points worth elaborating with respect to the role of the TFPMM in the performance management process. The first point is the ability of the TFPMM to integrate with and support both the strategic and developmental performance improvement planning process is an important feature since all gainsharing is goal related (O'Dell, 1981). The most effective gainsharing systems provide both information on strategic plans and progress reports to tell people how good a job they are doing and motivate constant improvement (Doyle, 1983). Second, with respect to productivity management control and improvement, the TFPMM makes for an effective decision support tool for productivity management control and improvement. Before managers can pinpoint what's needed to improve performance, management needs to know the reasons for profit change so it can decide whether to concentrate on productivity improvement or pricing strategies (Miller, 1984). Therefore, management needs measurement procedures for monitoring productivity and identifying improvement opportunities. Existing cost accounting and management control practices are unlikely to provide such indicators (Hayes and Clark, 1986; Kaplan, 1983, 1986). Commonly used gainsharing measures and the newer, family of measures approach, are also unlikely to provide such indicators. The TFPMM, however, provides the information needed to gain a

better understanding of input-output relationships and the various input factors relative contributions to changes in productivity and price recovery.

Second, the TFPMM focuses on total input factors: labor, capital, material, energy, data/information. A total factor approach to gainsharing is the best possible base because it alone rewards true productivity increases (Doyle, 1983). Partial factor approaches to gainsharing do not necessarily capture and reflect changes caused by a particular input factor. This is due to the fact that changes in productivity are passed from one input factor to another through managerial decisions (Craig and Harris, 1973). Therefore, the change in partial factor productivity may be the result of both active and/or passive interventions. Trade-offs among the various input factors almost precludes joint upward movement in partial factor productivity. As a result, partial factor gainsharing bases may drive improvement in partial factor productivity at the expense of long-term total factor productivity improvement.

Third, the TFPMM provides a structure within which to design and develop a gainsharing formula that fits a company's operations. Evidence of this is found in the approximately 50-100 companies in the U.S. that are using the TFPMM in one form or another (Sink, Tuttle, DeVries, and Swaim, 1983). Many of these applications have been developed around the same basic model and tailored for the specific operating scenario of the company. This is important since gainsharing must fit the company's operations if it is to be successful (Bullock and Bullock, 1982; Doyle, 1983; Lawler, 1981; Ringham, 1984; Ross and Ross, 1984). The TFPMM does not restrict the classes and types of inputs and outputs that can be included in the model. For example, while the

TFPMM allows capital to be included as an input factor, the decision to include capital depends on the management philosophy regarding capital use (Thor, 1986). If capital is excluded, the TFPMM will still provide meaningful information.

Fourth, the TFPMM would allow for the sharing of price recovery gains where appropriate. Gainsharing has been thought to fit particularly well with profit sharing plans (Lawler, 1986). Profit sharing involves the sharing of gains due to changes in both productivity and price recovery. The dollar effects on profits due to changes in productivity comes from changes in labor, material, capital, and energy productivity. The dollar effects on profits due to changes in price recovery comes from pricing decisions and the effects of inflation on labor, material, capital, and energy. The ability of the TFPMM to separate the dollar effects on profits due to changes in productivity and price recovery for each particular input factor provides the information needed to evolve towards a plan that combines gainsharing with certain elements of the price recovery component of profit sharing. For example, the ability of the organization to produce a high quality product or deliver a high quality service may have an effect on output prices; using the TFPMM, these gains could be measured and shared. Or, effective management of suppliers may result in lower input resource prices; once again, the TFPMM could measure these gains.

Fifth, the TFPMM could help alleviate the problems associated with maintaining the base period. Productivity measurement cannot provide a single, unique measure of productivity (Davis, 1955). Therefore, selection of an appropriate base period is critical for productivity measurement to be

meaningful. Choosing the base period is one of the most difficult decisions associated with the initial design and development of a gainsharing system (Thor, 1987). Once the base period is determined, shifts among product price lines, shifts among input price lines, changes in the quality of outputs and inputs, and new outputs and inputs all pose potential decision points for adjusting the base period. In short, the measurement used for gainsharing needs to accurately reflect what is going on in the organization and must be adjusted to changing conditions. Issues associated with the base period will have to be addressed in TFPMM-based gainsharing as with other forms of gainsharing. However, by capturing both quantity and price data and tracking it over time, the TFPMM provides decision-makers with more comprehensive and detailed information on which to base decisions on whether the base period is appropriate for current operating conditions.

1.3.1 Potential Shortcomings

There are three general concerns with the use of the TFPMM for gainsharing. First, is the ability to communicate the TFPMM so that everyone in the organization understands it. The TFPMM is considerably more complex than the formulas commonly used for gainsharing or the family of measures approach. For gainsharing to be successful, the formula must be understood (Frost, Wakely, and Ruh, 1974; Lawler, 1981; Moore and Ross, 1983). Second, the TFPMM requires considerable expertise to implement and use effectively (Sink, 1985). Last, is the ability to capture total costs in the TFPMM that reflect a company's operations. Kaplan (1986) found that while firms were making significant changes in operations, comparable changes were not being made in accounting and control systems. In fact, Kaplan (1983) states that most cost

accounting systems are inadequate for even traditional operations, much less for the new products and processes being introduced by innovative companies. Since internal, cost accounting data is used to run the TFPMM, the potential exists for bad data in and bad information out. This would make the TFPMM an ineffective tool to support both gainsharing and the general productivity management process.

1.4 HOW THE RESEARCH WAS DONE

Two case studies were employed to illustrate how the TFPMM could be used for gainsharing. Data was used from the actual operations of two organizations in the process of implementing the TFPMM. To protect the confidentiality of the organizations, all the data shown in this thesis was scaled. The first organization is a manufacturing firm, Xaloy, Inc., located in Pulaski, Virginia. Xaloy is a producer of steel and alloy cylinders used in plastic extrusion, injection molding, and resin compounding machines. Over the years there has been a tremendous number of technological advances in the manufacturing of their products. The company has implemented a Just-in-Time manufacturing system which has allowed it to nearly double sales while only raising the work force ten percent. More recently, a Scanlon Plan has been implemented. Management at Xaloy wanted to implement plant level productivity measurement to integrate with and support their productivity improvement planning, control, and improvement process. The Virginia Productivity Center's computerized version of the TFPMM was selected as the tool for productivity measurement.

The second case study involves a white-collar, service organization, the Virginia Productivity Center (VPC), located in the College of Engineering at Virginia Tech and housed in the Department of Industrial Engineering and Operations Research. The VPC is a small research and consulting firm that serves business, industry, organized labor, academia, and federal, state, and local government agencies. Management at the VPC wanted to institute measurement at the firm/center level and the group level. The VPC's computerized version of the TFPMM was selected as the tool for productivity measurement and gainsharing at the center level.

There are several advantages to using these two organizations for this research. First, the author has first-hand knowledge of and experience with both efforts. Second, both measurement efforts are new implementations; as such, they will provide useful information about the issues surrounding the design, development, and implementation of the TFPMM. Third, one company is a manufacturing organization and the other is a service organization. A criticism of gainsharing research is that too much attention has been given to gainsharing in manufacturing firms and not enough attention has been given to gainsharing in service firms (Ross and Hauck, 1983).

1.4.1 A Look Ahead

Chapter 2 discusses the role of gainsharing in the performance management process. This chapter draws heavily from the work of Sink (1985, 1986/1987) on the performance management process. Sink's concept of "stages of evolution" helps to structure our thinking on where gainsharing fits in a performance management effort; the chapter concludes with arguments as to why gainsharing is a later stage intervention in a

performance management effort.

Chapter 3 takes a look at both conventional and newer approaches to gainsharing. First, where gainsharing fits in an organization's compensation management system is discussed. Next, available gainsharing techniques and approaches are reviewed and a list of questions useful for selecting and evaluating various gainsharing approaches is presented. Last, a methodology for gainsharing design, development, implementation, and maintenance is presented.

The Xaloy and VPC TFPMM based gainsharing case studies are presented in Chapter 4. The case studies communicate how these organizations designed and implemented a TFPMM application and how the TFPMM could be used to drive Xaloy's gainsharing effort and how the VPC plans to use the TFPMM to drive their gainsharing effort. The chapter concludes with lessons learned about the TFPMM and TFPMM based gainsharing.

Chapter 5 contains summary remarks and conclusions. Areas for future research are identified. References are listed at the back of each chapter.

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2.0 THE ROLE OF GAINSHARING IN THE PERFORMANCE MANAGEMENT PROCESS

HIGHLIGHTS

A Look at the Performance Management Process

Gainsharing: Where Does It Fit in the Performance Management Puzzle?

Yeah, But We Can Get There Quicker

Staying #1 is Different Than Becoming #1

OBJECTIVES

To review the characteristics along critical dimensions of the organization of the present and organization of the future.

To introduce three conceptualizations of the management process: the POLCA model of management, the Management System Model, and the Performance Management Process model.

To use these three models to structure our thinking about performance improvement.

To provide the reader with an improved understanding of gainsharing's role in the performance management process.

To convince the reader that gainsharing is a later stage intervention in the quest for improved performance.

To challenge the reader to become more patient, persistent, and disciplined in the application of performance improvement tools.

U.S. competitiveness has continued to decline for over a decade now and, as a result, has fallen below the level of competitiveness needed to meet the challenge of fierce international competition (Thurow, 1984). If U.S. organizations are to regain their competitive edge, they must transition from management systems designed to ensure "just get by" levels of performance to management systems designed to promote, achieve, and reward aggressive and motivated levels of performance (Walton, 1985). Simply put, the organization of the future must look dramatically different than the organization of the present if it is to compete, survive, and grow.

A miracle won't make this transition happen; moving the organization of the present towards the organization of the future requires changes in management practices, operating procedures, and performance standards along a number of dimensions (Table 2-1). However, in the absence of a grand strategy for change, piece-meal and programmatic efforts aimed at improving performance in one or several of these dimensions will be less effective than they could/should be and, in fact, may drive performance in the wrong direction. Poorly conceived or badly implemented management systems using state-of-the-art technological and sociological approaches are undoubtedly less effective than better managed conventional ones (Walton, 1985). The major management challenge of the 80's and 90's, then, lies in: 1) creating and shaping a vision of what the organization of the future must look like along each of these dimensions; 2) developing a grand strategy to achieve this vision; 3) planning, in a comprehensive and integrated fashion, for the changes that must occur; 4) identification, design, and development of the sociological and technological tools and techniques needed; and, 5) managing

Table 2-1. Work force Strategies
(Source: Walton, 1985)

	Organization of the Past	Organization of the Present	Organization of the Future
Job design principles	Individual attention to performing individual job.	Scope of individual responsibility extended to upgrading system performance via participative problem-soving groups.	Individual responsibility extended to upgrading system performance.
	Job design deskills and framents work and separates doing and thinking.	No change in traditional job design or accountability.	Job design enhances work, emphasizes whole task and combines doing and thinking.
	Accountability focused on individual.		Frequent use of teams as basic accountable unit.
	Fixed job definition.		Flexible definition of duties, contingent on changing conditions.
Performance expectations	Measured standards define minimum performance. Stability seen as desirable.		Emphasis placed on higher stretch objectives which tend dynamic and market oriented.
Management organization: structure, systems, and style	Structure tends to be layered with top-down controls.	No basic changes in approaches to structure, control or authority.	Flat organization with mutual influence systems.
	Coordination and control rely on rules and procedures.		Coordination and control based more on shared goals, values, and traditions.
	More emphasis on prerogatives and personal authority.		Management emphasis on problem solving and relevant information and expertise.
	Status symbols distributed to reinforce hierarchy.	A few visible symbols change.	Minimum status differentials to de-emphasize inherent hierarchy.

Table 2-1 Continued. Work force Strategies
(Source: Walton, 1985)

Compensation policies	Variable pay where feasible to provide individual incentive.	Typically no basic changes in compensation concepts.	Variable rewards to to create equity and to reinforce group achievements.
	Individual pay geared to job evaluation.		Individual pay linked to skills and mastery.
	In downturn, cuts concentrated on hourly payroll.	Equality of sacrifice among employee groups.	Equality of sacrifice.
Employment assurances	Employees regarded as variable costs.	Assurances that participation will not result in job loss.	Assurances that participation will not result in job loss.
		Extra effort to avoid layoffs.	High commitment to avoid or assist in reemployment.
			Priority training and retraining existing work force.
Employee voice policies	Employee input allowed on relatively narrow agenda. Attendant risks emphasized. Methods include open-door policy, attitude surveys, and greivance procedures.	Addition of limited, ad hoc consultation mechanisms. No change in corporate governance.	Employee participation encouraged on wide range of issues. Attendant benefits emphasized. New concepts of corporate governance.
	Business information distributed on strictly defined need to know basis.	Additional sharing of information.	Business data shared widely.
Labor-management relations	Adversarial labor relations; emphasis on interest conflict.	Thawing of adversarial attitudes; joint sponsorship of QWL or EI; emphasis on common fate.	Mutuality in labor relations; joint planning and problem-solving on expanded agenda.
			Unions, management, and workers redefine their respective roles.

effective implementation. In short, the performance management process is the key to becoming the organization of the future.

2.1 A LOOK AT THE PERFORMANCE MANAGEMENT PROCESS

2.1.1 Basic Management Process Model

Effective performance management is based on good, sound, and disciplined general management. The general management process can be conceptualized in a number of ways. Szilagyi (1981) presents a typical and simple management process depiction (Figure 2-1) referred to as POLCA (Planning, Organizing, Leading, Controlling, and Adapting). The management process begins with some type of planning through which management establishes organizational strategies, goals and objectives. Next, management must organize the system to achieve the goals and objectives identified in the planning process. At this point in the management process, management is concerned with certain, critical organizational design issues: structure, staffing, and communication systems (both formal and informal).

Once these issues have been thought through, management must consider how to obtain acceptable and motivated levels of performance to achieve the defined goals and objectives. Performance management issues, then, are wrapped into the leadership function. The focus of the leadership function is on the interrelationship between individual performance and group performance; the model assumes that improved performance at the individual level will lead to improved performance at the group level. In

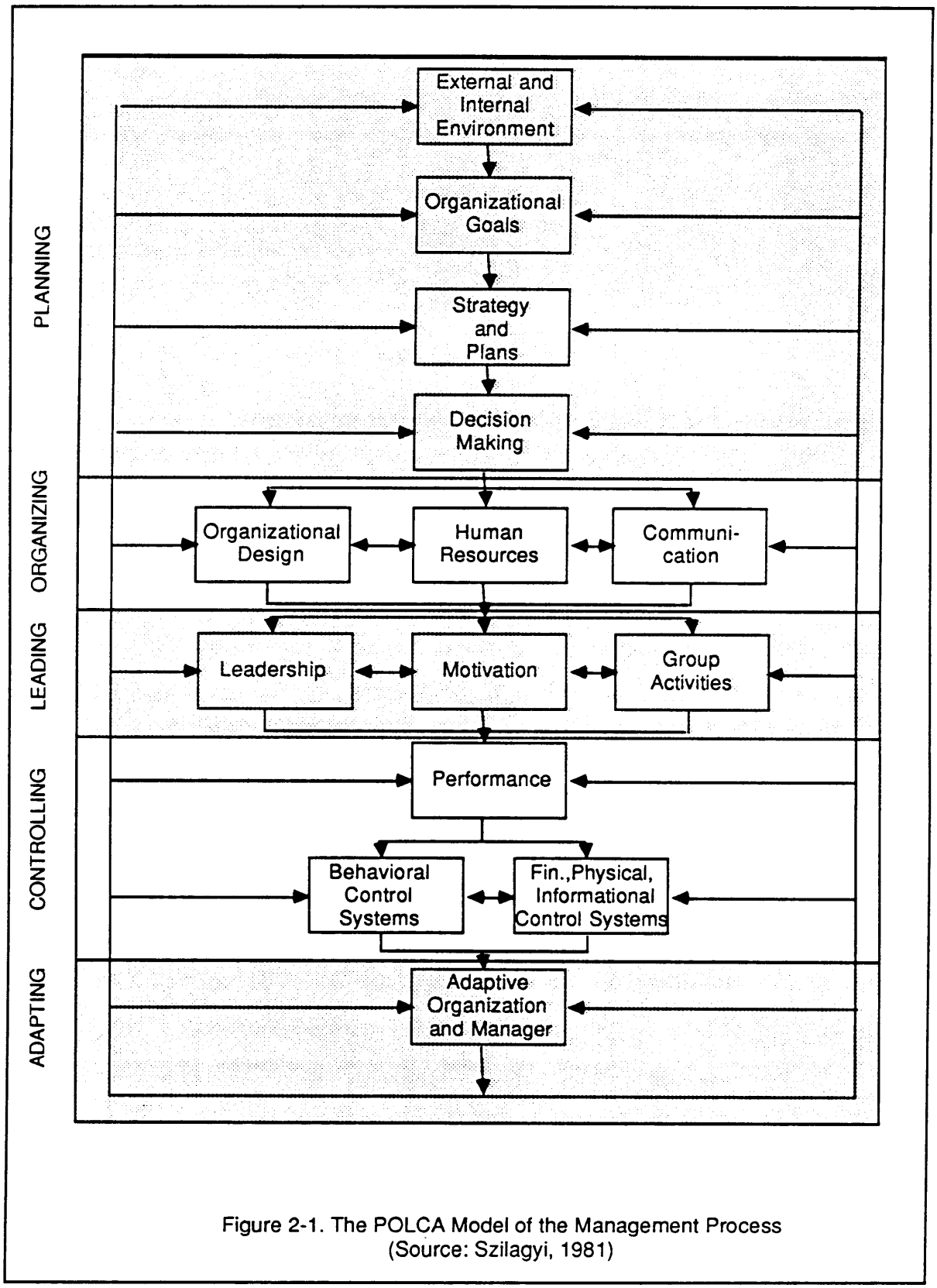

Figure 2-1. The POLCA Model of the Management Process
(Source: Szilagyi, 1981)

actual practice, however, the relationship between individual performance and group performance is not so clean. Managing group performance is complicated by the need for the different kinds of individual contributions required for group success (Barnard, 1938). The implication of this is the manager must practice effective "situational leadership" (see Hersey and Blanchard, 1982) in considering a mixed bag of skills, talents, abilities, and needs and designing and implementing management systems that elicit the type of individual performance that will result in group and organizational performance .

The major objective of the control function is ensuring that the organization is in fact moving toward achieving the formulated goals and objectives. To accomplish this, goals and objectives are translated into individual and group performance standards. Measurement and evaluation, while not made explicit here, are critical components of the control function. Behavioral control systems are put in place to ensure acceptable levels of performance. Note that, in this model, the behavioral control systems are separated from the financial, physical, and information control systems. Attention is given to the important non-behavioral aspects of performance, such as cost management, budgeting, quality control, inventory management, etc.

Last, the model clearly identifies the management of change as a component of the management process. In this model, the management process is depicted as an open system, in contact with the environment and having numerous feedback loops. One of the most important factors that managers need to fully understand is that organizations are dynamic, open

systems (Thompson, 1964). Management must constantly monitor and evaluate the organization's internal and external environment to proactively manage and adapt to change.

2.1.2 Management System Model

The Management System Model of management has been developed by Kurstedt (1985). Kurstedt's conceptualization of the management process has been developed with an emphasis on the problem-solving and decision-making role of managers. The emphasis on problem-solving and decision-making is, in fact, quite timely, in that the manager in the organization of the future will increasingly be called on to proactively solve problems and capitalize on opportunities. A modified vesion of the model is presented in Figure 2-2.

The basic Management System Model components are:

1. a manager and/or management team;
2. the organizational system that the manager or management team is responsible and accountable for;
3. the tools and techniques that the manager or management team uses to facilitate management and improvement of the system; and,
4. other managers, management teams, and audiences that the manager or management team must report to, or are accountable to, in one way or another.

The basic interfaces in the model are:

1. the decision to action interface which, fundamentally, represents specific improvement interventions being made by the management team;

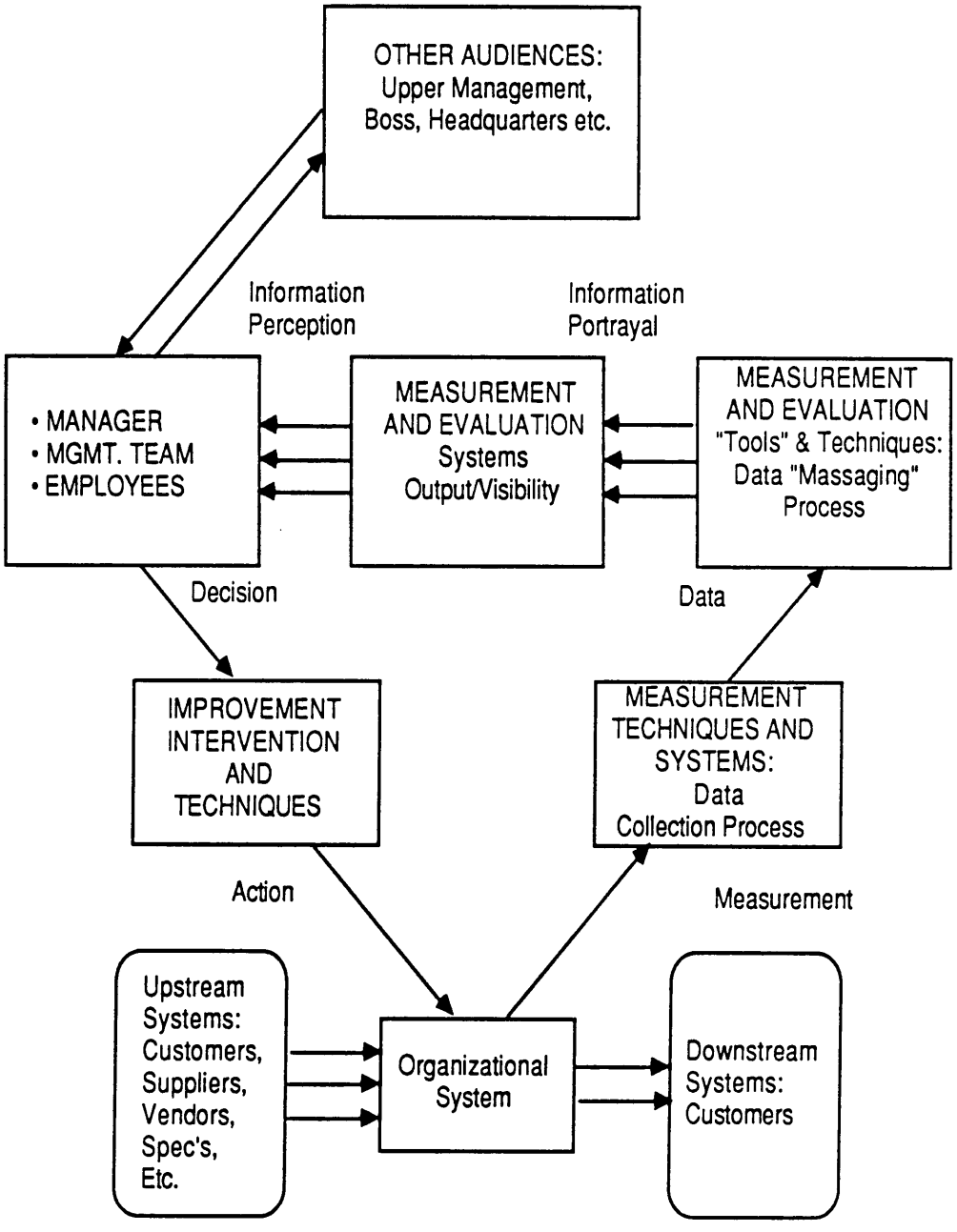

Figure 2-2. The Management System Model
(Adapted by Sink, 1986/1987, from Kurstedt, 1985)

2. the measurement to data interface which represents the process of collecting data from the system through the use measurement tools and/or measurement systems;
3. the information portrayal to information perception interface which represents the presentation of data to the management team and their resulting perception and interpretation of what the data/information means;
4. the other information portrayal to information perception interface has to do with the presentation of data/information from the management team to their various other audiences.

There are several points worth elaborating on with respect to this model. First, the model makes explicit the critical interfaces between the manager, the operation being managed, and management tools. The better job management does in considering these interrelationships in the design, development, and implementation of management systems, the higher the level of performance that can be expected. Second, the model highlights the role of measurement and evaluation in the management process. Last, the model considers a manager's cognition, personality type, and style.

2.1.3 The Performance Management Process

The third, and final, management process model that will be examined is the development of Sink (1985a, 1985b, 1986/1987). Figure 2-3 depicts the essential components of a performance management effort and Figure 2-4 depicts a process flow diagram of the performance management process. Both models reflect what the excellent U.S. companies are doing to proactively

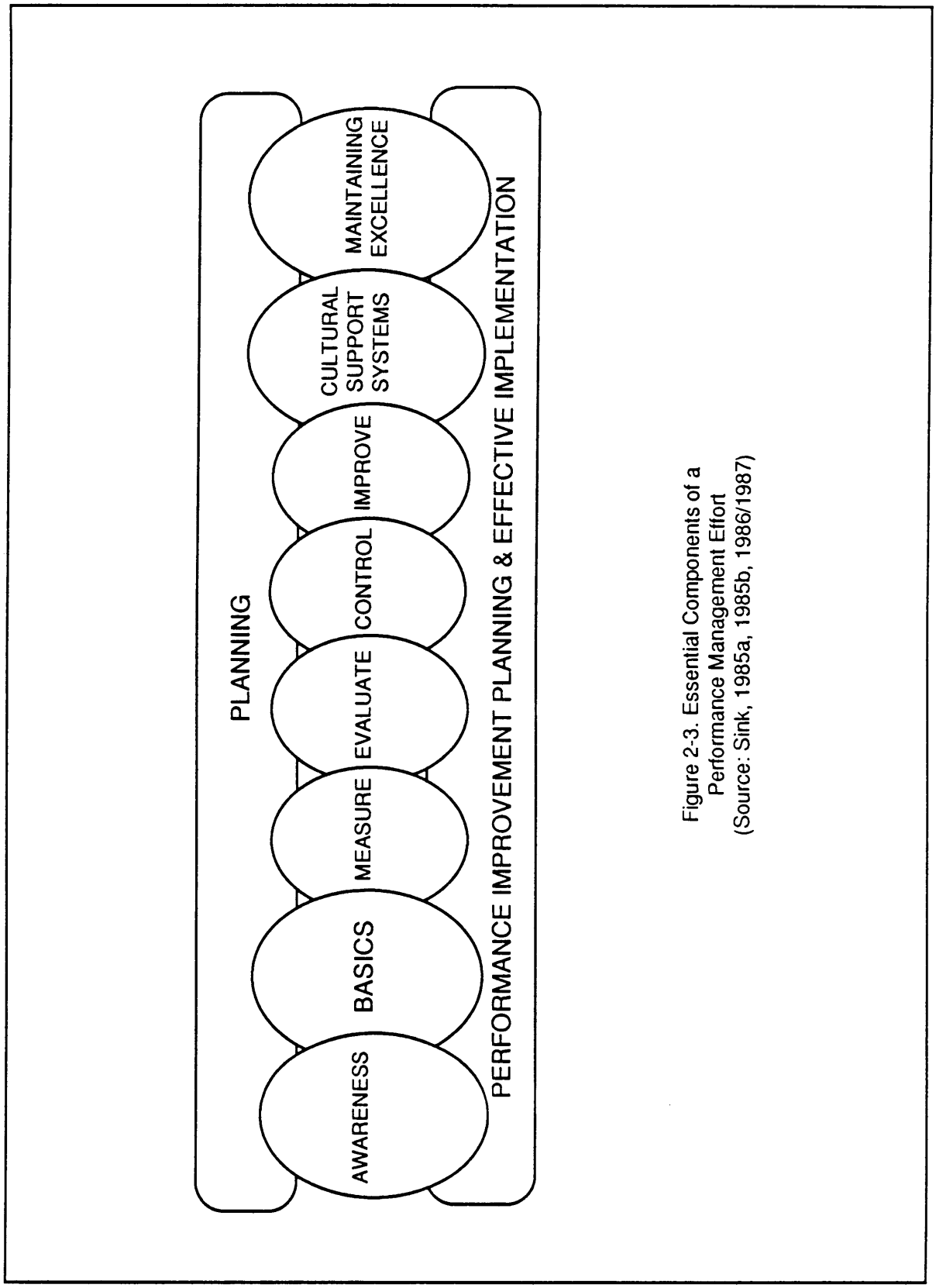

Figure 2-3. Essential Components of a Performance Management Effort (Source: Sink, 1985a, 1985b, 1986/1987)

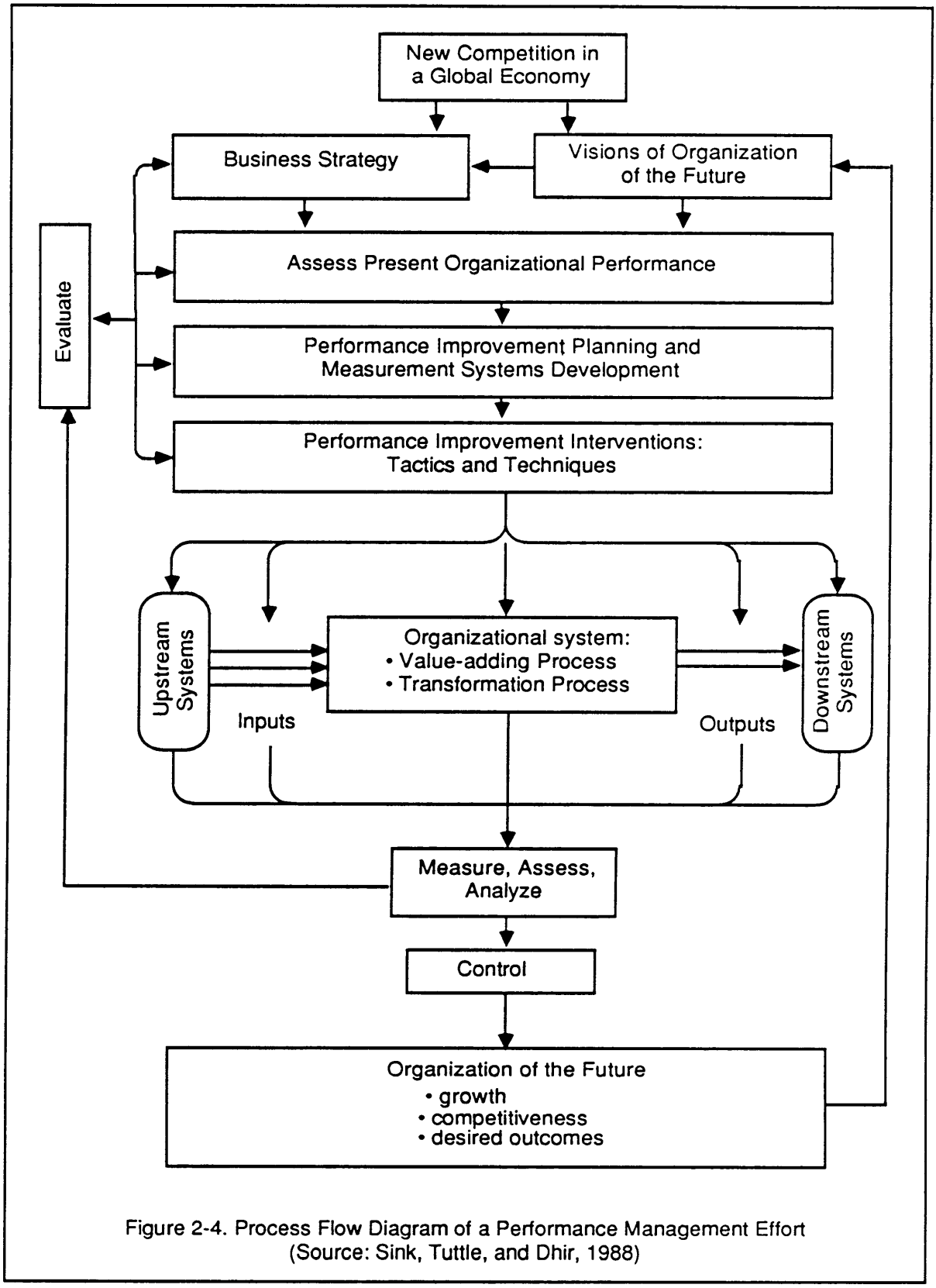

Figure 2-4. Process Flow Diagram of a Performance Management Effort
(Source: Sink, Tuttle, and Dhir, 1988)

manage and achieve competitive levels of performance (Sink, Tuttle, and Dhir, 1988). The background concepts for these models are (Sink, 1985a, 1985b, 1986):

1. There exists an ABC's to management and to change.

ABC's of Management	ABC's of Change
A. Goal	A. Awareness
B. Path	B. Know how to change
C. Assessment Criteria	C. Pay the price (effective implementation)

Assessment criteria is the link between the ABC's of management and the ABC's of change: that is, measurement helps create an awareness of the need to change by providing insight into current performance levels.

2. Performance management requires consistent and disciplined execution of the ABC's of management and will require the effective management of change.
3. There is a strong interrelationship between the design, development, and use of measurement and evaluation systems and management's ability to manage, promote, and stimulate change.
4. Properly designed measurement and evaluation systems can create and support an awareness of the need to change, motivate the willingness to change, and provide accountability and feedback to increase the probability of effective implementation of change.

The Performance Management Process model, then, provides us with several critical insights into the management process:

1. Performance management efforts will require a change in behaviors. Since change is often resisted, management must create

an awareness that change is necessary and will result in win-win situations. Performance improvement cannot be interpreted as meaning working harder, giving more and getting less, less job security, win-lose, etc.

2. Performance management efforts must be supported by a solid understanding of and practice of management basics.
3. Performance management efforts must begin with a well thought through, participatively developed long-range plan (e.g. 3-5 years, 5-7 years). This plan must create a vision of where the organization should/must head if it is to grow, compete, and survive. The establishment and communication of this vision ensures that everyone in the organization has a clear view of purpose, mission, and where the organization is headed and why. The planning process must ensure that goals and objectives link to action planning and effective implementation and complement existing strategic thrusts (i.e. capital budgeting, business planning, etc.). The plan must focus everyone's attention on what can/should be done over the long-range time horizon to ensure the organization is performing better tomorrow than today.
4. Measurement and evaluation, control and improvement are critical components of the performance management process. There is a critical and often complex interrelationship between measurement and evaluation and control and improvement. Improperly designed measurement and evaluation systems can in fact, and often do, lead to more apparent control but less improvement or even declining

performance. Management must understand that measurement systems have two diametrically opposed functions: improvement vs. control. Figure 2-5 identifies these two measurement and evaluation "loops" on the Management System Model. Frequently, the control oriented loop is dominated by the needs, wants, desires, etc. of other audiences. The improvement oriented loop is usually underdeveloped, if it even exists, and is driven by the genuine needs for visibility and feedback of the management team responsible for and accountable for system performance.

5. Performance management efforts take place in the context of specific organizational settings. Efforts that are not supported by the organization's culture will not be as effective as they could or should be.
6. The Performance Management Process is the key to achieving and then maintaining excellence. However, the strategies, tactics, tools and techniques used to achieve excellence are different than those used to maintain excellence; this has direct implications for the role of gainsharing in the performance management process.

2.1.4 Management Process Models - A Synthesis

Three state-of-the-art management process models have been presented graphically and discussed to communicate the management process. Together, these three models provide a reasonably complete conceptualization of the management process. The first model examined (Figure 2-1) is the more traditional of the three and the most complete and detailed relative to the functions and roles of managers. Elements of the last two models reviewed can

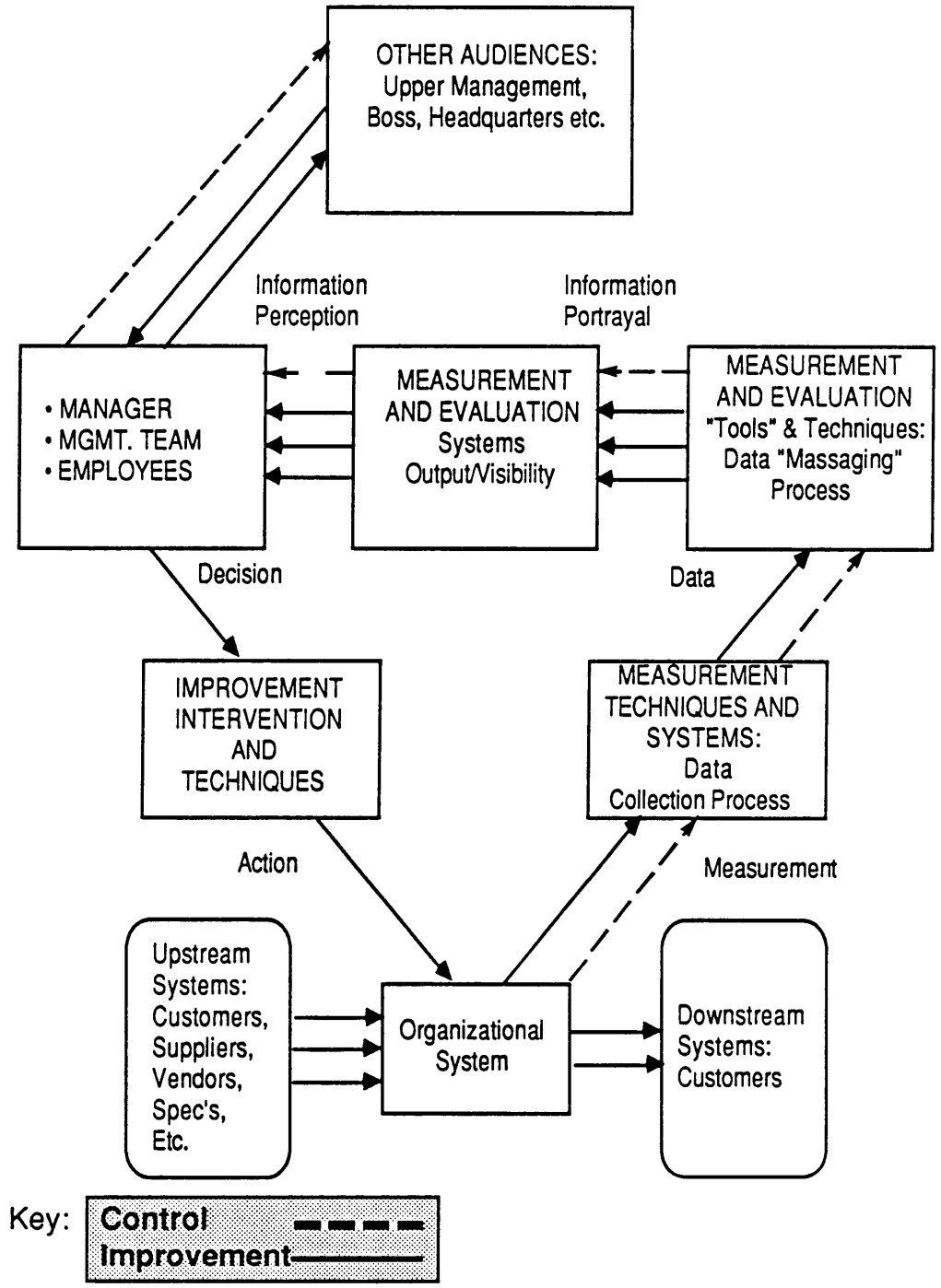

Figure 2-5. Measurement and Evaluation Systems
for the Purpose of Control vs. Improvement
(Source: Sink and Rossler, 1987)

be seen in this model. The second model reviewed, the Management System Model (Figure 2-2), is less comprehensive in detail but focuses on two critical aspects of the management process: problem-solving and decision-making. The model also makes explicit the critical, and often complex, interrelationships between who manages, what is managed, and what is used to manage. The combination of these first two models provides an excellent framework for identifying, diagnosing, and solving management process problems. The third model highlights yet another aspect of the management process. The Performance Management Process model (Figures 2-3 and 2-4) focuses attention on the management basics of planning, action planning, and effective implementation and on the critical interrelationships between measurement and evaluation and control and improvement. The next section will discuss the role of gainsharing in the performance management process.

2.2 GAINSHARING: WHERE DOES IT FIT IN THE PERFORMANCE MANAGEMENT PUZZLE?

A "grand strategy" appears to be driving or shaping the performance management efforts of excellent companies (Sink, 1985a). This grand strategy has six distinct stages (Sink, 1985a; Sink, Tuttle, and Dhir, 1988): Stage 0 - Improving Performance through Execution of the Basics; Stage 1 - Performance Improvement Planning; Stage 2 - Improved Measurement, Evaluation, and Reward Systems; Stage 3 - Integrated Planning; Stage 4: Employee Involvement through Problem-solving, Decision-making,

Implementation, and Follow-through; and, Stage 5 - Building on Excellence. Figure 2-6 depicts these stages of evolution over time.

2.2.1 Stage 0: Improving Performance through Execution of the Basics

A national study conducted by the Public Agenda Foundation reported that (Yankelovich and Immerwarh, 1983):

- Only 18 percent of the working population said they were not interested in improving performance. Yet, only 24 percent believed they were performing to their full capacity; the rest think there is a large gap between what they are doing and what they could be doing;
- 44 percent do not put much more effort into their jobs over and above what is required to keep their jobs;
- 73 percent said they could be significantly more effective in their jobs;
- 73 percent said that how much they are paid has very little to do with the quality and amount of effort they put into their jobs; and
- 76 percent said they have a strong dedication to work. 8 out of 10 people said they would do a better job if they were involved in decisions about their job and 6 out of 10 said they would like to be involved in efforts to get people to do their best on the job.

These data indicate there is tremendous room for performance improvement in most U.S. organizations. In fact, the study concluded that the productive capabilities of the U.S. could be greatly improved if we could tap into people's discretionary efforts. The report defines discretionary efforts as the difference between "just get by" levels of performance and motivated performance levels. A major reason why this situation exists is U.S. managers have generally come to rely on poor models for managing their work forces and to expect and accept much less than is potentially available (Walton, 1985).

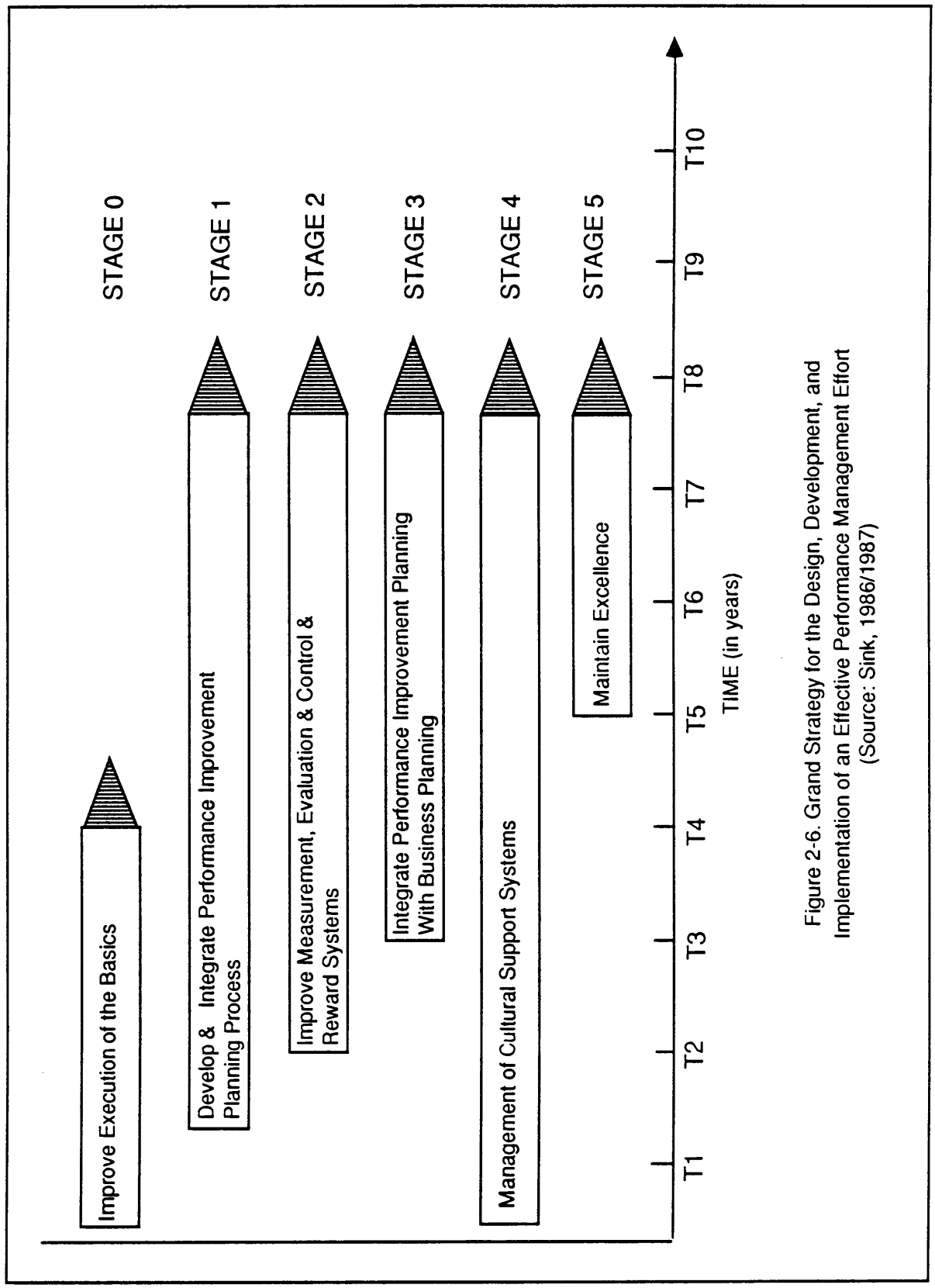

Figure 2-6. Grand Strategy for the Design, Development, and Implementation of an Effective Performance Management Effort (Source: Sink, 1986/1987)

As a result, many U.S. organizations are not performing at the levels they could/should be in certain critical, basic functions.

A lot of performance improvement, then, can be realized if changes are made in management practices, operating procedures, and performance standards. In Stage 0, the organization needs to focus on fundamentals with the goal of achieving acceptable performance levels:

- Basic Management: POLCA, problem solving, decision making
- Product and Service Engineering
- Education and Training
- Selection and Placement
- Compensation Management
- Job design/redesign
- Facilities management
- Quality management
- Industrial engineering
- Product and Process Innovation
- Design to production transition
- Value engineering
- Management development

The well publicized case in which Matsushita Electric Industrial acquired the Quasar Television plant from Motorola provides an excellent case study example of what can be accomplished by a return to management basics (see Sink, 1982). In 1974, the Quasar plant in Franklin Park, Illinois was experiencing a 140 percent in process rejection rate, high warranty costs, absenteeism in the neighborhood of 10 to 12 percent, and test rejects of 2.6 percent. The plant was considered in dire trouble. By 1982, Matsushita had reduced in-process rejection rates at the plant to 5 to 7 percent, lowered warranty costs, significantly reduced absenteeism to 2.25 percent and test rejects to 0.32 percent, decreased field rework by 90 percent, and increased labor productivity 30 percent. Profitability improved while maintaining the same sales price of the finished product.

According to Ossola, the plant manager, this was accomplished with the same work force and several basic changes in operations:

- Product engineering - 26 percent fewer parts.
- Automated assembly.
- Cooperation between design and manufacturing.
- Operator training
- Quality control/reliability engineering
- Simplified management systems
- Management team attitude

Achieving acceptable performance levels took six to eight years of concentration on the basics. Ossola said, "It wasn't hard to go from a 140 percent in-process rejection rate to 10 to 12 percent. We just went back to basics." But, he added, "Going from 10 to 12 percent to 1 to 2 percent (the corporate goal) will require the full effective involvement of the work force" (Sink, 1982). The message in Stage 0 is that you are not out of the starting gate unless you audit, evaluate, and strengthen certain basic functions.

2.2.2 Stage 1: Performance Improvement Planning

- Planning for improvement
- Roadblock identification
- Guiding principles
- Strategic thrusts
- Action planning and effective implementation

In Stage 1, the organization is implementing a management process that communicates to everyone, at all levels, in the organization they have two jobs: get the job done and constantly improve (see Deming, 1986; Sink, Tuttle, and Dhir, 1988). The organization addresses the question: what must we do, both in the short- and long-term to constantly improve quality, productivity, and performance? As was mentioned in Section 2.1.3, effective performance management efforts must begin with a well-thought-through, participatively developed plan that creates a vision of where the organization should/must

head if it is to grow, compete, and survive. The performance improvement planning process, then, attempts to capture, direct, and balance the organization's discretionary time and resources across a number of strategic thrusts (e.g. improved quality; reduce inventory; improve quality of work life) so that progress is made along a number of these fronts, not just a handful. Examples of effective Stage 1 interventions can be found in Pineda, Coleman, and Sink (1987) and Sink, Tuttle, and Dhir, (1988).

2.2.3 Stage 2: Improving Measurement and Evaluation and Reward Systems

- Planning for measurement system design
- Individual and group performance appraisal systems
- Management by Objectives (MBO), collaborative (group) MBO
- Work measurement systems
- Performance measurement systems
- Cost accounting systems
- Newer approaches to measurement
- Linking improvement to measurement
- Measuring and rewarding A while hoping for A
- Visibility system development

Properly designed measurement and evaluation systems (Sink, 1985a):

- Reflect what constitutes performance of the system so that we are not measuring A while hoping for B;
- Signal us as to when the system is "out of control";
- Allow us to gain insight into the systems being managed to help target control and improvement interventions; and,
- Provide scoreboards for people so they know how good a job they are doing and to motivate constant improvement (psychologists tell us that feedback is a core job dimension - see Hackman and Oldham, 1976);

Measurement systems, then, can help in realizing performance improvement:

> The Japanese have extensive and highly visible measures of quality throughout their factories. One U.S. executive, after returning from a trip to Japan, asked at one of his plants what fraction of products made it all the way through the manufacturing process without

> rework. This statistic was not...collected...given that no one was evaluated by this criterion. The data, when finally collected, revealed that fewer than ten percent of the items made it through the process without rework. A program was soon initiated to improve this situation. Within one year, the fraction making it through the first time had increased to 60 percent. Also, with the higher yield, the work force devoted to this product was reduced from 400 to 300 (while still achieving the same output of finished products) (Kaplan, 1983).

Organizations measure and evaluate performance in a variety of ways. Conventional approaches to measurement have served us well for the better part of the last century. Work measurement, engineering economic analysis, management by objectives, cost accounting methods, financial ratios, performance appraisal, and budget management (variance analysis) are just a few of these techniques. However, many firms are implementing imaginative and innovative changes in the way they do business, but continuing to measure and evaluate the performance of these operations using measurement systems from earlier eras (Johnson, 1982; Kaplan, 1983, 1986). This doesn't mean that conventional approaches to measurement are no longer applicable. To become an organization of the future demands that measurement systems be strategically thought through and modified, where appropriate, to capture and reflect changes brought on by a changing environment (both internal and external) and changing technology.

Stage 2 involves examining, in an integrated and strategic fashion, the relative importance of critical dimensions of performance and then evaluating the effectiveness, comprehensiveness, and adequacy of performance measurement systems. Audits of measurement and evaluation systems are a useful tool here (for an example of a measurement audit, see Bain, 1982; Rossler,

1987; Sink and Rossler, 1987). Where deficiencies are detected, improvements must be made.

Companies such as LTV Aircraft Products Group and Honeywell Aerospace and Defense have shown us the design, development, implementation, and continuing evolution of a measurement effort is not a simple or an easy thing to do (see Honeywell, 1987; Virginia Productivity Center, 1986). It requires a grand strategy, patience, persistence, and hard work. However, if the organization is to be competitive over the long run, it must apply both traditional and newer measurement techniques in such a way that the instrument panel which is used to assess the performance of operations is appropriate for those operations.

2.2.4 Stage 3: Integrated Planning

- Performance improvement planning
- Integration with behavioral, financial, production, and quality control systems
- Improved strategic business planning
- Improved effectiveness at linking planning to action and follow-through
- Specific performance improvement strategies, programs, and techniques

Figure 2-7 depicts the interrelationship between business planning and performance improvement planning. Most organizations have some type of business planning process. There is typically a financial component, a marketing component, a facilities component, a product or service component, and an organizational structure component. Stage 3 is devoted to integrating specific performance measurement and improvement goals and targets into the general business planning process. This is an attempt to balance

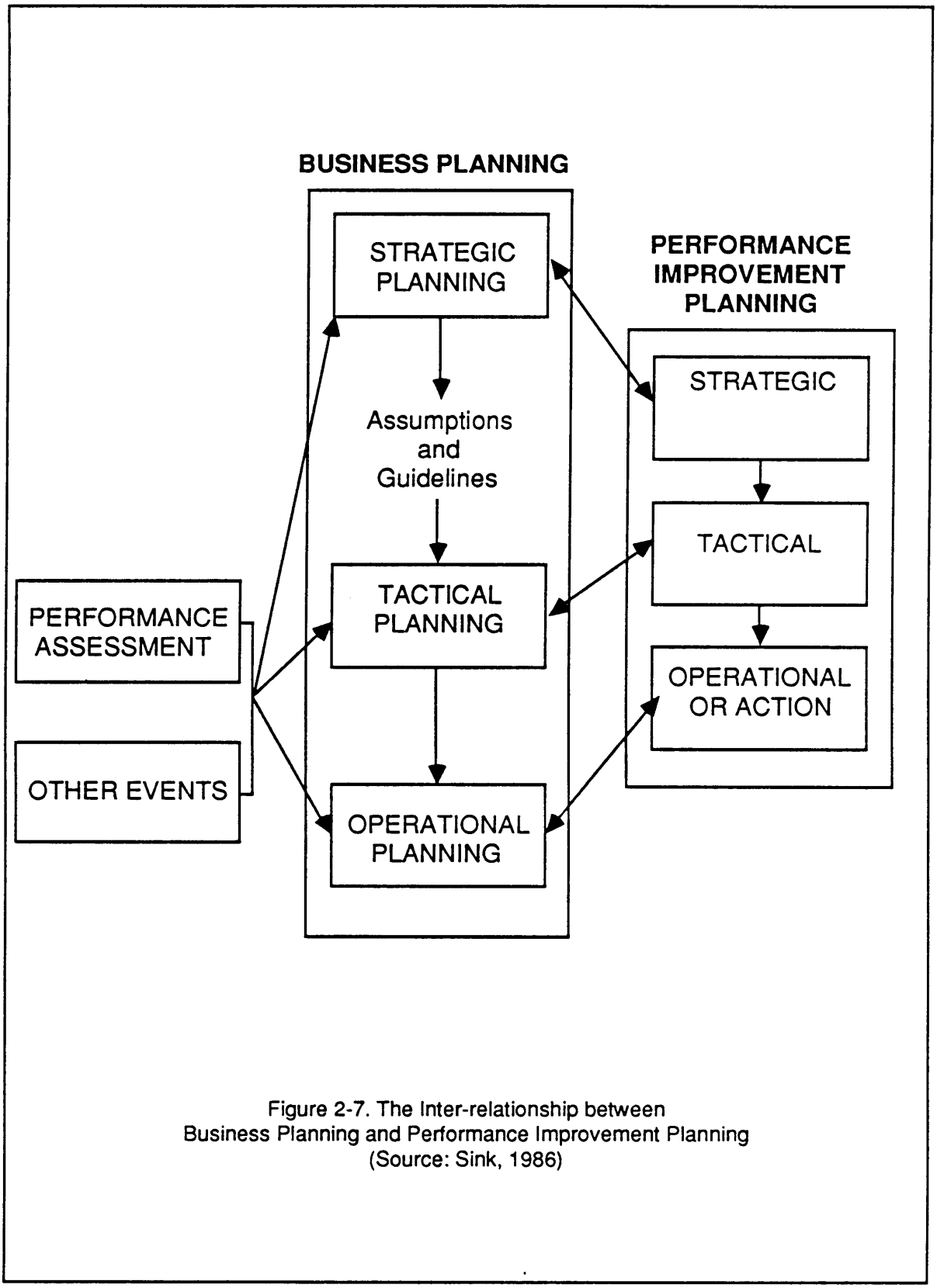

Figure 2-7. The Inter-relationship between
Business Planning and Performance Improvement Planning
(Source: Sink, 1986)

performance improvement planning, strategic business planning, and the budget planning, development and control process.

An example of a company that has successfully reached Stage 3 is Lockheed Missiles & Space Company (LSMC). In 1981, LSMC initiated a formal productivity improvement program with a goal of providing the highest quality to the customer at the lowest cost (see Lockheed Missiles & Space Company, 1985). By 1985, the company had $450 million in actual implemented savings against a goal of $304 million. The changes LSMC made were (LSMC, 1985):

- Annual strategic planning for productivity improvement coupled with productivity goal setting at the division level
- Design to production transition workshops
- Value engineering
- Use of task groups and improvement teams to tackle problems
- Automated assembly operations
- A suggestion system in which nearly 80% of all ideas submitted since 1981 have been implemented. In 1985, 15,969 employees participated,contributing 7,284 productivity improvement ideas of which 6,070 (83%) were implemented.
- CADAM (computer aided design and manufacturing)
- Computer data base for managing the manufacturing business process
- Cost management
- Participation in the Department of Defense's Industrial Modernization Incentive Program (IMIP) to modernize facilities
- Education and Training

Elements of Stage 0, 1, and 2 interventions can be seen in the LSMC approach. LSMC states that "improved productivity requires awareness, commitment, ingenuity, action, and perseverance."

2.2.5 Stage 4: Employee Involvement through Problem-solving, Decision-making, Implementation, and Follow-through

- Top management commitment and legitimization through involvement
- Process design perspective
- Team building

- Structured group processes
- Supervisor/subordinate relationship focus
- Supervisor development
- Action planning and effective implementation
- Effective and efficient problem solving/decision making techniques

Stages 0, 1, 2, and 3 of the grand strategy are excellent opportunities to build a foundation for what can take place in Stage 4. Participative management in and of itself is probably not sufficient to significantly improve employee performance (Kanter, 1983). However, some form of participation and/or involvement is likely to be an important, if not necessary, precondition for other performance improvement techniques which involve the human element. Participation, then, can be viewed as the foundation on which other improvement interventions are built. Unfortunately, most performance improvement efforts begin and end with participative management efforts (such as suggestion systems and quality circles). Stage 4 has to be phased into an overall effort in an appropriate fashion and at the appropriate time.

The small group activity program at Musashi Semiconductor Works in Japan provides an excellent example of the vast potential for improvement through participative management processes (see Davidson, 1982). Musashi began its small group activity program in 1971. The initial stage of implementation occurred between 1971 and 1975 and was called the enlightenment period. The focus during this period was on orientation of management and workers in the principles, philosophy, strategies, structure, techniques, and functions of small group (participative management) activities.

The results of the program are impressive (Table 2-2). The 2700 workers at the plant were organized into 360 groups of 8 to 10 persons per group. The first formal improvement proposals from groups were filed in 1977. Of the 98,347 improvements completed in the second half of 1980:

- 26 percent resulted in reduction of standard times;
- 27 percent resulted in inventory reduction;
- 24 percent resulted in efficiency improvements in office and clerical functions;
- 6 percent resulted in safety improvements and overhead cost savings; and,
- The remaining proposals were devoted primarily to increasing yields at various stages of production

The effectiveness of this small-group activity is impressive by U.S. standards, including those organizations that have participative components of their gainsharing efforts (see Geare, 1976; Bullock and Bullock, 1982). Yet the results achieved by Musashi as compared with other Japanese firms with similar programs are not that impressive (Davidson, 1982). This has serious implications for U.S. firms trying to compete in a global economy yet are still struggling with their performance improvement and participative management efforts.

2.2.6 Stage 5: Building on Excellence

- Continued evolution of participative management process
- Continued development of measurement and evaluation systems and control systems
- Continued evolution of management systems
- Management development
- Goal congruency
- Gainsharing

An organization that successfully accomplishes stages 0 through 4 would be in a position to maintain or exceed reasonably impressive levels of

Table 2-2. Results of Musashi's Small Group Activity
(Source: Davidson, 1982)

Period	Improvement Proposals Submitted[1]	Improvement Proposals Implemented[2]	Percent Implemented	Number of Proposals per Small Group
1978	26,543	Data not provided		73
1979 (Ist half)	47,347	Data not provided		131/half year.
1980 (2nd half)	112,022	98,347	87.8	311/half year

1. An improvement proposal is done by the small group and includes a statement of the problem, a proposed solution, and a description of the results achieved.

2. Small groups typically implement their own proposals.

performance. The major questions/issues to be addressed in Stage 5 are how to maintain (Sink, 1985a):

1. Motivated levels of performance on the part everyone in the organization;
2. High levels of proactivity with regard to innovation for improved performance;
3. A sense of organizational commitment and ownership;
4. High levels of communication, coordination, and cooperation within and between organizational systems; and
5. Progress towards improving the quality of management, the quality of work, and the quality of work life.

One answer may lie in gainsharing. Gainsharing, as a Stage 5 intervention, can help an organization maintain and build on excellence. Gainsharing can help to address many of the major questions and issues facing the organization that has successfully reached Stage 5. As such, some form of gainsharing is probably a necessary component of the organization that has reached impressive levels of performance and wants to build on excellence.

2.3 YEAH, BUT WE CAN GET THERE QUICKER

Many managers in the U.S. have not yet moved beyond the quick fix (Kilmann, 1984). Quite often, changes in the way people are rewarded are instituted as the solution to reverse declining levels of performance and competitiveness; the underlying assumption with such a strategy is that poor performance is due to a lack of motivation (essentially equating performance with motivation), money = motivation, so money is the "button to push" to restore competitive performance levels. In fact, the more competition a firm

reports, the more likely it is to implement a non-traditional reward system such as gainsharing (O'Dell, 1987). While these non-traditional reward systems do have a positive impact on performance, they are most often not what is needed to restore long-term competitiveness for several reasons.

1. Gainsharing is not needed to achieve acceptable, or even motivated, performance levels.

Several studies and case examples show that gainsharing results in performance improvement:

- A 1983 study by Fein of seventy-two companies with Improshare plans reported an average 22 percent improvement in productivity during the first year.
- A study by Bullock and Lawler (1984) of thirty-three companies with gainsharing efforts reported that over 80 percent of these efforts were responsible for cost reduction, productivity, and quality improvement.
- Bullock and Bullock (1982) provide a case study example of a plant within a Fortune 500 company that instituted a gainsharing effort. The plant was already one of the company's most profitable before it instituted gainsharing. During the first year of the plan, the average employee produced just less than one suggestion and the acceptance rate was 79 percent, for a net savings per employee of $441.16; labor productivity increased 27.2 percent; the scrap rate improved 14.3 percent; and there was a 64.2 percent net margin improvement.

Lack of performance data makes it difficult to assess whether or not these organizations had achieved acceptable or even motivated levels of performance. For example, the organization cited in the Bullock and Bullock case study does not appear to have reached Stage 4 in terms of participative management processes. In addition, profitability is just one dimension of performance and may or may not be an indication that this plant was performing at acceptable levels; there is a long list of companies and industries that were once, or still are, very profitable but no longer

competitive (Thurow, 1985). However, if we compare these results with those of effective Stage 0, 1, 2, 3, and 4 interventions (for example, Matsushita at Quasar, Musashi's small group activity, and Lockheed's productivity improvement program) the results of these gainsharing efforts are not that impressive and probably could have been achieved, though probably not as fast, by sound, basic management. There is a lot of performance improvement to be realized in the successful execution of Stages 0 through 4. In fact, Lawler (1985) suggests that if most of the conditions that favor gainsharing are present in an organization, gainsharing is probably not needed to drive improvement.

Second, if we look at the benefits of gainsharing relative to the roadblocks which need to be addressed in most U.S. organizations, we see that gainsharing only partially addresses a few of these and does not provide a process to remove the rest (Figure 2-8). On the other hand, high quality management processes built on Stages 0 through 4 can eliminate every single roadblock listed. These roadblocks were created by the presence of poor quality management processes, not by the absence of gainsharing.

Proponents of gainsharing would argue these roadblocks would disappear because the philosophy behind gainsharing shapes a set of management principles and practices that encourages people to identify with their work group, encourages people to participate as much as they can, and equitably rewards all members of the organization (Frost, Wakely, and Ruh, 1974). However, it is important not to confuse the philosophy behind a management tool or technique with the practice of that tool or technique (Taylor, 1911/1967). Joe Scanlon, the developer of the Scanlon Plan, "deeply

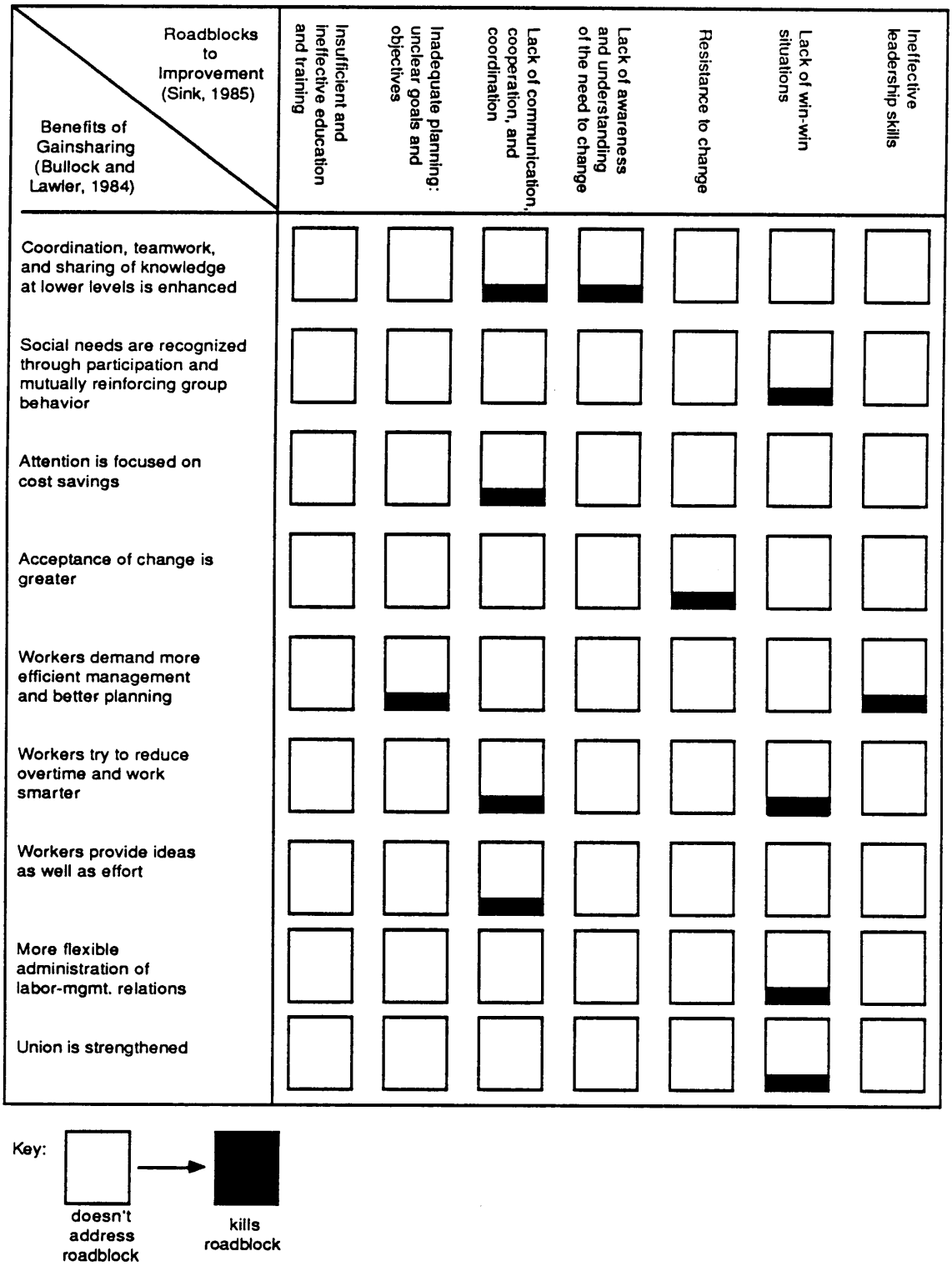

Figure 2.8. Gainsharing and Roadblocks to Performance Improvement (Based on Rossler's Perceptions)

believed the typical organization did not elicit the full potential from employees, either as individuals or as groups. He felt that employee interest and contribution could best be stimulated by providing the employee with a maximum amount of information and data concerning company problems and successes, and by soliciting (their) contributions as to how (they) felt the problem might best be solved and the job best done" (Lesieur and Puckett, 1969); he saw the Scanlon Plan as a way to elicit employee interest and contribution. But, is gainsharing the only way to do this? The point is that gainsharing is simply one of many tools and techniques that can be applied to get people to identify with their work group, encourage people to participate, and equitably reward them for their contribution. The challenge facing management is to select the proper tools and techniques appropriate for the system being managed.

2. There is a need to move beyond quick fixes.

Performance improvement requires patience, persistence, discipline, and hard work (Deming, 1986; Kilmann, 1984; Ishikawa, 1985; Sink, 1985a; Walton, 1985). Changing the way people are rewarded without changing the process by which you manage will have little or no long-term performance improvement impact.

Second, every organization has a culture that has developed over many years (Deal and Kennedy, 1982). Many of the conditions favoring gainsharing, such as open communication, trust, and cooperation (see Lawler, 1981 and White, 1979), do not miraculously appear overnight in an organization whose culture has not supported these characteristics in the past. These conditions exist because of the presence of poor quality management

processes, not the absence of gainsharing. Improving the quality of the process by which you manage is critical in shaping a "high-involvement" culture.

3. Money can motivate, but has many traps for the unwary or unsophisticated.

Money as a motivator is perhaps the most misunderstood, controversial, and debated topics among academicians and managers alike. While the research on money's role as a motivator is far from conclusive, we do know that money may not have the simple psychological effects on motivation that appear at first glance (Guzzo, Jette, and Katzell, 1985). For example, extrinsic outcomes such as money may adversely impact intrinsic motivation (Arnold, 1985; Deci, 1976; Staw, 1977). Second, we know that money can have a positive impact on motivation and performance when it is desired (Vroom, 1964; Porter and Lawler, 1968); when it is contingent on performance (Luthans and Kreitner, 1975); and when it is perceived as being equitable (Adams, 1963, 1965). If all or some of these conditions do not hold true, money can have either no impact on motivation and performance (which is often the case with base pay, merit raises, and fringe benefits) or a negative impact. In actual practice, environmental, organizational, and individual factors make it very difficult to apply money consistent with how theory tells us (Pinder, 1984). The point is that management systems that rely solely on money to motivate and sustain performance improvement are on shaky ground.

4. Performance is not the same as motivation.

The difference between performance and motivation is much more than one of semantics -- it is one that has powerful implications for designing management systems which promote and drive performance improvement.

First, motivation is an individual phenomenon (Mitchell, 1982) and motivating individual performance does not necessarily translate to group performance (see Hackman, 1976, for an excellent discussion of group influences on performance). Yet, group performance is more critical for organizational success than is individual performance (Barnard, 1938). Second, a common mistake made by managers who notice poor job performance is to automatically assume the problem is due to low motivation. However, performance is the result of an interaction among several factors of which motivation is just one. Performance is caused by at least four factors (Campbell and Pritchard, 1976): 1) knowing what is expected and required; 2) having the ability to do what is required; 3) being motivated to do what is required; and, 4) working in an environment which allows you to do what is required. The point is, that while motivation may be necessary for high performance, motivation alone is not sufficient for high performance. Reward systems, then, are not a substitute for proper selection and placement, education and training, job design/redesign, feedback, goal setting, and other basic management tools and techniques. Gainsharing systems put in place before the organization is managing and performing in these critical areas will undoubtedly be less effective than they could/should be.

5. There is a difference between organizational commitment and attachment.

Organizational commitment consists of (Mowday, Steers, and Porter, 1979): 1) a strong belief in and acceptance of organizational goals and values; 2) a willingness to exert considerable effort on behalf of the organization; and 3) a strong desire to remain a member of the organization. Individuals can appear to exhibit all three characteristics. This does not, however, mean they

are committed (Farrell and Rusbult, 1981). The point is that there is a difference between attachment and commitment. An organization can "buy" attachment through such efforts as gainsharing, employee stock ownership programs, cafeteria benefit plans, profit sharing, etc. Managing to obtain commitment, on the other hand, is much more complex and involves more than simply changing the way people are rewarded (see Steers, 1977). The organizations that design management systems and processes to elicit people's commitment are the ones that will grow, compete, and survive in the face of fierce competition (Walton, 1985).

6. Gainsharing has strategic implications.

Everyone doing their best in a system that hasn't defined what the right things are will just make things worse (Deming, 1986). In general, there are at least seven distinct, although not necessarily mutually exclusive, criteria of organizational performance (Sink, 1985a): effectiveness, efficiency, quality, productivity, quality of work life, innovation, profitability (for profit centers)/budgetability (for cost centers). Figure 2-9 depicts the interrelationships between these performance criteria. Management must systematically think through the relative importance of each of the seven performance criteria to the systems they manage. Management systems must then be designed to promote and achieve performance in those dimensions critical to long-term growth, survival, and competitiveness. Until this has been done, gainsharing should not be attempted.

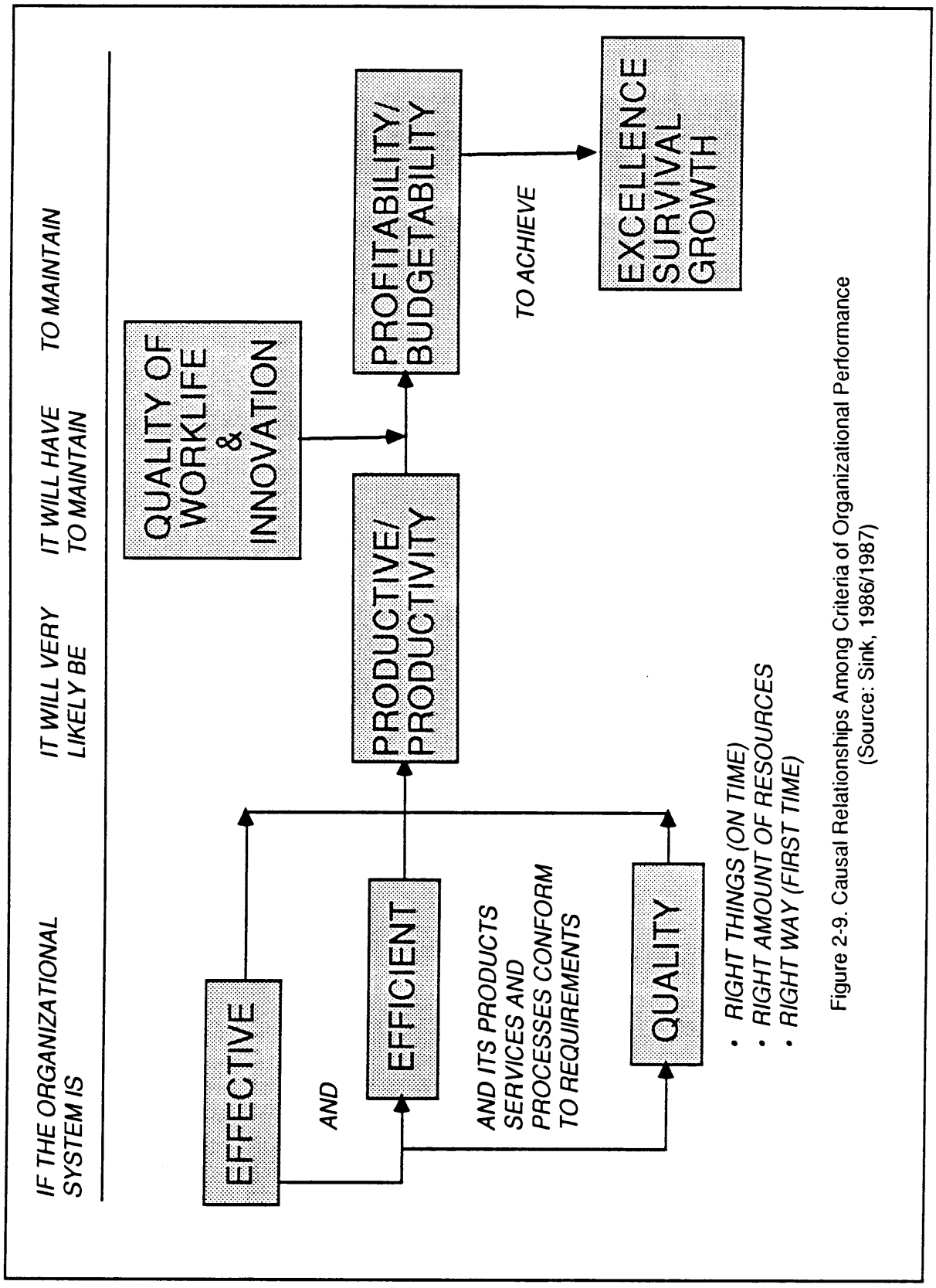

Figure 2-9. Causal Relationships Among Criteria of Organizational Performance (Source: Sink, 1986/1987)

7. The measurement component of gainsharing is just one dial on the instrument panel needed to assess performance and create line of sight.

Organizations need multiple measurement and evaluation systems to monitor, assess, and evaluate performance. Because gainsharing measures performance at the macro level, it is often difficult for people to relate individual and group level performance to plant and/or firm level performance. Evidence of this is found in the fact that size has been identified as a key determinant of gainsharing success (Lawler, 1981) and other group performance based rewards (Marriott, 1948; Rothe, 1978); the smaller the organization, the easier it is for individuals and groups to see a relationship between their performance and plant and firm level performance; the larger the organization, the more difficult this becomes. However, size may not be as critical a factor as appears at first glance (see White, 1979); perhaps a more critical factor for gainsharing success is the presence of improvement oriented measurement systems at the work group, department, and function unit of analyses. The use of improvement oriented measurement systems atthese lower level units of analysis are critical in showing how performance at the work group, department, and function level relate to performance at the plant or firm level. However, these measurement systems typically are not well designed and developed and are not comprehensive and integrated (Sink, 1985a). Without measurement systems at all levels that tell people how good a job they are doing and to create line of sight, gainsharing will be less effective than it could/should be.

8. Gainsharing design, development, implementation, and ongoing maintenance requires you to be a "chef" not a "cook."

Managers are faced with an onslaught of tools and techniques being touted as the solution to increase motivation and performance. However, many of these techniques are being applied in the absence of a grand strategy and with little knowledge of if, why, or how they work. The attitude of many managers is that of a "cook" vs. "chef": "Tell me how to do it, step by step. Don't waste my time telling me how or why it works" (Sink, 1985b). A paradox exists here in that managers accept the fact that engineers must understand both theory behind and application of a given technology. Yet, these same managers view the sociological and psychological knowledge and skills they need to design management systems as somehow different than and not as important as the technological skills needed by the engineer. However, to design effective sociological and behavioral interventions to motivate and elicit long-term performance improvement requires that managers take the time to learn how and why these tools and techniques work. Gainsharing is no exception to this: the sociological and behavioral consequences of gainsharing are complex. If the sociological and behavioral consequences of gainsharing are not considered in the design process, the effort will more than likely fail.

9. Gainsharing involves a number of critical decisions for which a participative strategy is best.

There is a high need for acceptance with any gainsharing effort (Lawler, 1981; White, 1979). Participative approaches to pay system design and development are appealing from the standpoint they improve acceptance (Jenkins and Lawler, 1981). However, participative approaches do not necessarily result in, or guarantee, quality designs (Kanter, 1983; Vroom and Yetton, 1973). Stages 0 through 4 of the performance management process

provide the foundation on which effective participative problem-solving and decision-making can be built. If the organization has not successfully completed these stages, they will more than likely be immature with respect to participation and measurement. Attempting to design and implement a gainsharing system under these conditions will probably result in 1) a poor quality design; 2) lack of effective implementation; and/or, 3) dependence on third party consultants throughout the life of the gainsharing effort.

10. "There is no such thing as a free lunch."

Gainsharing has costs associated with it Lawler (1986):

- Salary costs will go up;
- Training costs will go up;
- Support personnel will increase because the plan requires administrators;

and because of the limited form of participation typically associated with gainsharing (such as suggestion systems, quality circles, worker involvement teams):

- Unmet expectations for change may exist;
- Unmet expectations for personal growth and development may exist; and,
- Resistance by middle management and staff support groups will increase because suggestions affect them.

Again, if the process by which you manage is not mature with respect to the performance management process and is not of high quality, the qualitative costs associated with gainsharing may far outweigh any quantitative short-term gains.

11. Gainsharing is not a mutually exclusive alternative

Many innovations are taking place in the compensation management practices of U.S. companies. Profit sharing, gainsharing, two-tier plans, lump-sum bonuses, all salaried work force, small group rewards, merit pay, and cafeteria benefit plans are just a some of these newer approaches to compensation management now being adopted. These innovations are part of a continuing search by organizations for better approaches to administering pay, controlling labor costs, attracting and retaining human resources, and obtaining and rewarding motivated performance levels. However, most, if not all, of these systems are being implemented as the sole solution to the pay problem.

Need-satisfaction theories of motivation tell us that people's expectations, wants, and desires for job related outcomes vary significantly. Reward systems, and management systems in general, which assume people are guided by single needs and single job-related outcomes are misguided and will be less effective than they could/should be (Pinder, 1984). Yet, if we look at our compensation management practices, this is typically what we have done with respect to pay for work and performance; we see a single system, such as merit pay, skill based pay, gainsharing, etc. applied throughout the organization.

Reward systems in the organization of the future will need to be designed more like those used in sales and marketing. Reward systems in sales and marketing rely on a blend of different types of rewards to attract, retain, and motivate: base pay coupled with commission, merit pay, recognition, lump sum bonuses, merchandise, and travel. In the same vein, reward systems in

the organization of the future need to have an appropriate blend of different reward systems. For example, gainsharing is likely to fit in well with such practices as skill based pay, profit sharing, and employee stock ownership plans (Lawler, 1985).

Figure 2-10 shows an example breakdown of pay in the organization of the future. Such a system looks complex. However, so are the people that our reward systems are designed for. The point is that in our effort to keep pay and reward systems simple, we may have kept them too simple. The major challenge lies in creating a vision of what the compensation management system must look like in the organization of the future and developing a grand strategy by which to achieve it. Gainsharing then must not be viewed as a simple answer to a complex problem but rather as a component of an overall system.

12. Why pay for something you should already be getting?

Rarely, if ever, do you find an individual in an organization who does not know what the JGB (just-get-by) levels of performance are. If an organization as a whole is not performing at acceptable levels and it institutes gainsharing, then, at a minimum, any performance improvement realized up to acceptable performance levels, is performance the organization is paying double for. If the organization is performing at acceptable levels and there are inequities in the base pay structure, that's another issue; gainsharing is not a substitute for sound job evaluation and a sound base pay structure (Bullock and Bullock, 1984; Moore and Ross, 1983).

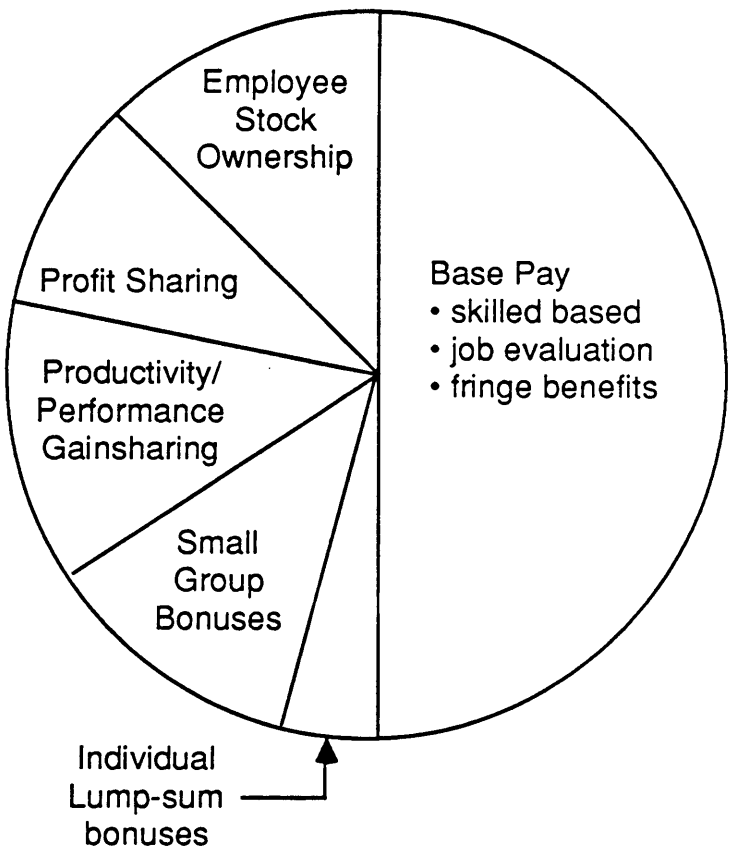

Figure 2-10. Example Breakdown of Sources of Pay in the Organization of the Future

2.4 STAYING #1 IS DIFFERENT THAN BECOMING #1

Any football, basketball, hockey, or baseball team that has won a national championship knows that getting to be Number 1 is different than, and may be easier than, staying Number 1. In terms of managing organizations, it takes a different set of strategies, tactics, tools and techniques to achieve excellence than it does to maintain and build on excellence. Gainsharing is one of those additional tools and techniques. Once again, a sports analogy is useful: there has never been a championship team in any professional sport that gave team bonuses for losing seasons; making the playoffs is what the team bonus is paid for; not coming close to making the playoffs, but actually making the playoffs. Making the playoffs for the first time comes from a lot of sacrifice, discipline, and hard work; making the playoffs a second, third, and fourth time requires just as much, if not more, sacrifice, discipline, and hard work. In the same vein, achieving the level of performance needed to be a world class competitor comes from hard work, patience, persistence, and disciplined performance management. Continuing to be a world class competitor year in and year out requires the same, if not greater, levels of discipline and hard work. While some form of gainsharing is appropriate in sharing the gains that result from these levels of performance, it doesn't, in and of itself, ensure future levels of high performance. There have been a lot of championship teams that experienced the financial rewards of a championship season, but failed to repeat as champions. The point is that the organizations that are going to survive, grow, and remain competitive over the long run are the ones that effectively execute the performance

management process; the organizations that rely primarily on quick fixes or gainsharing and other types of reward systems to drive improvement are the ones that are going to lose. And real competition means that you can lose (Thurow, 1984).

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3.0 THE WHY, WHAT, AND HOW OF GAINSHARING

HIGHLIGHTS

Where does Gainsharing Fit in the Compensation Management System?

- Influencing the Relationship between Performance and Rewards

Gainsharing: What's Available?

Towards a Decision Tree for Gainsharing Approaches

How to Plan for, Design, Develop, Implement, and Maintain a Gainsharing Effort

OBJECTIVES

To highlight the role of gainsharing in the compensation management process.

To succinctly review both traditional and newer approaches to gainsharing.

To present a list of questions useful for thinking through which particular gainsharing approach is appropriate for a given unit of analysis.

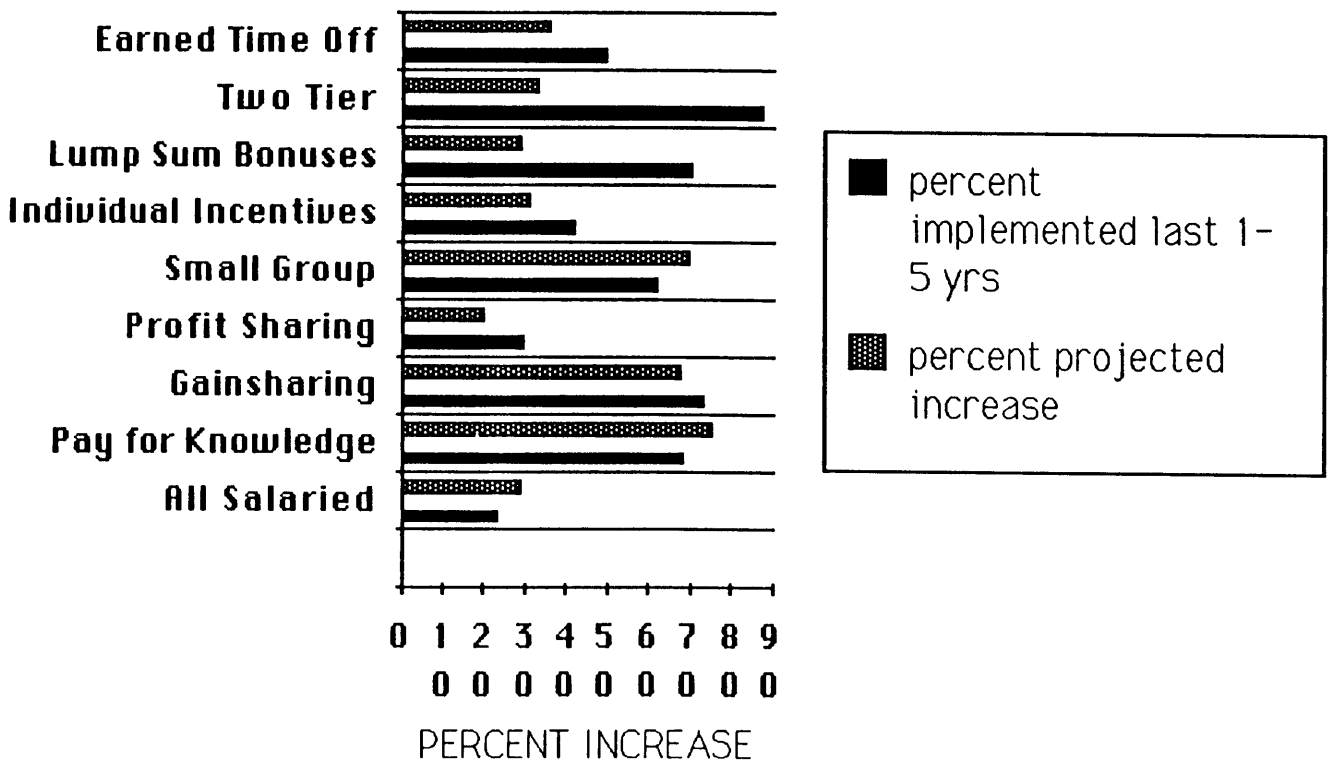
To present a methodology for gainsharing design, development, implementation, and maintenance.

An organization's compensation system has four objectives (Milkovich and Newman, 1984): 1) facilitate organizational performance; 2) control labor costs; 3) influence work attitudes and behaviors; and, 4) comply with regulations. There is a growing consensus among U.S. managers, academicians, and practitioners alike that, to successfully meet these objectives, compensation systems in the organization of the future will have to look different than those used today (Kanter, 1987). Evidence of this belief is found in the tremendous growth in the adoption of non-traditional reward systems (Table 3-1).

Why is compensation or pay considered such an important and critical dimension for U.S. organizations trying to achieve, maintain, and/or build on excellence? Lawler (1981) provides a number of reasons as to why pay can, and should, play a vital role in most, if not all, organizational development efforts:

1. Compensation can influence organizational performance. How people are paid affects their productivity and the quality of work they do (Adams, 1963, 1965; Lawler, 1971). In a review of the literature on productivity, Locke, Feren, McCaleb, Shaw, and Denny (1980) compared the relative effectiveness of four motivational techniques: money, goal setting, job enrichment, and participation. Money yielded the highest median increase: 30 percent; goal setting: 18 percent; job enrichment: 17 percent; and participation: 0.5 percent. While the findings of this study must be interpreted with some caution (Guzzo, Jette, and Katzell, 1985), money can be a powerful motivating force.

Table 3-1. Growth of Non-Traditional Reward Systems
(Source: O'Dell, 1987)



2. Compensation is an important cost. Studies show that payroll costs are a significant percentage of the total cost of doing business (U.S. Chamber of Commerce, 1982). It is not uncommon to find payroll costs accounting for more than 50 percent of total costs; in many public employment and service organizations, this figure is even higher. In addition, payroll costs vary among individual firms within an industry, giving some firms a competitive pricing advantage. Compensation practices, then, are an issue considered by virtually all key decision makers in most organizations. This means that any effort that affects pay is likely to be taken seriously by the key decision makers.
3. Compensation is a problem. There have been numerous studies showing that in most organizations, 50 percent or more of the people in the organization are dissatisfied with their pay (Lawler, 1981). Because pay is often a source of dissatisfaction and problems, changes in compensation practices can be both an entry point for an organizational development intervention and a factor to be considered in later interventions.
4. Compensation is important to individuals. Research on individual behavior in organizations has shown that pay is one of the most important job factors to people. How important pay is, the reasons it is important, and how people respond to it vary considerably from person to person. However, despite these differences, pay has the power to guide and direct individual behavior and performance.

5. Pay policy and pay practice are malleable. Although there are some legal and financial constraints on how pay can be administered in most organizations, there are a number of options open to organizations. Options for change exist in both the mechanics of pay system administration and the process of pay administration. Quite often, organizations are very open to changing their pay systems as a "quick fix" to reverse declining levels of competitiveness and performance (Kilmann, 1984).
6. Compensation and change. Many organizations administer pay in a similar fashion across all functions and levels. This means that an organizational development effort that is tied in with pay system change has a high probability of impacting the entire organization. In addition, compensation practices can and often do have an influence on the effectiveness of organizational change efforts. Almost any change effort has important implications for the pay system precisely because of the systemic nature of organizations. If individuals believe the implications for the pay system are favorable to them, acceptance of the change can be high. On the other hand, if they are negative, strong resistance to the change will occur.
7. Pay is visible and tangible. Because compensation management systems deal with a quantifiable, hard substance - money - they have a certain reality to them. When a person's pay changes or when a pay policy changes, an individual can see, touch, and feel the impact of that change.

8. Compensation is a systemic factor. Compensation systems closely link certain, critical major aspects of the organization: superior-subordinate relationships; job design; organizational structure; organizational culture; education, training, and development; information and control systems; performance appraisal; and, management style.

Pay's importance as both a cost factor and a potential motivator of behavior, its systemic ties to important aspects of the organization, its potential for impacting the total organization, and its flexibility with respect to both process and mechanics makes pay a critical component in the design of management systems to achieve, build on, and maintain excellence. In the next section, we will take a look at where gainsharing fits into an organization's compensation or pay system (the words are used interchangeably throughout this chapter).

3.1 WHERE DOES GAINSHARING FIT IN THE COMPENSATION MANAGEMENT SYSTEM?

Figure 3-1 depicts the dimensions of a compensation system. The first major part of the compensation system consists of direct and indirect financial rewards. Each dimension has a number of compensation components; each component, in turn, has a variety of features. Components and component features will differ for different groups of employees (e.g. exempt vs. non-exempt, full time vs. part time, white collar vs. blue collar). Gainsharing is a group-level reward system that falls under the general category of pay for

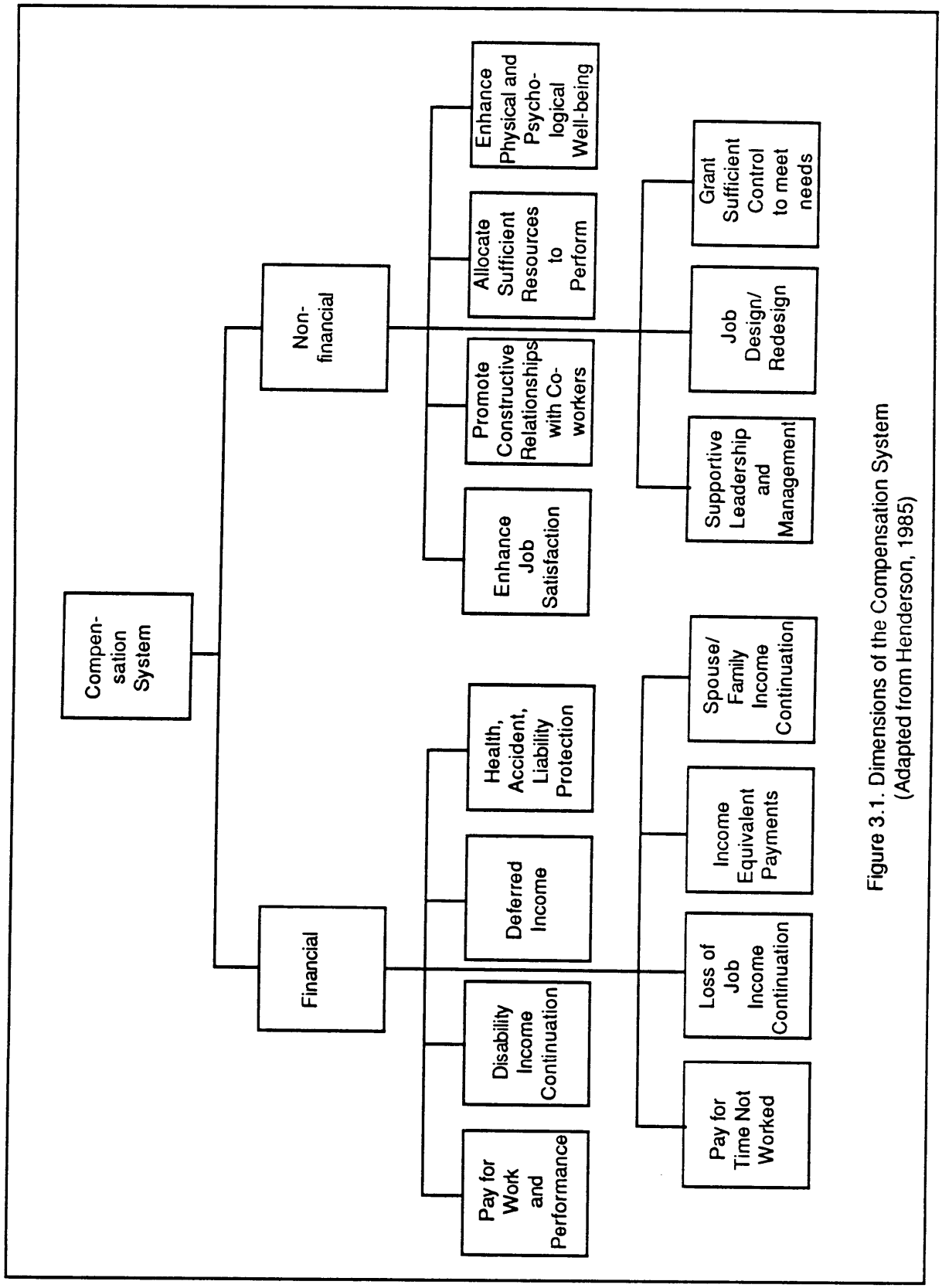


Figure 3.1. Dimensions of the Compensation System
(Adapted from Henderson, 1985)

work and performance; pay for work and performance includes money that is provided in the short term that permits employees to pay for goods and services. The amount of money paid to employees normally depends on specified job requirements; outputs that meet or exceed quantity, quality, or timeliness standards; innovations that may lead to improved productivity; dependability; loyalty; and some combination of these items.

Group level reward systems, such as gainsharing, are seen to fit in well with management systems that promote cooperation, coordination, and aggressive levels of performance (Walton, 1985). Gainsharing also helps an organization control labor costs since it is a "variable" component within the pay for work and performance dimension. As such, it is seen as a way to increase the variable portion of take-home pay while, at the same time, controlling the fixed portions.

The other major part of the reward system consists of non-financial rewards. These rewards are much more difficult to classify and their components far more complex than is the case for direct and indirect financial rewards and components. Non-financial rewards are all the work situation-related rewards that relate to people's psychological and sociological well being. An in-depth examination of Figure 3-1 reveals a close interrelationship between financial and non-financial rewards; the line between these two major categories may at first glance be sharply defined, but soon blurs as they interact and blend together. The structuring of features, components, and dimensions into an effective compensation management system, therefore, requires 1) an understanding of the sociological and behavioral relationships between work, financial rewards, and non-financial

rewards; 2) tools and techniques for identifying job content (e.g job analysis, job descriptions, job evaluations, job structure); 3) tools and techniques for determining pay (e.g. compensation surveys, pay policy lines, and pay structures) 4) valid and accepted measures and measurement systems for evaluating group and individual performance (e.g. performance appraisal, Management by Objectives, collaborative MBO, gainsharing, work measurement); and, 5) systems for planning, budgeting, administering, evaluating, and improving the compensation system.

3.1.1 Influencing the Relationship between Performance and Rewards

Locke (1982) noted the concept of paying employees on the basis of their output for the purposes of motivating high levels of performance dates back at least as far as the early days of scientific management (Taylor, 1911/1967) and probably much further. Expectancy theory (Vroom, 1964; Porter and Lawler, 1968; Pritchard and Campbell, 1976), Equity Theory (Adams, 1963, 1965), and Behavior Modification Theory (see Luthner and Kreitner, 1975) converge in suggesting that, for rewards to motivate, managers must establish a relationship between performance and work-related outcomes. However, in practice, it is difficult to tie rewards to performance in a way that would satisfy these theories. Pinder (1984) identifies a number of variables and factors that constitute practical constraints on the practice of tying rewards to performance:

1. Environmental variables

   Overall economic climate: in tough economic times, rewards may not be available and/or managers may be more inclined to distribute available

rewards among people equally.

Government regulations pertaining to minimum wages and other work conditions place limits on the degree to which it is possible to link rewards to performance.

Labor markets have a direct influence on pay levels, particularly the levels that are needed to attract new employees and retain current employees (i.e. maintain equity).

Labor unions and collective bargaining agreements can restrict management freedom to distribute performance contingent rewards.

Seniority tends to influence personnel management decisions by playing a role in benefit status (distribution of pay, vacations, pensions, etc. and competitive status provisions (who is promoted, laid off, transferred, etc.)

2. Organizational factors

Budgets and the budgetary process often reward managers for behaving in ways that are not entirely consistent with policies of distributing performance based rewards.

Task interdependencies and group performance. Careful enactment of policies tying work related outcomes to levels of job performance is difficult since much of the work that is accomplished in organizations results from the efforts of several individuals, working at separate, but interdependent, jobs.

Organizational goals and reward systems. Intentionally or inadvertently, formal reward systems often serve goals inconsistent with a policy of tying outcomes to performance by rewarding A while

hoping for B (Kerr, 1975).

Informal group norms and organizational culture. An important feature of group dynamics is the development of cohesiveness, the emergence of norms regarding behavior, and the adherence by individual members to these behavioral norms (Hackman, 1976). Adherence to group norms is developed and maintained by the administration of the group's social rewards and sanctions. Work groups tend to develop norms about how much work is appropriate and will administer social rewards and sanctions to support these norms. In addition, there is a relationship between the amount of cohesiveness within a group and the degree of variance observed among group members in terms of the amount of work they perform: highly cohesive groups tolerate less variance than low cohesive groups. The point is that managers must realize that there is an informal reward system operating within the organization and that people respond to the rewards and punishments of the informal system according to the same basic laws of psychology that regulate their reactions to the formal reward systems controlled by management (Whyte, 1972).

Organizational performance and profitability/budgetability. The ability of the organization to pay for performance is always a factor. In the private sector, low levels of profit can lead to an exodus of much needed talent into those organizations that are already profitable; likewise, limited budgets in public sector organizations often lead to an exodus of talent into the private sector where it is believed performance is rewarded.

3. Managerial factors.

Manager's cognition. The cognitive style of managers is a particularly important factor when we consider the practical aspects of distributing rewards based on performance.

Managerial work. The day-to-day nature of managerial work (see Mintzberg, 1973) can be almost antithetical to the practice of carefully assessing performance and distributing rewards according to a schedule closely correlated with merit and one that will be perceived as equitable by all concerned.

4. Employee factors.

Employee inputs. While it may be that managers are in favor of pay linked to performance, many non-performance related issues influence their beliefs and attitudes about reward distribution, both as it relates to their own pay, as well as the rewards they make available to others.

Although tying pay to performance is one of the best-justified prescriptions to derive from current theories of work motivation, the policy of tying work-related rewards outcomes to performance is, in fact, not widely practiced (Porter, Lawler, and Hackman, 1975). The primary reason for this gap between what theory suggests and actual practice can be understood when one considers the numerous practical constraints found in work settings. Gainsharing is no exception to this. As mentioned in Chapter 2, gainsharing implemented as a mutually exclusive alternative and in the absence of high quality management processes will more than likely fail.

3.2 GAINSHARING: WHAT'S AVAILABLE?

Table 3-2 presents characteristics of common gainsharing plans and approaches. The dimensions identified are design variables; application of a particular approach may or may not look the same within or along all dimensions depending on organizational characteristics. In fact, gainsharing plans or approaches implemented straight "off the shelf" without any tailoring will more than likely fail (Doyle, 1983).

Measurement

All gainsharing is measurement based. Most gainsharing plans use some form of partial factor productivity measure; labor productivity is the most common. An exception to the use of productivity measures is the family of measures approach; this approach would more appropriately be referred to as performance gainsharing as opposed to productivity gainsharing. Family of measures uses a multi-criteria, multi-attribute approach to measure improvement in the areas of effectiveness, efficiency, quality, innovation, and, quality of work life (e.g. safety and housekeeping measures); measures of productivity and profitability/budgetability are sometimes included.

Improshare and Shred-Cost make use of ceiling and buy-back principles (see Dar-el, 1986 and Fein, 1981, 1983). Consistent performance above the ceiling results in a buy-back of the base. This concept could be applied to all forms of gainsharing. The use of statistical process control theory and techniques could prove valuable in tracking performance over time to determine when buy-backs should occur (see Das, Pineda, and Coleman, 1987; Deming, 1986).

Table 3-2. Comparison of Gainsharing Plans and Approaches

PLAN / DIMENSION	SIMPLE OR SINGLE RATIO SCANLON	SPLIT RATIO SCANLON	MULTI-COST SCANLON	ALLOWED LABOR SCANLON	RUCKER	IMPROSHARE	SHRED-COST	FAMILY OF MEASURES
MEASUREMENT	Based on relationship of labor costs to sales value of production: $\frac{\text{Labor Costs}}{\text{Sales Value of Production}}$ where Sales Value of Production equals sales less returns and allowances ± changes in inventory.	Two or more single ratios weighted according to product labor content. Each ratio would include direct labor and an allocation of various overhead expenses. $\frac{\text{Labor Costs by Product}}{\text{Sales Value of Production}}$	Typically captures 75-90 percent of total costs. If total costs are captured, would be appropriately referred to as profit gainsharing. Can be designed as split ratio if costs vary along product lines. $\frac{\text{Labor, materials, and overhead}}{\text{Sales Value of Production}}$	Similar to Improshare. Compares actual with allowed labor for each product. Indirect labor and other personnel costs are included as percent of allowed direct labor. $\frac{\text{Actual Labor}}{\text{Production Standard}}$	Uses a ratio of labor costs to value added for the productivity base: $\frac{\text{Labor Costs}}{\text{Value Added}}$ where Value Added equals sales value of production less materials, supplies, and services.	Measures labor hours, direct and indirect used to produce one unit of product. Uses a Base Productivity Factor to adjust standards for past actual output: $\frac{\text{Actual Hours}}{\text{Total Standard Hours Produced}}$ Ceiling and buyback principles are employed	A "take-off" of Improshare. Measures include labor and/or materials, inventory, and energy. Ceiling and buyback principles are employed.	Uses a multi-criteria approach to measure performance. Improvement targets are established and tied to a gainsharing fund.
IMPROVEMENT FOCUS	Objective is to improve labor productivity: • Lower scrap and rework • Fewer customer rejects and returns • Increase output • Better methods • New equipment	Same as single ratio.	Objective is to improve multi-factor productivity: • Lower scrap and rework • Fewer customer rejects and returns • Increase output • Better methods • Inventory reduction • Material savings • Energy savings • New equipment	Objective is to improve labor productivity: • Lower scrap and rework • Increase output • Better methods • New equipment	Objective is to decrease labor to increase the value of what is produced. Some Rucker suggestions for improving productivity are: • Material and supply savings • Lower scrap and rework • Fewer customer rejects and returns • Increased prices • Higher output • Better methods • New equipment	Objective is to improve labor productivity: • Lower scrap and rework • Increase output • Better methods • New equipment	Objective is to improve labor and material productivity. Focus is on labor costs, material costs, and inventory reduction.	Objective is to improve performance in the areas of effectiveness, efficiency, quality, quality of work life, and innovation. Productivity and profitability/budgetability may be included.

Table 3.2 Continued. Comparision of Gainsharing Plans and Approaches

PLAN / DIMENSION	SIMPLE OR SINGLE RATIO SCANLON	SPLIT RATIO SCANLON	MULTI-COST SCANLON	ALLOWED LABOR SCANLON	RUCKER	IMPROSHARE	SHRED-COST	FAMILY OF MEASURES
EXAMPLE CALCULATIONS	Sales Value of Production 1,150,000 Allowed Labor Costs (21%) 241,500 Actual Labor Costs 210,000 Bonus Pool 31,500 Reserve Pool (25%) 7,875 Bonus Balance 23,625 Company Share (25%) 5,906 Employee Share (75%) 17,719	SVP Product A 575,000 SVP Product B 575,000 Allowed Labor Costs A (7%) 80,500 Allowed Labor Costs B (14%) 161,000 Actual Labor Costs 210,000 Bonus Pool 31,500 Remaining calculations same as single ratio	SVP 1,150,000 Allowed-Input costs (80%) 920,000 Actual Labor Costs 210,000 Actual Materiail Costs 600,000 Actual Energy Costs 78,500 Bonus Pool 31,500 Remaining calculations same as single ratio. Sharing ratio may differ	Units Produced 10,000 Allowed Direct Labor Hours 15,000 Allowed Indirect Labor Hours 7,500 Allowed Overhead Labor Hours 1,650 Actual Hours 21,000 Bonus Pool Hours 3,150 Bonus Pool in Dollars (avg. rate $10/hour) 31,500	SVP 1,150,000 Less Materials, Supplies 650,000 Value Added 500,000 Actual Labor Costs 210,000 Standard Value Added (actual labor x Rucker Standard) 525,000 Bonus Pool 25,000 Reserve Pool (33%)	Base Productivity Factor 1.61 Units Produced 10,000 Employee Standard Hours 1.5 Total Improshare Earned Hours 24,150 Actual Hours 21,000 Bonus Hours 3,150 Company Bonus Hours 1,575 Employee Bonus Hours 1,575	Calculation dependent on measure and on whether Plan A or B is used. In Plan A, productivity sharing is permitted upto a predefined ceiling and requires implementation of a buy-back once the participating group has demonstrated its ability to perform above the ceiling. Productivity sharing in Plan B is determined by a predefined Target Bonus whose value reflects the planned long term bonus earning for the plan. Plan B is based on a periodic evaluation of performance to implement whatever buy-backs are possible.	Site specific. Measures are tied to gainsharing fund.

Table 3.2 Continued. Comparision of Gainsharing Plans and Approaches

PLAN / DIMENSION	SIMPLE OR SINGLE RATIO SCANLON	SPLIT RATIO SCANLON	MULTI-COST SCANLON	ALLOWED LABOR SCANLON	RUCKER	IMPROSHARE	SHRED-COST	FAMILY OF MEASURES
LINE OF SIGHT	• Easy to understand • Related to employee costs • Does not separate productivity from price recovery • Does not capture impact of other factors	Same as single ratio	• More difficult to understand • Useful for identifying cost drivers • Does not separate productivity from price recovery	• Helps isolate problem areas in labor • Does not capture impact of other input factors • Employees relate to measure	• Difficult to communicate value-added concept • Not very helpful in isolating problem areas • Does not separate productivity from price recovery	• Very good. Most workers understand relationship between hours worked and units produced • Does not capture impact of other input factors	• Very good when used at department level • Does not separate productivity from price recovery • Does not capture impact of many input factors	• Site specific. Often, the unit of analysis for measurement is different than the unit of analysis for gainsharing
BEST FIT APPLICATIONS	• Manufacturing organizations • Labor is a major cost driver and labor productivity is a critical dimension of performance • Sales prices and labor costs change at similar rates • Stable product mix with few design changes • No major capital investments planned	• Manufacturing organizations • Labor is a major cost driver and labor productivity is a critical dimension of performance • Sales prices and labor costs change at similar rates • No major shifts in prices along product lines • Can accurately capture payroll costs by product • No major capital investments planned	• Manufacturing or service organizaitons • Educated workforce in regards to financial data. • No major shifts among quantities of inputs and outputs. • No major shifts in costs of inputs and prices of outputs. • Labor, material, and energy productivity are critical dimensions of performance	• Manufacturing organizations • Accurate, up-to-date time standards. • Ratio of direct to indirect costs is relatively stable. • Direct and indirect costs allocated properly. • Direct labor is a major cost driver. • Labor productivity is a critical dimension of performance	• Labor dominated manufacturing organizations • Educated workforce in regards to financial data • Labor and materials are major cost drivers and labor productivity is a critical dimension of performance • Stable relationship between labor costs and value added	• Manufacturing and labor dominated service organizations • Ratio of direct to indirect labor is relatively stable • Labor is a major cost driver labor productivity is a critical dimension of performance	• Labor domianted manufacturing organizations • Labor and materials are a major cost driver and labor productivity is a critical dimension of performance	• Manufacturing and service organizations • Productivity may or may not be a critical dimension of performance and/or dominated by materials and capital

Table 3.2 Continued. Comparision of Gainsharing Plans and Approaches

PLAN / DIMENSION	SIMPLE OR SINGLE RATIO SCANLON	SPLIT RATIO SCANLON	MULTI-COST SCANLON	ALLOWED LABOR SCANLON	RUCKER	IMPROSHARE	SHRED-COST	FAMILY OF MEASURES
UNIT OF ANALYSIS	Plant or Firm				Plant or Firm	Plant, Function, or Department	Plant, Function, or Department	Typically applied at plant and firm level
PARTICIPANTS	All plant and office personnel. Top management is typically excluded.				Includes at least all direct and indirect factory personnel. Other employees can participate directly in the bonus or can be paid a matching bonus from the company's share. Top management is excluded.	Designed for non-exempt operating personnel. Recommended that other employees be paid a matching bonus from the company's share. Top management is excluded.	When used at the department level, all employees plus supervisor. When used at the plant level, excludes management, personnel, marketing, R&D, finance.	Site specific.
MEASUREMENT SCOPE/ FREQUENCY OF PAYOUT	Typically Monthly. Quarterly is not, however, uncommon.				Typically Monthly. Quarterly is not, however, uncommon.	Weekly, based on four week moving average.	Monthly or quarterly.	Typically paid quarterly, semi-annually, or annually.
SHARING RATIO (company: participants)	Gain shared 25:75. 25 percent of participants share typically set aside in reserve fund.	Gain shared 25:75. 25 percent of participants share typically set aside in reserve fund.	Gain shared depending on inputs included. Typically 25:75 on labor, 50:50 on other inputs. 25 percent of participant's share typically set aside as reserve fund.	Usually shared 50:50. Reserve funds sometimes used.	The ratio of labor costs to value added determines what is available to pay labor, and money not used to pay wages and benefits is the bonus. 33 percent set aside as reserve. Remaining amount to participants.	Hours saved shared 50:50. Base is adjusted 80 percent for changes in machinery and equipment. Reserve fund not used.	50:50, 60:40, or 40:60 are used.	Site specific.

Table 3.2 Continued. Comparision of Gainsharing Plans and Approaches

PLAN / DIMENSION	SIMPLE OR SINGLE RATIO SCANLON	SPLIT RATIO SCANLON	MULTI-COST SCANLON	ALLOWED LABOR SCANLON	RUCKER	IMPROSHARE	SHRED-COST	FAMILY OF MEASURES
DATA REQUIRE-MENTS	3-5 years historical data: sales value of production and labor costs	3-5 years historical data: sales value of production and labor costs by product	3-5 years historical data: sales value of production and labor, material, and energy costs	Engineered labor standards, esti-mates, or historical data to formulate direct labor hours associated with output	3-8 years of histori-cal data: sales value of finished goods; costs of raw materi-als and supplies; payroll for all employees	Engineered labor standards, esti-mates, or historical data to formulate direct labor hours associated with each unit of output	Performance level averaged over a stable period in the past (typically six months to one year)	Historical data, standards, esti-mates, and/or goals/targets
ADVANTAGES	• Easy to under-stand • Related to controllable costs • Easy to admini-ster and maintain	• Easy to under-stand • Related to control-lable costs • Fairly easy to ad-minister and maintain	• Mosts costs included • Shares overall success • Adaptable to changes in product mix	• Considers some product mix prob-lems • Prices do not affect or can be easily adjusted • Easy to install • Related to control-lable inputs	• Cyclical variation of outside pur-chases and nonlabor costs are kept out of the formula • Deals with product mix and price changes by offsetting in-creased supply with selling prices	• Considers some product mix prob-lems • Prices do not affect • Easy to install • Related to control-lable inputs • Easy to under-stand	Dependent on measure used and unit of analysis	• Measures performance along several dimensions • Considers line of sight when de-veloping meas-ures
POTENTIAL PROBLEMS	• Limited inputs included •Product mix may influence • Changes in input and output prices influence • Inventory may influence more	• Limited inputs included • Changes in input and output prices influence • Inventory may influence more	• Changing input and output prices influence • Difficult to ascertain cause-effect relation-ships • Difficult to communicate	• Limited inputs included • Standards may have to be frozen • Disagreement over standard setting • Difficulty of adding inputs such as over-times and new products	•Some inputs exclued • Defining an outside pur-chase • Determining how to handle capital • Difficult to administer	• Tightening standards across the board. Tight standards become tighter • Loose standards may remain loose • Changes in ratio of direct to indirect	• Many inputs excluded • Does not necesarily use productivity measures • Ceiling and buy back is com-plex and difficult to communicate	• Unit of analysis for measures and gainsharing are often different • Unit of analysis not kept constant across measures • Translating measures into dollar amounts

Table 3.2 Continued. Comparision of Gainsharing Plans and Approaches

PLAN / DIMENSION	SIMPLE OR SINGLE RATIO SCANLON	SPLIT RATIO SCANLON	MULTI-COST SCANLON	ALLOWED LABOR SCANLON	RUCKER	IMPROSHARE	SHRED-COST	FAMILY OF MEASURES
MANAGEMENT PHILOSOPHY	Closely linked to McGregor's Theory Y. People prefer to express themselves in all situations, including work situations, and when they do, they can be constructive and supportive of the groups to which they belong.				The firm's greatest untapped source for productivity gains is its own workforce.	The goal of management and labor are congruent and can be met by encouraging the worker's will to work.	An organization's employees are among its most important resources anddeveloping these should be a major objective	Site specific
THEORY AND/OR ASSUMPTIONS	The basic philosophy is best served when all members of the organization participate as fully as they can in the activities of the organization and when they are equitably rewarded for their participation.				If management wants employees to find new ways to eliminate waste, reduce costs, and improve methods, they must allow people to share in the gains resulting from those improvements.	The group gainsharing bonus is the principal method of encouragement. Programs that offer job satisfaction as the prime reward will not have wide spread support and will not tap into the potential for improvement.	Gainsharing provides the logical reward system for use with participative approaches to improve productivity.	A family of measures approach helps activate interes, gets buy-in, and motivates improvement. Basing rewards on these same measures further motivates constant improvement.
MANAGEMENT STYLE AND PROCESS	Participative management emphasized. Uses structured suggestion system consisting of department production				Management is encouraged to communicate with, listen to, and solicit ideas from employees. Some companies have added single plant-wide or multi-level committees to process suggestions.	Doesn't encourage the adoption of new management practices. Suggests that as workers realize bonuses come from better methods, the ideas will flow. Can, however, be integrated with participative practices.	Steering counci and three types of formal teams used: coordinating committees, action teams to investigate problems, and worker involvement teams to provide a forum for solving problems.	Site specific

Improvement Focus

You get what you measure and reward for (Kerr, 1975; Sink, 1985a). Most gainsharing plans focus heavily on labor productivity improvement with labor efficiency and product/service quality indirectly captured. Shred-Cost allows use of partial factor measures to focus on labor, material, or energy productivity improvement. Comprehensive, multi-factor approaches such as the multi-cost Scanlon, Rucker (indirectly), and family of measures focus on improvements across many fronts.

Example Calculations

The bonus calculation is similar across all forms of gainsharing. In productivity gainsharing, historical data, estimates, standards, and/or goals are used to establish a base ratio of allowed input for a certain level of output. Any improvement above the base results in a bonus. Basically, there are five ways for this improvement to occur (Doyle, 1983; Sink, 1985a):

1. Output increases and input decreases;
2. Output increases and input remains constant;
3. Output increases and input increases at a slower rate;
4. Output remains constant and input decreases; and
5. Output decreases and input decreases at faster rate.

The bonus is shared between the company and employees according to a predetermined split; any bonus is distributed in-line with the measurement scope.

Many plans make use of reserve pools; reserve pools are bonus funds set aside, typically from the employees share, to reimburse the company for periods where performance fell below the base ratio. If the reserve pool

balance is positive at the end of the year, the money is distributed as a lump sum bonus to employees; if the reserve pool shows a deficit, the company absorbs the loss and the pool starts at zero for the new year.

Line of Sight

Clear line of sight is critical to gainsharing success. First, the measure used must be a valid, accepted criteria of performance that people have some control over. Second, participants must see a relationship between performance and rewards. Third, the formula for payout must be understood (Frost, Wakely, and Ruh, 1974; Lawler, 1981; Lesieur, 1958; Moore and Ross, 1978).

A problem with many gainsharing measures is that they do not provide a manager, management team, or work group with the information needed to make appropriate control and improvement interventions. Productivity measures must be reported differently at different level units of analysis (Gold, 1979). There is a shift in measurement from physical input-physical output ratios, to financial input-physical output ratios to financial input-financial output ratios as one moves from lower to higher organizational levels. Physical input-physical output relationships tend to dominate performance evaluation of the department, cost center, or work group producing components for the final, marketable product. The physical criteria is dominant because pricing and costing decisions are made by other units in the organization (e.g. accounting, marketing, procurement, labor relations). Input costs for evaluating performance replace physical input quantities at the function level which is responsible for manufacturing the complete product. This reflects management's ability to improve performance

by not only decreasing the quantities of input per unit of output, but also by altering the qualitative specifications of inputs, by adjusting input percentages, and seeking reduced input prices. Each of these interventions are driven, in part, from an emphasis on reducing unit costs. At the plant, division, and firm level, reducing costs relative to physical outputs is less important that increasing revenues relative to costs. A major impetus to the use of productivity measures by top management is that are typically not reported in financial terms (Cosgrove, 1987).

This does not mean to imply the varying units of analysis only need the one set of information. The relative importance of these different aspects changes from the standpoint of the evaluator. Effective managerial control of the system, therefore, requires integration of these different measures to gain visibility into the operations being managed and to target interventions necessary to achieve desired improvements in the aggregate financial ratios. Gainsharing measures, then, do not provide the information needed at all levels of the organization for effective planning, assessment, evaluation, control and improvement. The point is that gainsharing measures are not sufficient as stand alone measurement systems.

Best-fit Applications

A considerable amount is known about the institutional and situational factors that favor gainsharing plans (Table 3-3). Not all the conditions listed in Table 3-3 have to be met in order for gainsharing plans to be effective. However, some of the conditions are necessary for effective implementation. Management and labor must address the issues associated with each condition and determine the appropriateness of gainsharing for their organization.

Table 3-3. Conditions Favoring Gainsharing Plans
(Source: Lawler, 1986)

Organization Characteristic	**Favorable Condition**
Size	Small unit, usually less that 500 employees
Age	Old enough so that learning curve has flattened and standards can be set based on performance history
Financial measures	Simple, with a good history
Market for output	Good, can absorb additional production
Product costs	Controllable by employees
Organizational climate	Open, high level of trust
Style of management	Participative
Union status	No union or one that is favorable to a cooperative effort
Overtime History	Limited to no use of overtime
Seasonal nature of business	Relatively stable across time
Workfloor interdependence	High to moderate interdependence
Capital investment plans	Little investment planned
Product stability	Few product changes
Comptroller	Trusted, able to explain financial measures
Communication policy	Open, willing to share financial results
Plant manager	Trust, committed to plan, able to articulate goals and ideals of plan
Management	Technically competent, supportive of participative management style, good communications skills, able to deal with suggestions and new ideas
Corporate position	Favorable to plan
Work force	Technically knowledgeable, interested in participation and higer pay, financially knowledgeable or interested
Plant support services	Maintenance and engineering groups competent, willing and able to respond to increased demands

A criticism of gainsharing is that it has been designed primarily for manufacturing organizations (Hauck, 1983). The family of measures is an exception to this; a multi-criteria, multi-attribute approach to measurement is a particularly useful in white-collar settings (Riggs and Felix, 1983; Sink, 1985a; Stewart, 1979) or in other hard to measure areas.

Unit of Analysis

Gainsharing involves measurement at the macro level; most gainsharing is done at the plant or firm level. Improshare, Shred-Cost, and family of measures can be applied at lower level units of analysis. However, cost accounting systems often do not accurately capture the impact of changes at the function, department, or work group level; this is not as much a problem with Improshare and Shred-Cost as it is with the family of measures approach Second, interdependencies among various functions, departments, and work groups are not considered. Third, often application of the family of measures approach results in different units of analyses for measurement and gainsharing.

Participants

The participants vary depending on the measurement used. Again, participants must have some control over the measure. Unit of analysis and participants must be decided on before the measure is developed.

Joe Scanlon, developer of the Scanlon Plan, believed, and recommended, that everyone in the organization participate (Lesieur, 1958). Often, top management is excluded from the gainsharing effort. The practice of excluding top management sends conflicting signals to the system. By instituting gainsharing, top management is sending a signal to the system that

"we're all in this together." On the other hand, by not having any bonus compensation tied directly to the gainsharing effort, top management is saying "we're not all in this together"; in such a system, participants in the gainsharing effort could lose while top management could still win. An argument against including top management under the gainsharing umbrella is that they already have their own bonus system. But why can't or shouldn't this bonus system be revised to include a percentage of top management bonuses based on gainsharing? The organization of the future will require this "equality" in reward systems at all levels of the organization (Walton, 1985).

Measurement Scope/Frequency of Payout

The payout in gainsharing is closely linked to actual performance. Both Expectancy Theory and reinforcement theories of motivation tell us that the closer the reward is to actual performance, the more powerful is the motivational impact. Improshare is the best at this, paying out weekly. Most other plans pay out monthly, in-sync with the accounting cycle.

Sharing ratio

This is perhaps one of the most critical decisions in the design of a gainsharing plan. The distribution of the bonus must be perceived as fair and equitable. The bonus available for distribution is typically paid as a percent of participating payroll. Participating payroll is defined as everyone covered by the plan. Individuals who made suggestions which led to a productivity improvement do not receive a greater share of the gains than those individuals who made no suggestions. This is done with the belief that those individuals who did not have suggestions for productivity improvement will

make suggestions at a later date. Therefore, each participant in the plan shares in the same reward and gets the same percentage of that reward. This helps to foster teamwork and cooperation both within and between groups.

Academicians, managers, and consultants associated with gainsharing efforts have long held the belief that the equity established by the base pay system must be upheld (e.g. Frost, Wakely, and Ruh, 1974; Moore and Ross, 1983). This, of course, assumes that the base pay system is itself equitable. While each participant receives the same bonus percentage, the absolute dollar amount of the bonus is different for each participant in the plan. This is because the bonus percentage is multiplied by the base pay rate to arrive at the bonus amount. This encourages individuals to perform relative to their peers in such a way so as to increase their base pay.

Data requirements

Selecting a base period for gainsharing is a critical decision since it establishes the period against which the current period will be compared. Therefore, the base period should be as representative of normal business conditions as possible. The selection of a base period depends on (adapted from Sumanth, 1984):

- whether the quality of outputs has changed;
- the frequency with which outputs change (i.e. product/service mix, design changes, new products/services);
- the demand pattern for output (seasonal, trend, horizontal, cyclical, unpredictable);
- shifts among input resources;
- the price of outputs;

- data availability;
- whether the quality of inputs has changed;
- new inputs (e.g. material substitutions, new equipment, hiring); and,
- changes in cost drivers and factor dominance.

Standards, estimates, historical data, and/or goals can be used in establishing the base period. Some combination of these data sources is probably the best approach; the reason being that data will be available for some inputs and outputs and not others, and some changes in inputs and outputs are certain to happen (e.g. new product design).

There is a strong case for using a recent period as the base for several reasons. First, from a pragmatic business standpoint, the purpose of gainsharing is to promote and sustain motivated performance levels on the part of everyone to improve business operations, competitive position, and enhance accomplishment of longer-term goals of survival, profitability, missions, and so forth. Second, adjustments made for new products, changes in quality, the character of old products/services, and shifts in the quality and kinds of inputs are reduced. In addition the least difficulty is likely to be encountered in assembling the necessary data.

Management Philosophy, Theory and Assumptions

Managers operate and are guided by a set of assumptions about the systems they manage (McGregor, 1960). High quality management processes require both management philosophy and management tools and techniques to operationalize that philosophy. However, the management tools and techniques used should not be confused with the management philosophy they operationalize (Taylor, 1911).

Evidence of gainsharing being defined and treated as both a philosophy of management and a management tool is pervasive throughout the literature on gainsharing (see for example, Doyle, 1983; Frost, Wakely, and Ruh, 1974; O'Dell, 1981; Thor, 1987); a statement like "the Scanlon Plan is an abstraction" (Frost, Wakely, and Ruh, 1974) is just one example. Gainsharing is just one of many available tools and techniques which could be used alone or in combination to operationalize a philosophy of basing rewards on performance, recognizing that people are the organization's most important resource, and people are responsible for all performance improvement.

Management Style and Process

Some form of participative management practice has been identified as a key determinant of gainsharing success (Lawler, 1981; White, 1979). In fact, most organizations that implement gainsharing have some form of participative management practice involved in the effort (O'Dell, 1987). While some form of participation is needed to build a foundation for the effort, do not assume that a particular form of participation (e.g. suggestion systems, quality circles) is part of the gainsharing "package."

Advantages and Potential Problems

There is no one best way with respect to gainsharing. A particular gainsharing approach will work better in one environment than another. The next section presents a list of questions useful for developing a formal decision tree approach to aid managers in selecting a gainsharing approach.

3.3 TOWARDS A DECISION TREE FOR GAINSHARING APPROACHES

To date, there has been no formal decision tree approach developed for selecting a gainsharing approach. This does not mean to imply no work has been done in this area: Moore and Ross (1983) compared and contrasted the Scanlon, Rucker, and Improshare plans along a number of dimensions. Ross and Ross (1984) classified characteristics of gainsharing approaches as control oriented vs. reward oriented (this classification was oriented towards management philosophy about gainsharing); Hauck (1983) grouped approaches as rewarding "financial productivity" or "physical productivity"; and, a limited, multi-attribute decision technique was proposed and tested by Hauck (1987) to assist a group of managers in identifying the desired characteristics of a gainsharing approach (administrative ease, fairness, flexibility, soundness, understanding, usefulness) for their organization. Full development of a formal decision tree is beyond the scope of this research. However, a first cut at a list of questions has been taken to spark dialogue among academicians and practitioners in the field; integration of these questions with the work of Moore and Ross, Ross and Ross, and Hauck may take us one step closer to developing a decision tree for selection of a gainsharing technique.

1. Is there a common organizational pursuit - process, project, program, problem, and perplexity - for the unit of analysis being considered for gainsharing? These five classifications can be used to describe the major, broad effort or pursuit that characterize the unit of analysis (see Kurstedt,

1985, for an in-depth discussion of these pursuits). Note we are not classifying the entire unit of analysis as a process, project, program, problem, or perplexity; instead, one of these classifications typically dominates the unit of analysis and that predominance should influence gainsharing design, development, implementation, and maintenance. For example, Nabisco, Hershey Foods, and Ore-Ida are typically classified as food processing companies. This does not mean that Nabisco, Hershey Foods, and Ore-Ida are not faced with projects, programs, problems, and perplexities at all levels of their organization. It does mean that individuals within those organizations should see their roles as performing and supporting a process.

A process routinely and repeatedly achieves the same known end through well defined intermediate steps from start to finish. Examples of organizations involved in process pursuits are a soft drink bottling plant, a chemical plant, or a government student loan payment processing office.

A project has a definite starting point and full, quantitative specifications for the end. A program has a definite starting point but only a qualitative fix on the end. Examples of project and/or program oriented organizations are a research and development firm, an aerospace and defense contractor, a consulting firm, and a construction firm.

A problem has a definite starting point but a completely unspecifiable end. Examples of organizations that deal with problems are automotive repair facilities, maintenance organizations, or police, fire, and rescue departments.

A perplexity is something for which the start and the end cannot be specified. An example of an organization that deals with perplexities is a federal emergency management organization.

These five pursuits differ in their level of uncertainty; degree of goal specificity; degree of knowledge concerning cause-and-effect relationships; and, whether certain organizational factors such as resource consumption, price of input resources, quality of input resources, quantity of outputs, price of outputs, quality of outputs, product/service mix, design changes, planning horizon, and profits/budgets are constraints, contingencies, controllables, fixed, or varying. Regardless of the pursuit, you need management tools appropriate for that pursuit (Kurstedt, 1985; also see Thompson, 1964). Gainsharing is no exception to this; certain gainsharing approaches are more appropriate for certain types of pursuits.

2. Which of the seven criteria (effectiveness, efficiency, quality, productivity, innovation, quality of work life, and profitability/budgetability) are critical dimensions of performance? (See Sink, 1985, for a discussion on and operational definitions of the seven performance criteria). The type of organization influences which of the seven criteria are critical dimensions of performance: private sector, public sector, manufacturing, service, large, small, vertically integrated, highly differentiated. For example, in process organizations, efficiency, quality, and productivitity are important criteria; in project and program related organizations, such as research and development firms, efficiency, productivity, and profitability are relatively less important than effectiveness, quality, and innovation. The point is that management must think through the relative importance of each criteria to the systems they manage. The gainsharing effort then needs to reflect this prioritization.

3. What input factors dominate? In what areas are the unit of analysis cost drivers? Factor dominance and cost drivers are key variables to be

considered with any gainsharing approach. The influence of factor dominance on productivity relationships can have important implications for the use of a particular gainsharing approach (see Gold, 1979 for a discussion on the influence of factor dominance on productivity relationships). Changes in partial factor productivity may be the result of active or passive interventions. That is, an active change results from an intervention aimed at the specific input; a passive change occurs when this intervention affects other factors. The point is that certain gainsharing approaches may be inappropriate for an organization depending on which factors are dominant.

Cost drivers, like factor dominance, also influence the appropriateness of a gainsharing approach. Maximizing productivity gains begins with the matching of improvement efforts to cost drivers (Dhir, 1986). The gainsharing approach that addresses an organization's cost drivers offers the best potential for realizing productivity gains.

4. What data is available? The data base issue is a crucial one in the design of a gainsharing system.since all gainsharing is measurement based. There is no one universal data base common to all organizations; for example, organizations cost accounting databases differ in the type of data captured (Kaplan, 1983, 1986).

5. How "measurement and business-wise" are people within the unit of analysis being considered for gainsharing? What type of macro level measurements are they used to seeing (e.g. financial, physical, mixed)? The gainsharing measurement must be understood for gainsharing to be effective (Frost, Wakely, and Ruh, 1974). Various gainsharing approaches differ in their level of complexity which, in turn, affects understanding (Ross and

Moore, 1983).

6. What are markets for products and services like? Are there trends, seasonal patterns, cycles, no clear pattern? Is there a single market or are markets highly differentiated? Gainsharing approaches differ in their flexibility to adapt to changing market conditions (Moore and Ross, 1983).

This list of questions, while by no means exhaustive, provides a useful scheme for classifying and evaluating various gainsharing approaches. For example, Improshare would be most appropriate in process dominated industries where efficiency, productivity, and profitability are critical dimensions of performance, labor is a major cost driver, people are familiar with standards and standard setting, standards are up-to-date, and demand is fairly constant. Likewise, a Shred-Cost plan based on materials would be appropriate for a similar process environment, but where materials are dominant and a major cost driver and inventory accounting is well developed and communicated. The multi-cost Scanlon would be most applicable in process, project, and program related organizations where efficiency, quality, and productivity are key dimensions of performance; labor, material, and energy are major cost drivers; and people are used to seeing financial measures of performance.

In addition, a decision tree approach can be useful in specifying the design characteristics of a gainsharing approach that would be appropriate for a particular organization. For example, in a public-sector, white-collar, project oriented organization where effectiveness, quality, and budgetability are critical dimensions of performance and labor and material are major cost drivers, a multi-criteria, multi-attribute approach to gainsharing would be

most appropriate. The measures developed should focus on effective, quality delivery of service, and labor and material cost issues. The decision tree could also help provide a quality audit of the gainsharing measure design process.

3.4 HOW TO PLAN FOR, DESIGN, IMPLEMENT, AND MAINTAIN A GAINSHARING EFFORT

Several methodologies for gainsharing design and development have been documented in the literature (see Doyle, 1983; Moore and Ross, 1978; O'Dell, 1981; Schuster, 1987). There are two major shortcomings of these methodologies. First, they do not address the integration of and interfaces between business planning, performance improvement planning, human resource planning, reward system planning, and gainsharing system planning, nor provide a planning process. Poor planning is often a source of gainsharing failure (Thor, 1987). Second, the specific tools and techniques needed to execute each step have not been communicated. An eight-step methodology is proposed here that considers the interrelationship between various types of planning and identifies specific tools and techniques. The steps are based on the performance improvement planning process described by Sink (1983, 1985a, 1985b, 1987) and Sink, Tuttle, and Dhir (1988):

1. Organizational Systems Analysis
2. Planning Assumptions
3. Strategic Objectives
4. Action Items
5. Action Teams

6. Project Management
7. Measure, Assess, and Evaluate
8. Manage Effective Implementation

Recycle and constantly improve process

Figure 3-2 depicts these steps in process flow fashion. Groups that should be represented on the design team and involved where appropriate are (Doyle, 1983):

Top management	Other key staff areas (dependent on organization type)
Operations management	Professional and technical employees
Labor union officials	Office administration and clerical employees
Finance/accounting staff	Production or operations employees
Human Resource staff	
First line supervision	

3.4.1 Step 1 - Organizational Systems Analysis

Step 1 of the methodology, Organizational Systems Analysis (OSA), involves examining a number of critical issues relative to gainsharing and the gainsharing effort (see Sink, Tuttle, and Dhir, 1988; VPC, 1986, for a complete description of OSA). As such, this step represents the interface to the performance improvement and business plan. In OSA, the team takes a critical look at many of the issues, systems, and components that should, could, and will affect the gainsharing effort

- Guiding principles. What are the principles (implicit or explicit) that appear to be guiding our reward system strategies, tactics, and practices? What should be the principles on which our reward systems are based? Are there inconsistencies and/or conflicts between the as-is and should be principles?
- Review of Business and Performance Improvement Plans. Do our current reward systems support our plans? How will changes in our

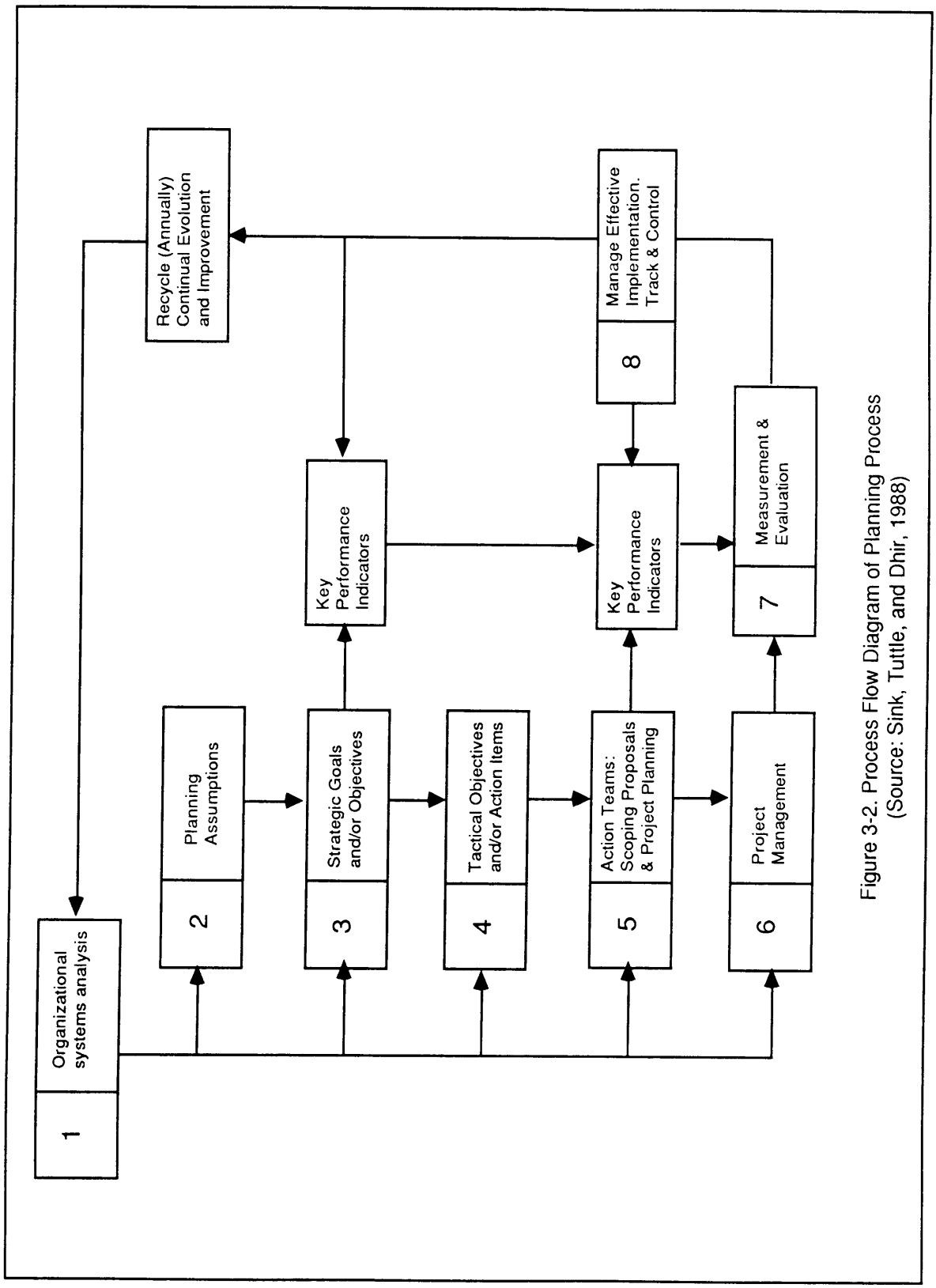


Figure 3-2. Process Flow Diagram of Planning Process
(Source: Sink, Tuttle, and Dhir, 1988)

reward systems support strategic thrusts and performance improvement interventions so that we will grow, survive, and compete in the long-term? Does gainsharing appear to support our long-range goals and objectives?

- Internal and external strategic audit. What is happening inside the organization that could/will affect reward systems? What is happening outside the organization that could/will affect reward systems and the gainsharing effort?
- Roadblocks to reward system improvement. What are the factors, variables, conditions, etc. that inhibit reward system improvement? What are the factors, variables, conditions, etc. that would inhibit an effective gainsharing effort (e.g. individual suggestion systems; piece-rate incentive systems, etc.)?
- Current performance levels. Are we performing at competitive levels? Do our reward systems promote the level of performance needed to grow, survive, and compete? Have we operationally defined what performance means for the organization?
- Systems employed. Are we employing "non-traditional" reward systems just for the sake of having "the latest and greatest?" Do we evaluate the appropriateness of our reward systems? Do we audit the quality and effectiveness of our reward systems? Is there a process by which we evaluate needed skills, talents, abilities? Is our base pay system appropriate and equitable? In what order do we promote individual performance, group, and firm level performance?

- Review Input/Output Analysis (see Section 3.5.4 for a description of Input/Output Analysis).

Out of this process will come data that will provide the foundation for the next step in the process. OSA should be facilitated by a competent facilitator in a retreat like setting using a structured group process. Forms can be designed to assist this. In addition, there are several excellent audits and checklists available to assist the management team with OSA as it relates to gainsharing (see Doyle, 1983; Moore and Ross, 1978; Schuster, 1987). Individuals involved in this step should be:

Top management
Operations management
Labor union officials
Finance/accounting staff
Human Resource staff
Other key staff areas (e.g. quality and productivity manager, industrial engineering)

3.4.2 Step 2 - Planning Assumptions

Step 2 involves the development and analysis of assumptions on which gainsharing system will be based. The same individuals involved in Step 1 should perform Step 2. Each member of the team is asked to silently generate assumptions and a round-robin process is employed to solicit and post the assumptions. After all assumptions have been posted, each individual is asked to perform an analysis of each assumption on an importance-certainty grid (Figure 3-3). Each assumption is placed in a cell representing the degree to which the individual feels the assumption is valid and/or certain. These assumptions then influence the development of strategic objectives for the gainsharing effort by creating awareness of the group's consensus relative to each assumption's importance and validity.

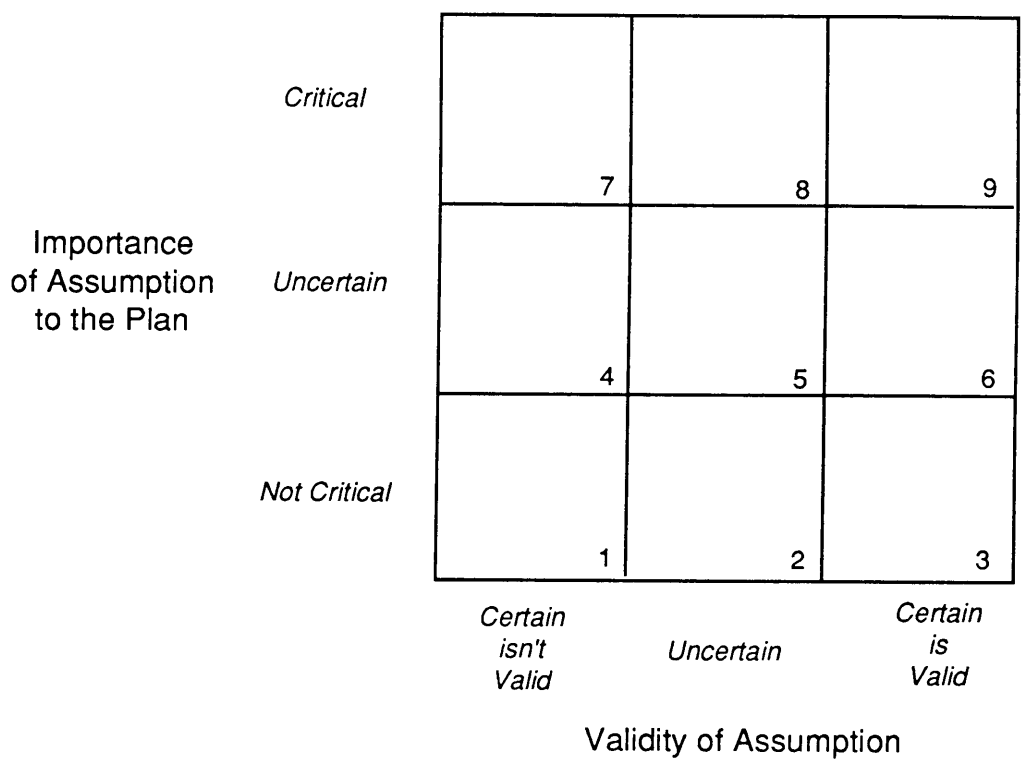


Figure 3-3. Importance-Certainty Grid
(Source: Sink, 1986/1987)

3.4.3 Step 3 - Strategic Objectives

OSA and planning assumptions logically lead to Step 3 in which the management team develops a consensus, prioritized list of 3-5 year objectives for the gainsharing effort. The Nominal Group Technique (NGT) is used with groups of 12-20 people in a two to three hour session to develop these goals (for a description and tutorial on the NGT see Delbeq, Van De Ven, Gustafson, 1975; Fox, 1987; Morris, 1979; Sink, 1983). Data from steps 1 and 2 are used as background. A critical mass of key decision makers should be involved in this step to ensure that the resulting plan incorporates as many views and issues as possible; this may involve bringing in individuals from areas not involved in steps 1 and 2 to supplement the design team.

The resulting set of objectives should be audited against mission statements, superordinate goals, upline plans, values and beliefs, and guiding principles to ensure consistency. The resulting plan will need to be integrated with the business plan, performance improvement plan, and the human resource plan (sse Mills and Balbaky, 1985, for a discussion on human resource planning and its components).

3.4.4 Step 4 - Action Items

Step 4 involves identifying specific actions that need to be implemented or started in the next year to move towards achieving strategic objectives. The same individuals involved in step 3 should complete step 4. The task to be addressed in this step is direct and pragmatic: what must we do in the next year to begin to move toward our strategic objectives? The NGT is useful for this step. The output of step 4 is a prioritized, consensus list of specific projects for which resources should be devoted during the next year to improve the quality

of the gainsharing effort. Teams of 3-5 people develop scoping proposals for these improvement projects in the next step.

Step 4 looks different if designing a gainsharing system for the first time than if revisiting an existing effort to maintain and improve upon it. In the initial design and development of a gainsharing effort, several action items must be done:

1. Determine gainsharing measure or measures;
2. Select a base period;
3. Determine a measurement scope;
4. Identify data needs and database requirements;
5. Select measurement tools and techniques;
6. Collect data and track over time;
7. Determine the bonus calculation and sharing ratio;
8. Design visibility system; and,
9. Address integration with existing management systems.

The design team may want to add to, or modify, this list based on the specifics of their organization; however, these areas must be addressed in the initial design and development of an effective gainsharing effort. When revisiting an existing design, the design team may wish to audit each of these areas to ensure the gainsharing effort is in-line with what the organization is trying to accomplish and devote time and resources to those areas where improvement or change is needed. Figure 3-4 depicts a typical Gantt chart for initial design and development. Following is a brief discussion on each area.

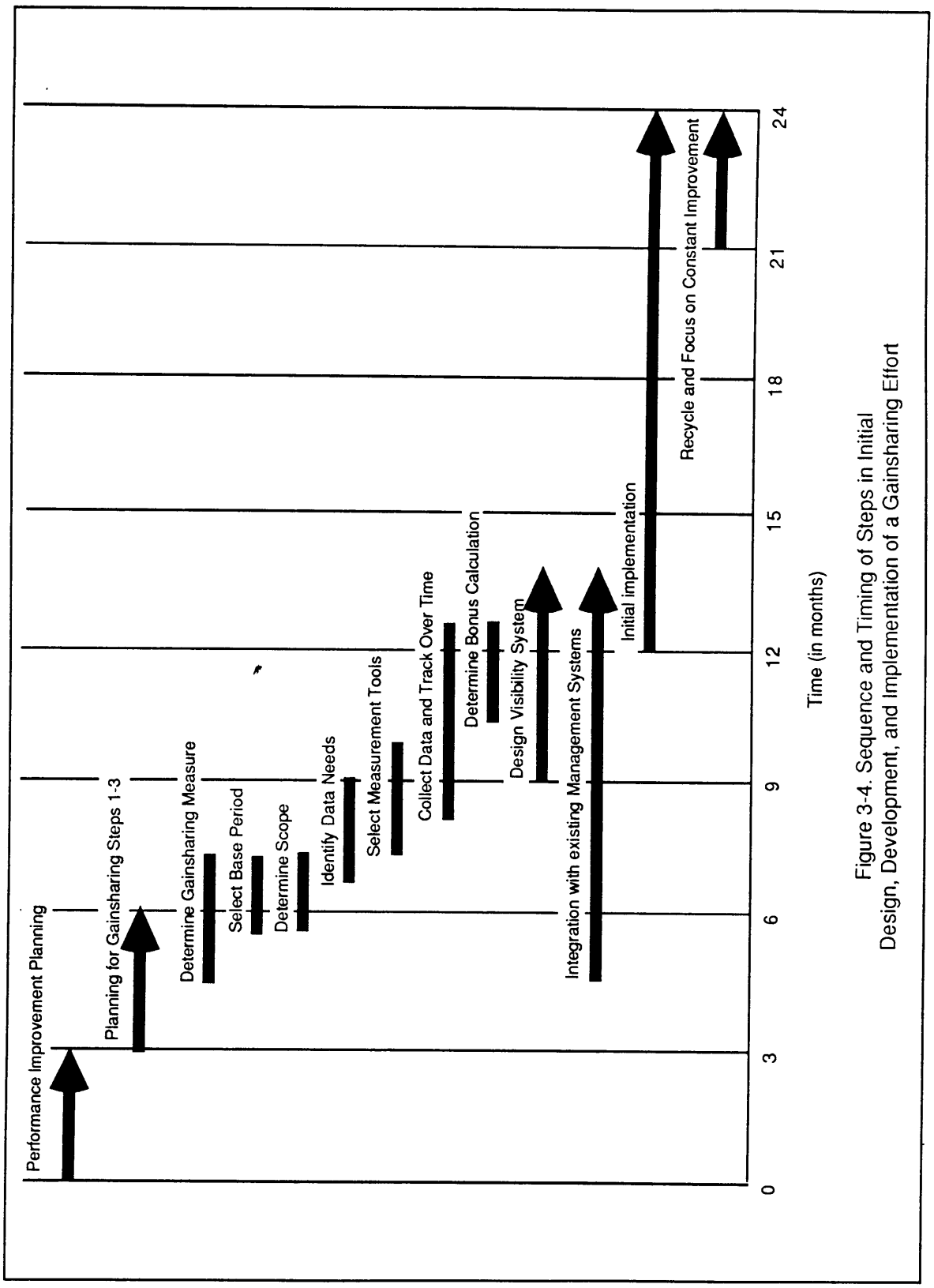


Figure 3-4. Sequence and Timing of Steps in Initial Design, Development, and Implementation of a Gainsharing Effort

Determine Gainsharing Measure or Measures

Most problems with gainsharing originate from: a poor definition of the unit of analysis; a problem with defining inputs and outputs; and how to measure (Ross and Ross, 1984; Ringham, 1984; Thor, 1987). A technique that can address these issues is Input/Output Analysis (IOA) (a component of OSA); in fact, the first step in measurement system design is IOA (Sink, 1985a). IOA, if done properly, can set the stage for improving existing measurement and gainsharing systems, can improve internal communication and coordination, can set the stage for more effective performance improvement, and can improve customer orientation and sensitivity (Sink and Rossler, 1987). In short, IOA focuses on having the management team develop a better understanding of the system they are managing. IOA should have been done for the organization as part of its business and performance improvement planning process; in OSA, the design team needs to revisit that IOA chart and familiarize themselves with it, modify it if need be, and use it to design the gainsharing measure.

There are four sub-steps in IOA. The *first sub-step* seeks to get the team to define the system for which gainsharing is being proposed:

- Downstream systems (i.e., customers, internal or external) are listed. Customers are discussed in very specific terms. Who are they? What do they want, expect, need, demand from us? How can we serve them better? Where are our obvious problems at this interface?
- Upstream systems (i.e., customers, suppliers, vendors, personnel, procurement) are listed. Specific, major upstream systems are discussed, again, in very specific terms. Who are they? What do we

want, need, demand, expect from them? How can they serve us better? How can we better communicate our needs to them? Do we cross that boundary enough and manage interactions? Do we strive to develop quality, long term relationships with these systems?

- Mission, purpose, values, beliefs, guiding principles, and behaviors are discussed next. The focus is on goal clarity and culture support system audit. Are we all clear as to where we're headed and does our culture support what we're trying to do?

Other issues can be addressed during this first substep of IOA; however, these points represent the major focus. Do not assume clarity and consensus relative to these issues exists!

The *second sub-step* forces the management team to identify and agree upon what the outputs of the system are. It is important in this step to distinguish between outcomes (desired, undesired, functional, dysfunctional) and outputs. The focus is on outputs. Boundary clarification is important at this stage. Again, lack of discipline as to what the unit of analysis is will cause problems relative to output definition. The key is to consistently separate outcomes and activities from outputs. Do not assume this step is obvious or simple!

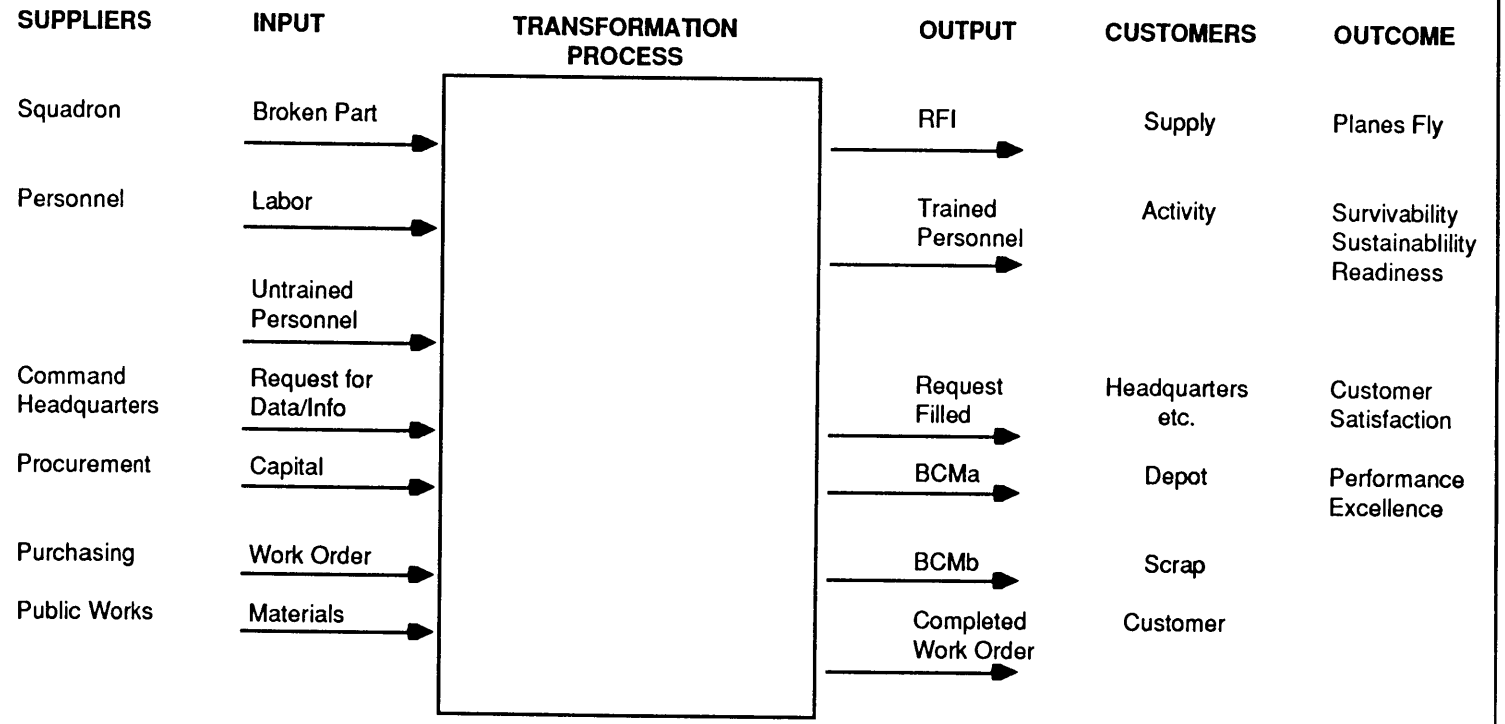
Sub-step three focuses the team on the task of identifying major activities or transformations that are made within the system to convert inputs into outputs. The secret to this sub-step is not to get micro, yet, on the other hand, not be too macro. We are attempting to do a system level (not task or job level) process flow analysis. The goal is to simply improve clarity within the whole team as to what goes on in the system. Do not assume this clarity exists.

Sub-step four has the team identify major inputs to the system. What are they? Who do they come from? How do we use them? A comprehensive list needs to be developed. Again, we can be too macro as well as too micro here. Labor, material, energy, capital, and data/information is too macro a list. On the other hand, paper clips, staples, pads of paper, etc. is too micro.

When these four substeps for IOA are completed and charted on an IOA chart, the management team has a collective better understanding of the system. An example of a completed Input/Output Analysis chart is shown in Figure 3-5.

The IOA chart in Figure 3-5 is for an aircraft, intermediate, level, maintenance department (an AIMD) on an aircraft carrier. When an F-14 gets back from a mission and has identified several failed components, these components are brought to an AIMD for repair. This scenario represents a major function of an AIMD; however, as you can see from Figure 3-5, this is not the complete picture of inputs and output. In order to measure and reward total performance we must have a complete picture of the system's inputs and outputs.

IOA, is a necessary but not an easy or particularly fun step, in gainsharing system design. It takes discipline and some leadership skill to get the team to complete this important first step. IOA, if properly done, can assist the design team with selection of the unit of analysis for gainsharing; identification of participants; and the design of a gainsharing measure or set of measures.



Key:

RFI = Ready For Issue
BCM = Beyond Capability of Maintenance

Figure 3-5. Example of a Partially Completed IOA Chart for an AIMD
(Source: Sink and Rossler, 1987)

Select a Base Period

Establishing the base period is a critical decision in gainsharing system design. The selection of a base period depends on:

- whether the quality of outputs has changed
- the frequency with which outputs change (i.e. product/service mix, design changes, new products/services)
- the demand pattern for output (seasonal, trend, horizontal, cyclical, unpredictable)
- shifts among input resources
- the price of outputs
- data availability
- whether the quality of inputs has changed
- new inputs (e.g. material substitutions, new equipment, hiring)

Standards, estimates, historical data, and/or goals can be used in establishing the base period. Some combination of these data sources is probably the best approach; the reason being that data will be available for some inputs and outputs and not others and some changes are certain to happen.

Regardless of the approach, a period near the present should be selected as the base (Davis, 1955). There is a strong case for a one, rather than two-three year base; adjustments made for new products, changes in quality, the character of old products/services, and shifts in the quality and kinds of inputs are reduced. In addition the least difficulty is likely to be encountered in assembling the necessary data.

Determine a Measurement Scope (i.e. frequency of payout)

The scope selected should be appropriate for business conditions and help to create clear line of sight. Typical scopes for gainsharing are weekly, monthly, and quarterly.

Identify Data Needs and Database Requirements

The primary question being answered and addressed here is: "What data do we require in order to drive the gainsharing calculation?" Where is the data located? How will we obtain/retrieve the data? What data required is not currently available and how will we obtain it?

This step focuses the design team's attention on data sources, data acquisition, data retrieval, data requirements, etc. The step forces the team to better understand the system from a measurement and data perspective. It forces an attention to detail with respect to measurement that is very positive.

Select Measurement Tools and Techniques

What measurement tools and techniques are, will be, can be, or should be used to collect data on performance, transform this data into information, and portray this information so that people have line of sight? Both conventional and newer gainsharing approaches can be researched here to determine if the measurement techniques used are applicable to your situation (i.e. is the measurement technique able to capture the needed data, massage this data, and portray the needed information?).

In addition, the design team must determine how the gainsharing measure and or set of measures integrates with and supports existing measurement systems. For example, are there measurement systems that measure A while the gainsharing system rewards B? Do traditional reports

present data conflicting with the gainsharing effort? How does the gainsharing measure complement existing measurement efforts and reports. What type of measurement systems are needed that would help support the gainsharing effort?

Collect Data and Track Over Time

The design team needs to collect data and track performance over time to ensure the measure (adapted from Moore and Ross, 1978):

1. Is a valid measure of performance over time;
2. Is reliable;
3. Is precise and accurate;
4. Is an accepted measure of performance;
5. Helps to create line of sight;
6. Is easy to administer;
7. Is flexible enough to meet changing internal and external conditions.

Data collected in this step can be used to refine the base period, develop systems for data collection, and gain expertise with the gainsharing measurement tool or technique being used.

Determine the Bonus Calculation and Sharing Ratio

This step focuses attention on development of a bonus calculation and sharing ratio. Data collected to date can be used to evaluate, assess, and analyze various bonus calculations and sharing ratios. Audits and workshops can be held with a cross-section of participants to elicit feedback and improve the quality of the bonus calculation.

Design Visibility System

Participants should be exposed to the measure(s) for a three to six

month period (at a minimum); this would allow people to gain a better understanding of the gainsharing measure(s); learn cause-and-effect relationships, and develop preferences for how they would like the data portrayed. Audits can be conducted to evaluate, assess, and analyze participant's understanding of and use of the gainsharing measure (see Doyle, 1983; Moore and Ross, 1978). Workshops can be held to educate participants and elicit feedback to improve the quality of information being provided by the measure. Integration with existing visibility systems should also take place.

Address integration with existing management systems

This step involves formulating answers to several key questions/issues:

1. Why the organization is being asked to approve and support a gainsharing effort;
   - Visions of organization of the future
   - Values and beliefs
   - Guiding principles
   - Mission, goals, and objectives.
   - Competitive challenge
2. Management commitment to performance improvement and gainsharing through involvement;
3. Integration with existing participative management practices;
4. Integration with existing reward systems;
5. Other issues such as:
   - how the gainsharing effort was designed and developed;
   - how it will be monitored and evaluated;

- how it will be refined and changed;
- when, where, and how information about the effort will be provided; and,
- where to go for further information

3.4.5 Step 5 - Action Teams

Step 5 is the link between planning, action planning, and effective implementation. Volunteer teams of 3-5 people develop scoping proposals for each priority action item identified in step 4. These teams should be the individuals involved in steps 1-4 and supplemented by staff, other managers, and employees. These teams are given approximately one month to develop a scoping proposal for their respective action item. A scoping proposal addresses: what has to be done; who has to be involved; when things should be done; how the project should be implemented; associated costs and benefits; related activities that must be coordinated and integrated with; and measures of success. Once a "green light" is given to a scoping proposal, an implementation team is formed. The implementation team continues development of the project and manages implementation.

3.4.6 Step 6 - Project Management and Step 7 - Measure, Assess, and Analyze Performance

Steps 6 and 7 of the process involve project management of the various action items and measuring, evaluating, and assessing the quality and innovation of design, effectiveness of implementation, and associated costs and benefits. Implementation teams are responsible and held accountable for tracking implementation progress. Ultimately, steps 6 and 7 are most critical in that they ensure effective implementation and feedback.

3.4.7 Step 8 - Manage Effective Implementation

Step 8 involves managing both the various action teams and the gainsharing effort in a systematic, well-thought-through, and coordinated manner. Typically, for a first time implementation or new design, a vote is taken among plan participants to determine whether support exists for the gainsharing effort. This vote represents the "green light" for the implementation plan. If this vote is favorable (80-90 percent favor adoption), a one year trial implementation begins. The implementation team continues development of the gainsharing effort and manages implementation.

3.4.8 Recycle process and focus on constant improvement

Gainsharing must be viewed as a dynamic, evolving component of the organization's management process. The systems we manage are dynamic and changing over time. As such, reward system design and development is a continuous and evolving process. As such, this eight-step methodology must be recycled annually to ensure congruence between the gainsharing effort and the system being managed.

3.5 TECHNIQUES ALONE ARE NOT ENOUGH

> "If experience alone were enough, no one could compete with U.S. industry; after all, we have more experience than the rest of the world combined. What we lack is profound knowledge: theory plus experience. Competitive advantage is found in profound knowledge." (Deming, 1986, 1987).

What I have tried to do in this chapter and the previous chapter was get you thinking about gainsharing at two different levels: the philosophical level and the operational level. I presented a more philosophical treatment of gainsharing and compensation management and their roles in the

performance management process (Chapter 2 and the early part of Chapter 3) ahead of a more techniques oriented treatment of gainsharing to put techniques in perspective and challenge you to become more patient and disciplined in your application of tools and techniques like gainsharing. We often start at the technique level in the design and engineering of our management systems and never step back and examine the theory, philosophies, and assumptions behind those techniques; in fact, U.S. managers' impatience with theory is a major roadblock to becoming competitive in a global economy (Deming, 1986). The results are "islands of improvement," pushing out on one strategic thrust at the expense of others, and management systems and processes that are less effective than they could or should be. Gainsharing is no exception. Implemented in the absence of a clear and comprehensive understanding of the theory behind the performance management process and the role of reward systems in that process, gainsharing will more than likely fail. The next chapter looks at the use of the TFPMM for gainsharing.

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4.0 BUILDING GAINSHARING SYSTEMS USING THE TFPMM

HIGHLIGHTS

Xaloy, Inc.: Applying the TFPMM in Manufacturing

- The Scanlon Plan at Xaloy
- The TFPMM at Xaloy
- Scanlon Plan Calculations and the TFPMM: A Comparison
- Using the TFPMM to Drive Gainsharing at Xaloy

Virginia Productivity Center: Designing a Gainsharing System Based on the TFPMM

- VPC Management Practices
- The TFPMM at the VPC
- Using the TFPMM to Drive Total Gainsharing System Design

Lessons Learned

- A Methodology for Implementing the TFPMM
- A Problem with How Outputs and Inputs are Aggregated
- Summary Observations and Comments

OBJECTIVES

To communicate how two organizations, one manufacturing, one white collar, designed and implemented a TFPMM application.

To compare and contrast a manufacturing organization's Scanlon Plan calculation with the TFPMM.

To discuss how the TFPMM could be used, in one manufacturing organization, to support an existing Scanlon Plan.

To communicate how a white collar organization plans to use the TFPMM to drive gainsharing.

To present and discuss a methodology for TFPMM implementation.

To assist managers and practitioners with the development of measurement and reward systems.

How can an organization use the TFPMM to drive gainsharing? To answer this question, two case studies are presented and discussed. These two case studies are not about organizations that have implemented TFPMM based gainsharing; rather, the case studies document how these organizations worked to implement the TFPMM and how it could be used to drive gainsharing. Xaloy, Inc. is the subject of the first case study. Xaloy is a manufacturing firm (to be described in more detail later) that is nine months into a TFPMM implementation. The company is also in its fifteenth month of a Scanlon Plan implementation. The case study describes Xaloy's Scanlon Plan effort and its experience with the TFPMM. Example TFPMM output is then compared with a Scanlon Plan calculation. Last, the implications of this comparison for Xaloy and its gainsharing effort are discussed.

The second case study involves a TFPMM application in a white collar organization, the Virginia Productivity Center (VPC) (also to be described in more detail later). Like Xaloy, the VPC is also nine months into a TFPMM application. The case study documents the VPC's experience with the TFPMM to date and how the VPC plans to use the TFPMM to drive its gainsharing effort. Lessons learned from these two cases are presented at the end of the chapter.

4.1 XALOY, INC.: APPYING THE TFPMM IN MANUFACTURING

4.1.1 Company Description

Xaloy is the world's largest manufacturer of bimetallic cylinders. A bimetallic cylinder is used in injection molding or extrusion machinery; the cylinder combines with a screw or auger to plasticate resin. The cylinder is composed of two parts: a low carbon backing material and a special wear or corrosion resistant alloy which has been centrifugally cast.

Xaloy has a 102,000 square foot facility located in Pulaski, Virginia; 96,000 square feet is devoted to manufacturing. The manufacturing facility can be described as a machine shop with a small foundry (centrifugal casting operation) tacked onto it. Machinery and equipment includes saws, deephole boring, mills, and lathes. The company employs 179 people, 130 of whom work in the manufacture of product.

Xaloy's emphasis on performance improvement dates back to 1983 with the implementation of a strategic planning process. An analysis of the company's strengths and weaknesses was performed and objectives, much along the lines of Drucker's (1980) seven key result areas, were developed. The strategic analysis revealed that Xaloy was strong in marketing but weak in operations, especially in working capital management. A comparison of Xaloy's inventory management showed it ranked in the bottom 25 percent against companies in similar industries. The company began practicing basic elements of "Just-in-Time" manufacturing: shorter queues, improved material handling, and reduced set-up times (see Waters, 1985, for a description of

Xaloy's JIT effort). Within one year, inventory turns moved from two per year to just short of eight; Xaloy's inventory turns went from the bottom 25 percent in the industry to the top 25 percent.

After the initial success of JIT, a backward drift was beginning. JIT in and of itself did not provide a focal point or spearhead for continuous productivity improvement. Management came to believe that some method or process was necessary to promote and sustain a continuous improvement orientation. A Scanlon Plan was adopted. The next section, based on Xaloy's booklet entitled "Pro Plan: People Recognizing Opportunities," describes the major components of Xaloy's Scanlon Plan.

4.1.2 The Scanlon Plan at Xaloy

The Scanlon Plan at Xaloy was implemented in July 1986. The purpose of the plan was to:

- Provide all employees with an opportunity and the responsibility for participation in decision-making;
- Focus the entire organization on making incremental improvements;
- Provide a process for implementation of these improvements; and,
- Ensure long-term growth, survival, and competitiveness.

Specific objectives of the plan were to:

- Solicit employee involvement and support in achieving company objectives;
- Equitably reward employees for productivity improvement;
- Improve product quality;
- Provide a formal system for identification of, solution to, and elimination of problems;
- Increase job security by allowing for increased flexibility and a reduction in fixed costs;
- Improve communication and cooperation;
- Allow employees to better understand the external realities in which Xaloy operates; and,
- Provide a system which allows employees to be accountable to each other.

Participative Management. Figure 4-1 depicts, in process flow fashion, Xaloy's participative component of their Scanlon Plan, a structured suggestion system. The suggestion system is facilitated by Area Committees, a Review Committee, and a Screening Committee. A gainsharing facilitator, appointed by the President, coordinates the activities of these committees. An Area Committee consists of three non-management employees elected by the area they represent and one supervisor appointed by the Department Manager; there are thirteen Area Committees at Xaloy, organized around functional and operational lines. All suggestions are submitted to the Area Committee. Employees are, however, encouraged to work with their supervisor to implement improvements without going through the formal review process. The Area Committee, upon approval of the Review Committee, is authorized to spend up to $500 to implement a suggestion. If the cost is over $500, or they or the department cannot agree as to whether to implement the suggestion, or they have rejected a suggestion, the suggestion is referred to the Screening Committee. A maximum amount of $1000 per period per committee is permitted.

The Review Committee consists of the chairperson from each of the thirteen area teams. The Review Committee's responsibilities are:

- Review all suggestions submitted by area teams;
- Assure that all duplicate suggestions or like suggestions are combined;
- Monitor implementation of suggestions;
- Assure that suggestions implemented are beneficial to overall company performance; and,
- Develop the agenda for the screening committee meeting.

The Screening Committee is made up of the Review Committee plus the President and the President's staff. The responsibilities of the Screening Committee include:

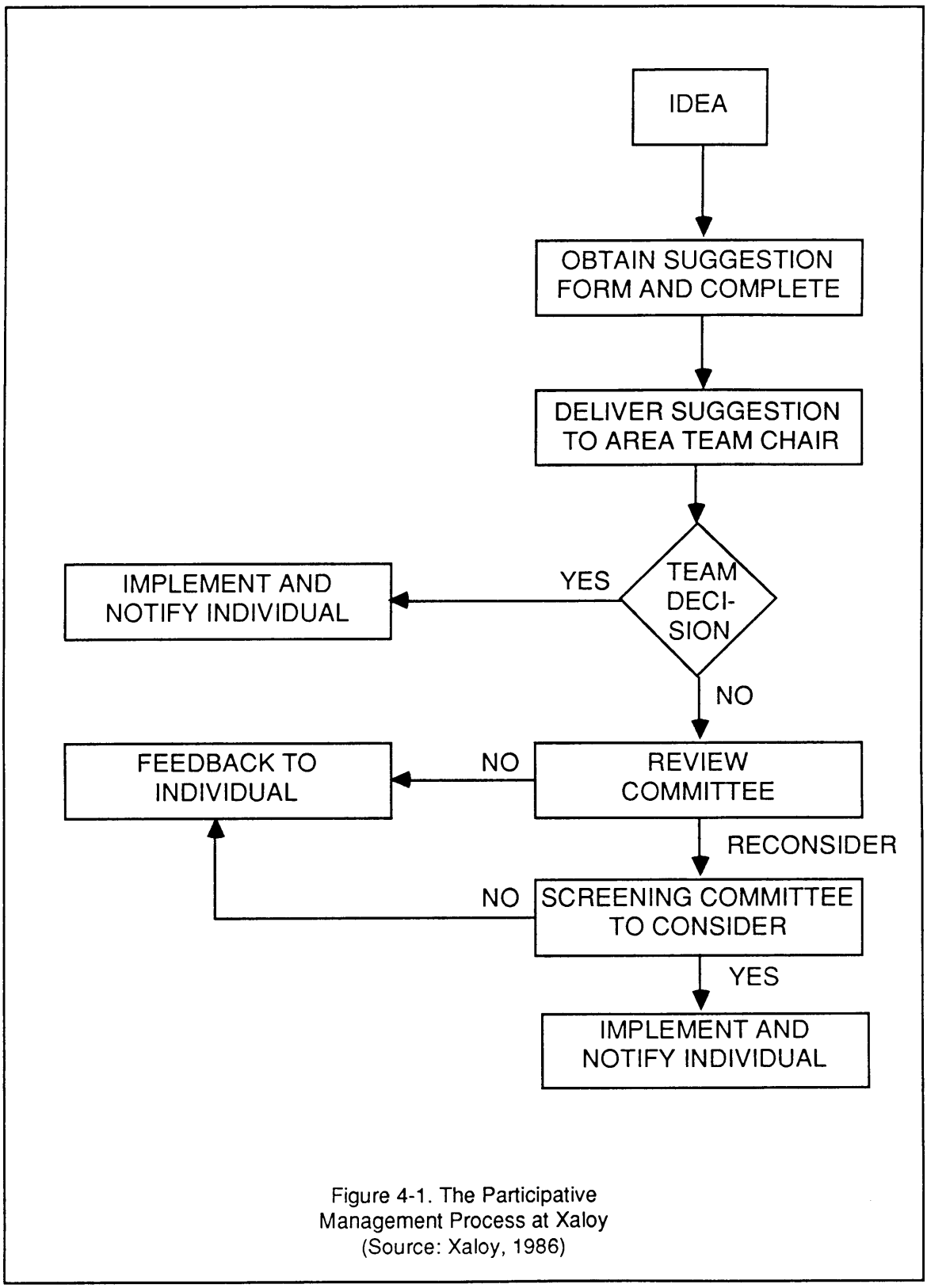


Figure 4-1. The Participative Management Process at Xaloy (Source: Xaloy, 1986)

- Assisting and monitoring area committee activities;
- Reviewing all suggestions;
- Sharing information and reviewing overall plan performance, including bonus results.

During the period from July 1986 to February 1987, employees made 177 suggestions which resulted in $170,508 in savings (Scott and Zatsick, 1987).

Bonus Calculation. The costs included in the bonus calculation are:

1. Direct material (cost of goods sold)
2. Direct labor salaries
3. Indirect and office salaries
4. Shift premium
5. Overtime premium
6. Holiday pay
7. Sick pay
8. Vacation pay
9. Repairs and maintenance expense - building and grounds
10. Repairs and maintenance expense - machinery and equipment
11. All operating and office supplies
12. Telephone
13. Manufacturing variance expense (scrap and rework)

Table 4-1 shows an example calculation.

The base period was established using the average of the most recent three year period: fiscal 1983, 1984, and 1985. The average of these thirteen cost categories for Xaloy's fiscal 1983, 1984, and 1985 accounting years was 61.23 percent of sales. The intent was that, over time, the base would be expanded to cover five years and that this five year time span would be a rolling average; that is, each current year's base would be the average of the five previous year's expenses, except for any year in which actual expenses, as a percentage of sales, exceeded the current five year average. In the event that the company would experience such a year, that year's results would be disallowed from the formula's computation. The reason for disallowing such a year from the base period calculation is a purpose of Xaloy's Scanlon Plan is to promote and sustain constant improvement (see page 137); a year in which

Table 4-1.Example Scanlon Plan
Calculations at Xaloy
(Source: Xaloy, 1986)

	Positive Period	Negative Period
Gross Sales	$1,521,770	$1,592,135
Less Returns & Credits	21,223	12,162
Net Sales Revenue	$1,500,547	$1,579,973
Direct Labor (Input)	188,764	193,696
Direct Material (COGS)	292,849	361,478
Ind. Labor by Indirects	33,194	35,947
Ind. Labor by Directs	22,317	24,587
Salaries, Supervision	63,353	61,376
Salaries, Technical	49,634	52,925
Salaries, Clerical	17,849	17,546
Overtime Premium	26,032	29,970
Holiday Pay	12,200	12,200
Vacation Pay	8,253	8,253
Sick Pay	4,928	1,090
Repairs & Maint. M&E	11,202	23,620
Repairs & Maint. B&G	485	395
Operating Supplies	123,829	149,078
Office Supplies	847	1,321
Telephone	6,280	9,748
Mfg. Var. (Writeoffs)	19,512	20,888
Total All Expenses	881,528	1,004,118
Base (61.23% of Sales)	918,785	967,417
Gain to Share	37,257	(36,701)
Company Share	12,163	
Employee Share (33.7%)	12,556	(12,368)
Reserve (25%)	3,139	0
Available for Distribution	9,417	0
Participating Payroll	413,897	425,527
Percent Bonus	2.28%	0.00%

productivity declined should not help set the new benchmark or standard of excellence.

One year into the Scanlon Plan effort, changes were made to this initial base period. It became clear to management that the fiscal 1983, 1984, and 1985 base period represented a market situation that no longer existed. In the mid-1980's, the U.S. Original Equipment Manufacturer (OEM) business was strong and profit margins, held high primarily through price recovery practices, reflected it. Today, Xaloy deals primarily in a processor market, where pricing is less competitive but production quantities are low.

To make the base more representative of new business conditions, the base was changed to include only the last three periods of fiscal 1986 and the first three periods of fiscal 1987 (a period represents a four-week time span). The average of the thirteen cost categories for the revised base period is 66.93 percent of sales. This new base period is, however, temporary; a task force has been named to derive a new gainsharing formula before the end of fiscal 1987. In period seven of fiscal 1987, seven months after beginning the Scanlon Plan, Xaloy experienced its first payout.

Sharing Formula. Any gain is divided equally between 1) participants (meaning all Xaloy employees, including temporary and part-time personnel, that have completed their 90 day probationary period) and 2) investors and customers. Equal is defined as placing both investors and customers and plan participants on an identical pre-tax footing. Since Xaloy is taxed on profit before an amount is distributed to investors and customers, the sharing formula was designed so that the company's after-tax share and the employee's pre-tax share were equal:

Let G_t = total gain for period t

Let B_x = Xaloy's share of G_t and x = Xaloy's percent of G_t

Let B_e = Employee's share of G_t and e = Employee's percent of Gt

so,

(1) $G_t x(1\text{-CTR}) = B_x$, where CTR = corporate tax rate and (2) $G_t e = B_e$

and

(3) $B_x = B_e$ and (4) $x + e = 1.0$

Based on Xaloy's corporate tax rate of 49.24 percent, the sharing formula is calculated as:

$G_t x(1- 0.4924) = G_t e$

$0.5076 G_t x = G_t e$

$0.5076x = e$

Substituting 0.5076x for e in equation (4) we get:

$x + 0.5076\ x = 1.0$

x = .663 or 66.3 percent (Xaloy's percent of gains)

therefore e = 33.7 percent (Employee's percent of gains)

For example, based on a gain of $33,450:

Xaloy's share =

($33,450 x 66.3% x (1-49.24%)) = $11,257.22

Employees' share =

($33,450 x 33.7%) = $11,272.65

The employee's share is then distributed as a percent of participating payroll.

Xaloy makes use of a reserve pool to help protect the company from large bonuses in "easy to earn" periods and taking a loss in bad periods. The reserve pool is equal to 25 percent of the accumulated bonus. If the reserve

has a negative balance, then 50 percent of the accumulated bonus will be put into the reserve until it has a positive balance. At the end of the year, all of the reserve balance, if positive, will be paid out as a lump-sum bonus; if the reserve balance is negative, Xaloy absorbs the loss and the reserve starts over.

Job Security. The Scanlon Plan at Xaloy places no constraints on management decisions concerning company policies and procedures such as base pay, promotion, staffing, scheduling, shutdowns, layoffs, selection of suppliers, and disciplinary procedures. Xaloy management is, however, committed to keeping any individual whose position is eliminated due to technology improvements or methods improvement; such an individual would be kept at their current rate of pay and re-trained. There is no commitment to the individual if their job is affected by economic factors, such as reduced order rates or a declining market. The next section looks at Xaloy's implementation of the TFPMM.

4.1.3 The TFPMM at Xaloy

Management considers its European and Japanese competitors, not its U.S. competitors, as the greatest threat to market share. They were aware of the productivity gains being achieved by the European and Japanese economies and set an objective to exceed the gains being made by these two economies. Management needed an appropriate measurement system to track progress towards this objective and target appropriate control and improvement interventions. Simply stated, without productivity measurement, Xaloy management could not manage productivity.

Xaloy uses traditional cost accounting data to measure trends in efficiencies against standard and labor utilization. Yields of acceptable

product are measured at the casting operation and machining operation. While these two measures are closely related to productivity, they are not productivity measures (output/input). Trends in efficiencies and labor utilization are input side issues; yields are an output side issue. In addition, total or multi-factor productivity cannot be managed by just looking at these measures. The TFPMM, then, was seen as a potential measurement tool to complement efficiency and yield measures.

4.1.3.1 Approach and Major Milestones. The complete project leading up to initial implementation was a fifteen week effort. Figure 4-2 depicts major milestones.

Initial Design Session The initial design session entailed bringing the Industrial Engineer (IE), given the task of getting the model up and running, "up to speed" on the what TFPMM does and taking a first cut at identifying inputs and outputs. This was accomplished in our initial meeting which lasted three hours. The first hour of the meeting was devoted to a tour of Xaloy's facilities. The second hour was devoted to educational intervention on the TFPMM (i.e. what the TFPMM does and how it works). At the end of this educational intervention, copies of two articles were given to the IE: "Productivity Measurement and Evaluation: What's Available?" (Sink, Tuttle, and DeVries, 1984) and "Tying Productivity Measurement to the Bottom Line" (van Loggerenberg and Cucchiaro, 1981-82). It was also recommended the IE buy a copy of *Productivity Management: Planning, Measurement and Evaluation, Control and Improvement* (Sink, 1985a); this book gives a thorough overview of productivity measurement and dedicates an entire chapter to the TFPMM.

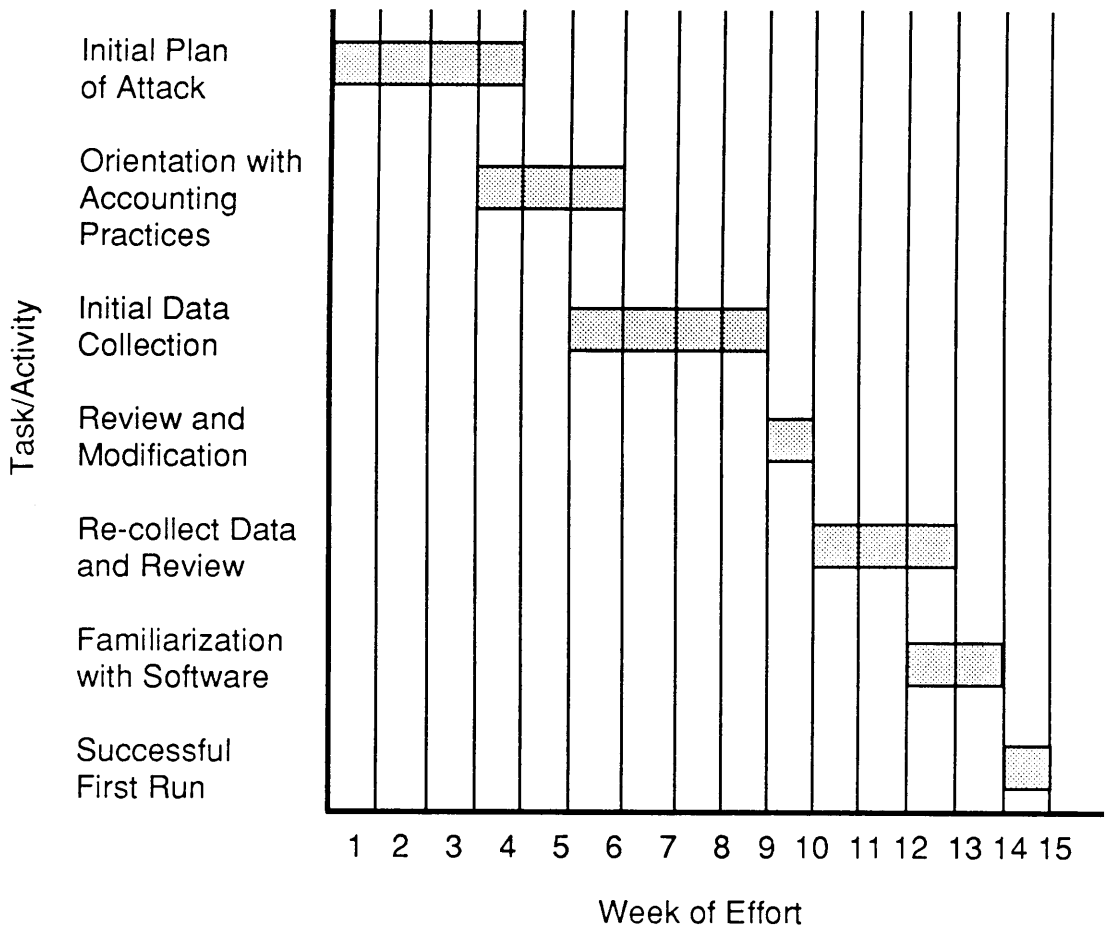


Figure 4-2. TFPMM Implementation at Xaloy: Major Milesones

The last hour of this initial meeting was spent performing a rough cut Input/Output Analysis (IOA) (see Sink, 1985a, for a description of this technique; also see Chapter 3, Section 3.5 - pages 118-121). Figure 4-3 depicts a partially completed IOA for Xaloy. With respect to outputs, there are single barrels and twin cylinders; these products are similar in end use, but entail very different manufacturing techniques, and are processed in different areas of the manufacturing facility. Inputs fall under the traditional classes of labor, material, capital, energy, and data/information. Initially, capital input was left out of Xaloy's application for several reasons (one of Xaloy's next steps is to include capital in the model - see Section 4.1.3.4). First, Xaloy management, early in the effort, was not aware capital could be included in the TFPMM and therefore, just wanted labor, material, and energy included in the model. Two possible reasons for this are 1) I never brought the subject of capital up in conversations with Xaloy management and 2) the model is referred to as the Multi-Factor Productivity Measurement Model in the literature Xaloy management read (see Sink, 1985a; Sink, Tuttle, and DeVries, 1984). For example, Sink (1985a) discusses the decision to leave capital out of his version of the model (as opposed to the American Productivity Center model - see APC, 1978); while Sink does not state that capital cannot be included, a manager unfamiliar with the model could get this impression. This does not mean to imply that Xaloy management was unaware of something called capital productivity. Xaloy employed some forms of capital productivity ratios: inventory turnover and return on investment. Second, capital productivity at the plant level is more complex to understand and measure than labor, material, or energy productivity (Thor, 1986); given the IE's non-

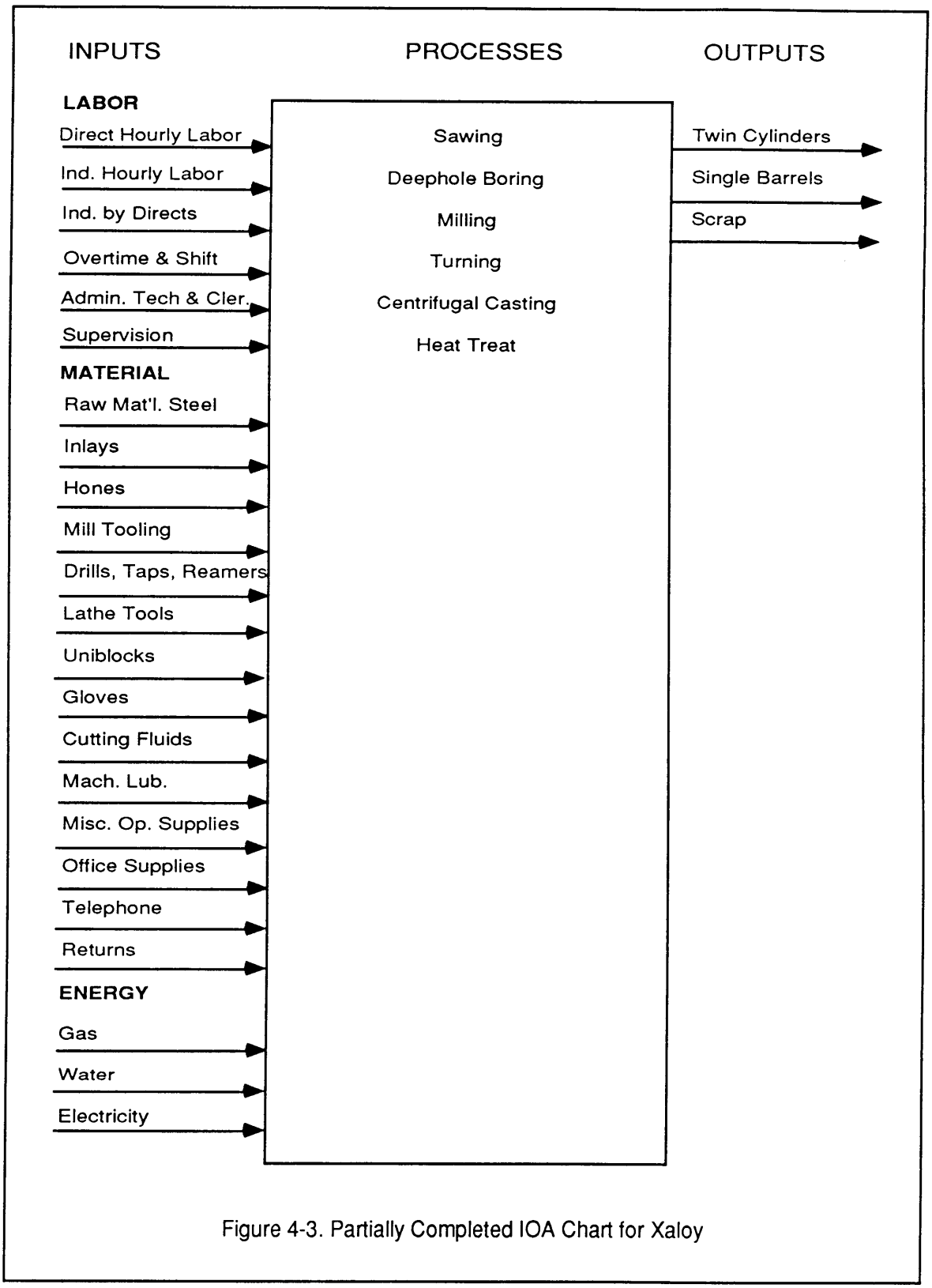


Figure 4-3. Partially Completed IOA Chart for Xaloy

accounting based background, I believed it best to tackle labor, material, and energy first and then, as the IE's experience with and understanding of the TFPMM increased, begin to address capital. In addition, management had made a decision to invest in new machinery and equipment to revamp parts of its manufacturing operations. This would have meant spending time collecting data for equipment that would soon be replaced. Therefore, Xaloy's initial application would more appropriately be called a multi-factor approach, MFA, within the TFPMM framework. At the end of this first meeting, the IE felt "what we were were trying to accomplish was clear."

Base Period Selection. Selecting the base period was the next step in preparing to implement the TFPMM at Xaloy. Because the bimetallic cylinder market does not exhibit consistent patterns, it was important to incorporate a base of at least one fiscal year to reflect a wide variety of market conditions. It was believed that going back further than one year would generate misleading results (a lesson learned from having to adjust the Scanlon Plan base period). In addition, complete quantity and price data were not available except the most recent fiscal year. To further encourage the use of a fiscal year, Xaloy had an objective for fiscal 1987 to improve productivity five percent over fiscal 1986. By choosing fiscal 1986 as a base, data would be readily available and the information needed to track progress towards this objective would be obtained.

In fiscal 1987, Xaloy's calendar consisted of thirteen four-week periods. This calendar was different from that of fiscal 1986, which had twelve periods of varying lengths. To overcome the differences between the base and current period lengths, it was decided that the data for all of fiscal 1986 be

collected, and then divided by thirteen to get a four week average. Individual periods of fiscal 1987 would then be compared against this average period.

Determining an appropriate measurement scope (frequency) was difficult due to the extensive leadtime required to manufacture bimetallic cylinders. The average leadtime on a single barrel is six weeks, with leadtime on a twin cylinder running as high as eighteen weeks. The overall average leadtime is eight weeks, so there is a problem with matching outputs to inputs within a four week period. However, problems with matching does not appear to affect management's use of operations reports which are run weekly and monthly. In addition, management wanted to run the model as frequently as possible to move down the learning curve with it. A rolling base period, then, to be updated every four week period, was decided upon. Under this format, period one in fiscal 1987 would be compared with the average period in fiscal 1986; at the end of period two in fiscal 1987, period two data would be added to period one data and then compared with two times the average period in fiscal 1986; this would continue for each period so that at the end of the fiscal year, fiscal 1987 would be compared to fiscal 1986.

The use of a rolling base period was a design decision Xaloy made to make the TFPMM work in their environment. Under this scheme, to compare one period to the next requires that you "back into" the information by subtracting last period's TFPMM results from the current period's. The cost accounting system at Xaloy is such that it cannot match inputs to outputs within a given time period; for example, work-in-process is not accounted for on the basis of percentage complete, due to the great diversity of finished products. However, perfect matching of inputs to outputs may not be needed.

The costs of obtaining the perfect measure of productivity may outweigh the benefits. From a pragmatic standpoint, the purpose of measurement is improvement.

Data Collection. The TFPMM is an accounting based productivity measurement model. Therefore, an understanding of accounting and company accounting practices is needed to successfully implement the TFPMM. The IE spent two days of training in the accounting department learning how Xaloy's accounting system worked, where to get the needed data, and how to read and interpret ledgers. All in all, a total of fifty hours were spent by the IE in the accounting department over a three week period. When this initial foundation was established, data collection began.

The objectives set by the President, Operations Manager, and Comptroller for data collection were:

- To account for 95 percent of Xaloy's operating costs; and,
- To obtain specificity to a point where data was comprehensive, but not unmanageable (i.e. too micro).

Labor and energy costs presented no problems with respect to these objectives, but materials (numerous sizes of bar 4140 steel, flame-cut 1020 specialty components, forgings, etc.) and operating supplies (various cutting tools, abrasives, etc.) did. Materials and operating supplies consisted of a wide variety of comparatively low-cost items that represent 28 percent of Xaloy's total costs; in addition, there are a number of these items that are not used from one year to the next. Xaloy has typically captured 86 percent of labor costs, 61 percent of direct material costs (cost of goods sold), and 14 percent of operating supply costs. When compared to the total input costs captured in the Scanlon Plan calculation, we have typically captured about 62 percent of these

in the TFPMM (Table 4-2). The total number of inputs to the model is 26. To capture remaining costs, Xaloy should use cost driver analysis to tell them what inputs to target their data collection efforts on.

The time spent collecting data was considerable, due in part to our not involving a member of the accounting staff on the design team. The initial data collection was predominantly trial and error, and was dependent on repeated interaction with accounting. Though data were readily available, there was a significant learning curve associated with this first collection; the IE's unfamiliarity with the accounting system caused this initial collection to take around thirty hours. After the initial collection was completed, the data were reviewed by the IE and accounting personnel, and problems were isolated (e.g. misreading ledgers, double counting). Very little of this original data were saved; most was either insufficient or erroneous. Over the next three weeks, the IE went through two more cycles of collecting and recollecting data before the data collected were considered valid.

Data were first collected for the base period, fiscal 1986. Data were collected for each of the twelve periods of the year, and it immediately became apparent that period one was an outlier. Period one had been six weeks long, and was a record month in shipments. It was later discovered there were a number of jobs held over from fiscal 1985, which rendered the period uncharacteristic of Xaloy's shipping norm. Because of this, only periods two through eleven (for a total of 48 weeks) were included in the base period.

When the data from fiscal 1986 were collected and the IE documented the ledgers needed for obtaining the data, data collection for the first three

Table 4-2. Comparison of Costs Captured in the Scanlon Plan Calculation and the TFPMM at XALOY

SCANLON PLAN Expense Category	Actual Cost*	TFPMM Expense Category	Actual Cost*	Percent of Actual Costs Captured in TFPMM
Direct Labor	146,166.96	Hourly Labor	168,422.76	
Ind. Labor by Indirects	26,086.08			
Ind. Labor by Directs	20,119.62			
Salaries, Supervision • Plant and Office	54,572.49	Supervision • Plant only	12,399.02	
Salaries, Technical	35,663.91	Administrative	97,642.26	
Salaries, Clerical	15,915.78	• Includes supervision office		
Holiday Pay	8,879.22	Holiday, Vacation, and		
Vacation Pay	11,939.01	Sick Pay included in		
Sick Pay	3,183.33	labor cost categories		
Total Labor	322,526.40	Total Labor	278,464.04	0.86
Overtime Premium	12,170.43	Overtime & Shift Prem.	12,399.02	1.02
Direct Mat'l (COGS)	219,569.73	RMS	75,633.63	
		Inlay	40,869.26	
		Energy	17,185.62	
		Total Direct Mat'l	133,688.51	0.61
Operating Supplies	98,015.94	Hones	13,606.84	0.14
Office Supplies	1,578.18	Not included	0.00	0.00
Repairs & Maint. M&E	12,718.53	Not included	0.00	0
Repairs & Maint. B&G	1,802.64	Not included	0.00	
Telephone	8,616.48	Not included	0.00	
Mfg. Var. (Writeoffs)	31,516.62	Not included	0.00	
Total All Expenses	**708,514.95**		**438,158.41**	

* Data has been scaled to ensure confidentiality

periods of fiscal 1987 was a simple operation. Within one week, data had been collected. Attention was then focused on running the TFPMM software.

Running the TFPMM Software I met with the IE for two-and-a-half hours, reviewing the data collected and teaching the IE how to use the Virginia Productivity Center's software version of the TFPMM, SCORBORD™. The software is programmed in basic and runs on an IBM-PC with a minimum of 64K, a color graphics card, and DOS 2.0 or higher. Poor editing capabilities in the software and poor instructions made this a particularly painful process. The VPC is in the process of coming out with a new version of SCORBORD, programmed in Pascal, that eliminates the problems found in the previous version and adds many new features such as a Lotus 1-2-3 interface, graphics support, and a report generator. The new software will be available in 1988; Xaloy will receive this new version at no charge from the VPC.

Two weeks later, the IE had a successful first run. This run came fifteen weeks after the initial design session. The IE met with the President, Comptroller, and Operations Manager to present and discuss the output. The IE began the meeting with an explanation of how the TFPMM worked and what the output meant. Though the TFPMM was received favorably, there were criticisms concerning the broad nature of most input categories; the inputs were inclusive, but general. For example, different sizes of bar stock were not considered as separate inputs. Expansion was requested and was completed over the next two periods (eight weeks). In addition, several inputs were dropped because of changing market conditions in fiscal 1987.

After the IE's meeting with upper management, I met with the IE for two hours discussing progress to date and problem areas. A major source of

misunderstanding on my part was the use of surrogate quantity and price data for hard to measure inputs. I believed that people had a tendency to want to go too micro with data collection to achieve perfection. The TFPMM is most appropriate as a macro level (firm or plant) measurement technique (see Sink, Tuttle, and DeVries, 1984) and, therefore, I believed, you must compromise rigor for relevance. For example, Xaloy uses a wide variety of tooling. There are three to four dozen lathe tools and even more mill and drill tooling. In addition, usage among these tools is not consistent. To capture quantity and price data for tooling is, therefore, a difficult if not impossible task. However, if you know the value of tooling used and the quantity of tools checked out from the tool crib, you can "back into" an average price. This approach, however, has some problems with it (see Section 4.3.2).

Another area of discussion was Xaloy's choice of measurement scope. The TFPMM was being run every four week period. However, Xaloy's product mix and production schedule change significantly from period to period. In addition, there are relatively long product cycle times (i.e. greater than four weeks). The TFPMM is best applicable in situations where there is a relatively stable product mix, little or no design changes, and short product cycle times (Sink, Tuttle, and DeVries, 1984). As was mentioned earlier, to smooth the effects of these changes, Xaloy was employing a rolling base period. I recommended that Xaloy use a fixed base period and extend their measurement scope to quarterly. This recommendation was not accepted.

The model is now being run every four week period. The inputs have remained the same for the three most recent runs. Data collection and data input take no more than five hours total for each run.

4.1.3.2 Using the TFPMM's Output. TFPMM output is given to the President, Operations Manager, and Comptroller. At present, the TFPMM is of limited use in supporting managerial decision making. In fact, no action is being taken on any of the model's output for several reasons. First, there is little or no understanding within the company beyond these three people and the IE of how the TFPMM works. Some education will be required. Second, the validity of the model's output has not been established. The Comptroller has begun tracking the model's output against conventional productivity ratios and indexes. Third, Xaloy is a company that has been transitioning to a standard manufacturing operation from a job shop operation. Until this transition is complete, the data is too broad based to offer significant insight into where specific action might be taken. The intent of management is to monitor TFPMM output over time and, as confidence in both the model and understanding of it builds, to use it as an integral part of their management and measurement systems.

4.1.3.3 Next Steps

- To include capital in the model;
- To build a data base of adequate size to test the validity and reliability of the model;
- To educate management as to the workings of the model;
- How to present the output; and,
- To integrate the TFPMM into existing management and measurement systems.

A lot of work lies ahead at Xaloy before the TFPMM is an integral component of their measurement and management systems. The design, development, implementation, and continuing evolution of a measurement effort is not a simple or an easy thing to do. It requires patience, persistence, consistence, and hard work. However, new techniques, such as the TFPMM,

must be learned, experimented with, and integrated into existing management systems if the organization is to be competitive over the long run. We must learn to apply these measurement techniques in such a way that the instrument panel which we use to assess the performance of our operations will be appropriate for those operations.

4.1.4 Scanlon Plan Calculations and the TFPMM: A Comparison

Direct comparison of Xaloy's Scanlon Plan calculations with TFPMM output is difficult for two reasons. First, different base periods are being used. Second, the Scanlon Plan calculation captures more costs than the TFPMM is able to capture at this time (see Table 4-2). The reason the Scanlon Plan calculation is able to capture more costs than the TFPMM at Xaloy is that, at the plant level, value is obtainable for all inputs while quantity or price data for those same inputs are not readily available; the TFPMM needs, at a minimum, two out of the three (i.e quantity and price, quantity and value, or price and value). This does not mean to imply the TFPMM cannot capture total costs at the plant or firm level when there is incomplete quantity, price, or value data. A company can use inflators/deflators; the inflators/deflators can be used as a surrogate for price or quantity data (see Dhir, 1986).

A comparison can be made between the Scanlon Plan calculation and the TFPMM if we just look at the inputs and outputs captured in the TFPMM and use these in a Scanlon Plan calculation. This would give us an indication as to whether the TFPMM and Scanlon Plan produce similar results in terms of the dollar effects on profits due to productivity gains/losses.

Period 6 of fiscal 1987 is the only four-week period where a comparison between the TFPMM and Scanlon Plan could be made. A total of five TFPMM runs were available, covering periods 1-8 of fiscal 1987:

Run #1: Period 1-3
Run #2: Period 1-4 (note the use of a rolling base)
Run #3: Period 1-5
Run #4: Period 1-6
Run #5: Period 1-8 (a separate run was not made for Period 7)

A comparison over time using all five runs, while desirable, was not possible with this data set for several reasons. First, only runs #3, #4, and #5 contain the same inputs. Second, run #3 was the first time the IE felt confident about data collection methods. Third, no data was readily available for Period 7; once the data was inputted into the model and the IE checked it for accuracy, the IE threw away the data collection sheet. Because of this, there was no way to "back into" the Period 7 data using run #4 and #5. The data for period 7 could have been re-collected; however, my opinion was the time needed by the IE to do this (five hours) was not worth the benefit received (i.e. one more data point). This leaves period 6 as the only period that lent itself to be used for comparison. Table 4-3 shows the period 6 TFPMM run; quantity and price data have been scaled to protect data confidentiality. The columns of interest for comparing a Scanlon Plan calculation with the TFPMM are columns 17, 18, 19, and 20.

Columns 17-20 reflect the dollar equivalence of corresponding cells in Columns 14-16, Performance Indexes. In other words, these columns indicate what impact an increase (decrease) in productivity (column 17), price recovery (column 18), or joint effects (column 19) has on profits. The total impact on profits from productivity, price recovery, and joint effects is

Table 4-3. Xaloy TFPMM Run for Period 6*
Columns 1-6

	BASE PERIOD			CURRENT PERIOD		
	1	2	3	4	5	6
	QUANTITY	PRICE	VALUE	QUANTITY	PRICE	VALUE
Barrels Sold	264	3462.57	914118.48	205	3593.99	736767.95
Twins Sold	11	10123.32	111356.52	4	13213.27	52853.08
TOTAL OUTPUTS			**1025475.00**			**789621.03**
Hourly Labor	20347	8.83	179664.01	18427	9.14	168422.78
Overtime & Shift Prem.	3274	5.45	17843.30	1812	5.81	10527.72
Administrative Labor	6937	13.94	96701.78	6697	14.58	97642.26
Supervision	1554	9.93	15431.22	974	12.73	12399.02
TOTAL LABOR			**309640.31**			**288991.78**
RMS 3.5"-4.75"	1202	2.96	3557.92	1517	2.96	4490.32
RMS 5.25"-6"	2281	2.96	6751.76	1126	2.96	3332.96
RMS 6.25"-7"	4557	2.96	13488.72	3823	2.96	11316.08
RMS 7.5"-9"	10351	2.96	30638.96	8005	2.96	23694.80
RMS 9.5"-10.5"	9969	2.96	29508.24	7940	2.96	23502.40
RMS 11"-11.5"	1815	4.00	7260.00	728	4.00	2912.00
RMS 12"-13.5"	2787	4.79	13349.73	1333	4.79	6385.07
Total Steel			**104555.33**			**75633.63**
Inlay X-800	1241	25.19	31260.79	1012	25.19	25492.28
Inlay Matrix	1618	5.44	8801.92	1574	5.05	7948.70
Inlay X-101	7150	1.08	7722.00	3972	1.08	4289.76
Inlay X-306	512	8.44	4321.28	340	8.44	2869.60
Inlay X-PSI	329	1.00	329.00	249	1.08	268.92
Total Inlay			**52434.99**			**40869.26**
Hone 00219	35	90.02	3150.70	44	90.02	3960.88
Hone 00200	5	148.97	744.85	28	148.97	4171.16
Hone 00202	24	88.14	2115.36	35	88.14	3084.90
Hone 00206	19	148.97	2830.43	10	148.97	1489.70
Hone 00014	17	163.77	2784.09	0	0.00	0.00
Hone 00181	6	158.89	953.34	0	0.00	0.00
Hone 00013	14	90.02	1260.28	10	90.02	900.20
Total Hones			**13839.05**			**13606.84**
TOTAL MATERIALS			**170829.37**			**130109.73**
Gas(10 ccf)	2010	3.85	7738.50	2178	3.54	7710.12
Water(1000 gal)	121	2.73	330.33	80	3.18	254.40
Power(1000 kwh)	232	40.52	9400.64	210	43.91	9221.10
TOTAL ENERGY			**17469.47**			**17185.62**
TOTAL INPUTS			**497939.15**			**436570.98**

* Data has been disguised to ensure confidentiality

Table 4-3 Continued. Xaloy TFPMM Run for Period 6*
Columns 7-11

	WEIGHTED	CHANGE	RATIOS	COST/REVENUE RATIOS	
	7	8	9	10	11
	QUANTITY	PRICE	VALUE	BASE	CURRENT
Barrels Sold	0.78	1.04	0.81		
Twins Sold	0.36	1.31	0.47		
TOTAL OUTPUTS	**0.73**	**1.07**	**0.78**		
Hourly Labor	0.91	1.04	0.95	0.1752	0.2133
Overtime & Shift Prem.	0.55	1.07	0.59	0.0174	0.0133
Administrative Labor	0.97	1.05	1.02	0.0943	0.1237
Supervision	0.63	1.28	0.81	0.0150	0.0157
TOTAL LABOR	**0.89**	**1.05**	**0.93**	**0.3019**	**0.3660**
RMS 3.5"-4.75"	1.26	1.00	1.26	0.0035	0.0057
RMS 5.25"-6"	0.49	1.00	0.49	0.0066	0.0042
RMS 6.25"-7"	0.84	1.00	0.84	0.0132	0.0143
RMS 7.5"-9"	0.77	1.00	0.77	0.0299	0.0300
RMS 9.5"-10.5"	0.80	1.00	0.80	0.0288	0.0298
RMS 11"-11.5"	0.40	1.00	0.40	0.0071	0.0037
RMS 12"-13.5"	0.48	1.00	0.48	0.0130	0.0081
Total Steel	**0.72**	**1.00**	**0.72**	**0.1020**	**0.0958**
Inlay X-800	0.82	1.00	0.82	0.0305	0.0323
Inlay Matrix	0.97	0.93	0.90	0.0086	0.0101
Inlay X-101	0.56	1.00	0.56	0.0075	0.0054
Inlay X-306	0.66	1.00	0.66	0.0042	0.0036
Inlay X-PSI	0.76	1.08	0.82	0.0003	0.0003
Total Inlay	**0.79**	**0.99**	**0.78**	**0.0511**	**0.0518**
Hone 00219	1.26	1.00	1.26	0.0031	0.0050
Hone 00200	5.60	1.00	5.60	0.0007	0.0053
Hone 00202	1.46	1.00	1.46	0.0021	0.0039
Hone 00206	0.53	1.00	0.53	0.0028	0.0019
Hone 00014					
Hone 00181					
Hone 00013	0.71	1.00	0.71	0.0012	0.0011
Total Hones	**0.98**	**0.73**	**0.72**	**0.0135**	**0.0172**
TOTAL MATERIALS	**0.77**	**0.97**	**0.75**	**0.1666**	**0.1648**
Gas(10 ccf)	1.08	0.92	0.99	0.0075	0.0098
Water(1000 gal)	0.66	1.16	0.77	0.0003	0.0003
Power(1000 kwh)	0.91	1.08	0.98	0.0092	0.0117
TOTAL ENERGY	**0.98**	**1.01**	**0.99**	**0.0170**	**0.0218**
TOTAL INPUTS	**0.85**	**1.02**	**0.87**	**0.4856**	**0.5529**

* Data has been disguised to ensure confidentiality

Table 4-3 Continued. Xaloy TFPMM Run for Period 6*
Columns 12-16

	PRODUCTIVITY	RATIOS	WEIGHTED PERFORMANCE INDEXES		
	12	13	14	15	16
	BASE	1 QTR 87	PRODUCTIVITY	PRICE RECVRY	PROFITABILITY
Barrels Sold					
Twins Sold					
TOTAL OUTPUTS					
Hourly Labor	5.71	4.61	0.80	1.03	0.82
Overtime & Shift Prem.	57.47	75.98	1.33	1.00	1.32
Administrative Labor	10.60	8.04	0.75	1.02	0.76
Supervision	66.45	77.58	1.16	0.84	0.96
TOTAL LABOR	**3.31**	**2.72**	**0.82**	**1.02**	**0.84**
RMS 3.5"-4.75"	288.22	167.10	0.58	1.07	0.62
RMS 5.25"-6"	151.88	225.12	1.49	1.07	1.59
RMS 6.25"-7"	76.02	66.31	0.87	1.07	0.93
RMS 7.5"-9"	33.47	31.67	0.95	1.07	1.01
RMS 9.5"-10.5"	34.75	31.93	0.91	1.07	0.98
RMS 11"-11.5"	141.25	257.66	1.83	1.07	1.95
RMS 12"-13.5"	76.82	117.51	1.52	1.07	1.63
Total Steel	**9.81**	**9.92**	**1.01**	**1.07**	**1.08**
Inlay X-800	32.80	29.43	0.89	1.07	0.95
Inlay Matrix	116.51	87.63	0.75	1.15	0.87
Inlay X-101	132.80	174.91	1.30	1.07	1.39
Inlay X-306	237.31	261.47	1.11	1.07	1.18
Inlay X-PSI	3116.95	3013.33	0.96	0.99	0.95
Total Inlay	**19.56**	**18.10**	**0.92**	**1.08**	**1.00**
Hone 00219	325.48	189.43	0.58	1.07	0.62
Hone 00200	1376.75	179.88	0.13	1.07	0.14
Hone 00202	484.78	243.22	0.50	1.07	0.53
Hone 00206	362.30	503.67	1.38	1.07	1.47
Hone 00014					
Hone 00181					
Hone 00013	813.69	833.50	1.03	1.07	1.10
Total Hones	**74.10**	**55.14**	**0.74**	**1.47**	**1.08**
TOTAL MATERIALS	**6.00**	**5.74**	**0.95**	**1.10**	**1.04**
Gas(10 ccf)	132.52	89.48	0.68	1.16	0.79
Water(1000 gal)	3104.40	3435.53	1.11	0.92	1.01
Power(1000 kwh)	109.09	88.18	0.80	0.99	0.80
TOTAL ENERGY	**58.70**	**43.85**	**0.74**	**1.06**	**0.79**
TOTAL INPUTS	**2.06**	**1.77**	**0.86**	**1.05**	**0.90**

* Data has been disguised to ensure confidentiality

Table 4-3 Continued. Xaloy TFPMM Run for Period 6*
Columns 17-20

	DOLLAR EFFECTS ON PROFITS			
	17	18	19	20
	PRODUCTIVITY	PRICE RECVRY	JOINT EFFECTS	PROFITS
Barrels Sold				
Twins Sold				
TOTAL OUTPUTS				
Hourly Labor	-32339.52	5389.92	-3593.28	-30542.88
Overtime & Shift Prem.	3211.79	0.00	178.44	3390.23
Administrative Labor	-23208.43	1934.04	-1934.04	-23208.43
Supervision	1543.12	-3240.56	1234.50	-462.94
TOTAL LABOR	**-49542.45**	**6192.81**	**-3096.41**	**-46446.05**
RMS 3.5"-4.75"	-1885.70	249.05	-71.15	-1707.80
RMS 5.25"-6"	1620.42	472.62	-135.03	1958.01
RMS 6.25"-7"	-1483.76	944.21	-269.77	-809.32
RMS 7.5"-9"	-1225.56	2144.73	-612.78	306.39
RMS 9.5"-10.5"	-2065.58	2065.58	-590.16	-590.16
RMS 11"-11.5"	2395.80	508.20	-145.20	2758.80
RMS 12"-13.5"	3337.43	934.48	-266.99	4004.92
Total Steel	**1045.55**	**7318.87**	**-2091.10**	**6273.32**
Inlay X-800	-2813.47	2188.26	-625.22	-1250.43
Inlay Matrix	-2112.46	1232.27	-176.04	-1056.23
Inlay X-101	1312.74	540.54	-154.44	1698.84
Inlay X-306	302.49	302.49	-86.43	518.55
Inlay X-PSI	-9.87	-3.29	0.00	-13.16
Total Inlay	**-3146.10**	**4194.80**	**-1048.70**	**0.00**
Hone 00219	-1669.87	220.55	-63.02	-1512.34
Hone 00200	-3627.42	52.14	-14.90	-3590.18
Hone 00202	-1544.21	148.08	-42.31	-1438.44
Hone 00206	566.09	198.13	-56.61	707.61
Hone 00014				
Hone 00181				
Hone 00013	25.21	88.22	-25.21	88.22
Total Hones	**-3459.76**	**4705.28**	**-415.18**	**830.34**
TOTAL MATERIALS	**-6833.17**	**17082.94**	**-5124.89**	**5124.88**
Gas(10 ccf)	-2708.48	1160.78	-77.39	-1625.09
Water(1000 gal)	23.12	-29.73	9.91	3.30
Power(1000 kwh)	-1692.12	-94.01	-94.00	-1880.13
TOTAL ENERGY	**-4367.37**	**1048.17**	**-349.39**	**-3668.59**
TOTAL INPUTS	**-59752.70**	**24896.96**	**-9958.78**	**-44814.52**

* Data has been disguised to ensure confidentiality

indicated in Column 20. The formulas for these columns appear in Figure 4-4. Figure 4-5 depicts the inter-relationship between change in profit and changes in productivity, price recovery, and joint effects.

Most people believe it makes sense to label columns 17-20 as "dollar effects on profits" if all of the outputs and all of the inputs have been captured. However, sometimes a question is raised as to whether it makes sense to call these dollar effects on profits when we have captured all of the outputs, but not all of the inputs; after all, isn't a measure of profit revenues minus costs, not revenues minus partial costs? What do columns 17, 18, 19, 20 represent when you have all of the outputs and not all of the inputs? The answer is: dollar effects on profits.

The TFPMM calculates dollar effects on profits for a particular input or input class independent of other inputs by working solely with change ratios (see Figure 4-4 and 4-5). So, it doesn't make a bit of difference to the TFPMM whether we have:

1) all of the inputs or all of the inputs;

2) all of the outputs and some of the inputs;

3) some of the outputs and all of the inputs; or,

4) some of the outputs and some of the inputs.

Regardless of any one of these four scenarios, columns 17, 18, 19, and 20 will still accurately capture dollar effects on profits.

The TFPMM shows that, in period 6, Xaloy experienced a negative change in profits of $44,814; that is, a 14 percent decline in productivity coupled with a five percent increase in price recovery resulted in Xaloy being 10 percent less profitable in period 6 than it would have been if productivity

Column 17: Dollar Effects on Profits Due to Changes in Productivity

$$Q^{I}_{i1}p^{I}_{i1}\left[\frac{\sum Q^{O}_{i2}p^{O}_{i1}}{\sum Q^{I}_{i1}p^{I}_{i1}} - \frac{Q^{I}_{i2}p^{I}_{i1}}{Q^{I}_{i1}p^{I}_{i1}}\right]$$

Base Period Value for Each Corresponding Input (Column 3)

[Price-weighted Output Quantity Change (Column 7) — Price-weighted Input Quantity Change for each Input (Column 7)]

Column 18: Dollar Effects on Profits Due to Changes in Price Recovery

$$Q^{I}_{i1}p^{I}_{i1}\left[\frac{\sum Q^{O}_{i1}p^{O}_{i2}}{\sum Q^{I}_{i1}p^{I}_{i1}} - \frac{Q^{I}_{i1}p^{I}_{i2}}{Q^{I}_{i1}p^{I}_{i1}}\right]$$

Base Period Value for Each Corresponding Input (Column 3)

[Quantity-weighted Output Price Change (Column 8) — Quantity-weighted Input Price Change for each Input (Column 8)]

Column 19: Dollar Effects on Profits Due to Joint Changes

Column 20 - Column 17 - Column 18

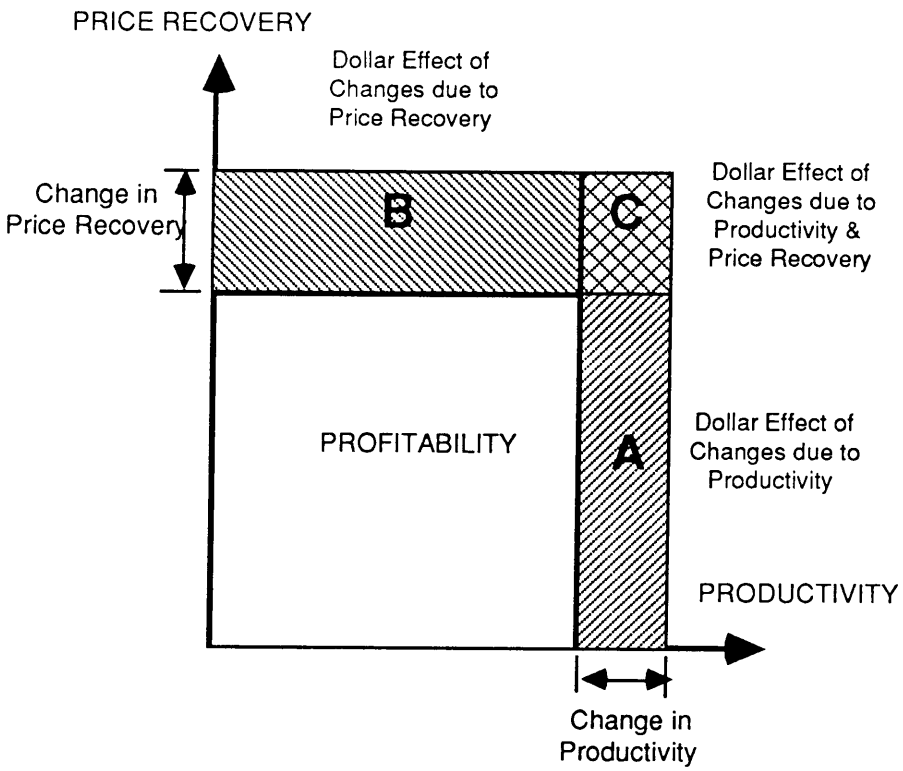
Column 20: Change in Profits

$$Q^{I}_{i1}p^{I}_{i1}\left[\frac{\sum Q^{O}_{i2}p^{O}_{i2}}{\sum Q^{I}_{i1}p^{I}_{i1}} - \frac{Q^{I}_{i2}p^{I}_{i2}}{Q^{I}_{i1}p^{I}_{i1}}\right]$$

Base Period Value for Each Corresponding Input (Column 3)

[Change in Output Quantity and Price (Column 9) — Change in Input Quantity and Price for each Input (Column 9)]

Figure 4-4. Formulas for SCORBORD Columns 17, 18, 19, 20
(Source: Sink, 1985a, 1986/1987)



Change in Profits = A + B + C

Figure 4-5. The Inter-relationships Between Changes in Productivity, Price Recovery, Joint Effects, and Profts

and price recovery remained unchanged relative to the base period. This does not mean that Xaloy lost money in period 6. If we look at revenue minus costs (column 6), we see that Xaloy generated a surplus of $353,050. The surplus of $353,050, however, cannot be considered the "bottom line" profit figure that would appear on an income statement. Recall that the TFPMM only captures 62 percent of Xaloy's costs when compared to a Scanlon Plan calculation. So, in period 6, there were $271,944 in costs unaccounted for in the TFPMM. As was stated earlier, the reason for some inputs being left out of the TFPMM goes back to the fact that, while the value of inputs is tracked at the plant level, quantity or price data is sometimes unavailable; we could have put these costs in the model as a miscellaneous "catch all" by using a value of 1.0 for price in the base period and current period (assuming no increase in prices) or current period price inflators/deflators. This was not done at Xaloy because we did not consider this at the time; a logical next step is to obtain price inflators/deflators either from industry sources, accounting data, or expert opinion. In addition, we did not consider capital (i.e. inventories, depreciation expense, taxes, etc.) in our initial implementation of the TFPMM (see page 142). Column 20 would equal the income sheet profit figure if and only if we had all of the outputs and all of the inputs captured and the base period output value/input value ratio was one or unity (Davis, 1955)

As was mentioned earlier, multi-factor productivity declined in period 6 14 percent (column 14). This 14 percent decline translates to a negative change in profitability of $59,753 (column 17). A Scanlon Plan calculation for this same period shows a negative change in profitability of $53,210 (Table 4-4, Column A). The difference between the dollar effects as calculated by the

Table 4-4. Example Scanlon Plan Calculations Using Output and Inputs Captured in TFPMM

	A Outputs & Inputs in Period 6 Prices	B Outputs & Inputs in Base Period Prices	C Change in Productivity Calculated by the TFPMM
Output	$789,621.03	$750,320.13	
Allowed Labor (30.19%)	238,386.59	226,521.65	
Allowed Material (16.66%)	131,550.86	125,033.33	
Allowed Energy (1.7%)	13,423.56	12,755.44	
Total Allowed Inputs	383,361.01	364,280.42	
Total Actual Inputs	436,570.98	423,430.38	
Gain (Loss)	(53,209.97)	(59,149.96)	(59,752.70)
Difference from TFPMM	6,542.73	602.74	

Scanlon Plan and the TFPMM is $6,543. This difference is due to the fact that the TFPMM calculated the change in productivity using current period quantities evaluated at base period prices; that is, the TFPMM calculation took into account quantity changes and ignored price changes. The TFPMM, then, isolated the change in productivity since productivity is a physical relationship between the quantity of outputs produced by a given system and the quantity of inputs consumed to produce those outputs (Sink, 1985a). On the other hand, the Scanlon Plan calculation used current period quantities evaluated at current period prices. As such, the Scanlon Plan calculation considered the joint effects of quantity and price changes; the resulting dollar value then is not due solely to a change in productivity, but rather a change in productivity plus joint effects.

Change in productivity can be isolated in the Scanlon Plan calculation if we use current period quantities evaluated at base period prices (recall this is the same approach used by the TFPMM). This calculation shows a negative change in profits due to productivity of $59,150 (Table 4-4, Column B). The difference between the value of the productivity change calculated by the TFPMM and the Scanlon Plan using base period prices is $603. This difference translates to an error of 0.01 percent; since we rounded all quantities to the nearest integer when calculating value, we would expect a maximum error rate or uncertainty of ± 0.05 percent. The difference in this example, then, between the TFPMM and Scanlon Plan calculation is not significant. The TFPMM produces similar results as a quantity weighted Scanlon Plan calculation; that is, the TFPMM appears to accurately capture the dollar effects

of productivity change when compared to a Scanlon Plan calculation adjusted for price changes.

4.1.5 Using the TFPMM to Drive Gainsharing at Xaloy

It appears that the TFPMM could be used at Xaloy to support and/or drive gainsharing in five different ways:

1. Support the Scanlon Plan by providing insight into changes that are occurring (e.g. quantity and price weighted changes, productivity ratios and indexes). The TFPMM is a more complete productivity measurement tool than a Scanlon Plan calculation.
2. Provide information that can be used to remove the effects of price recovery and joint effects from the Scanlon Plan calculation. This does not mean to imply that price recovery and joint effects could not/should not be shared. However, by isolating the dollar effects due to productivity, price recovery, and joint effects, participants would know the real source of any gain (loss).
3. A Scanlon Plan calculation could be used to complement a TFPMM based gainsharing system by capturing inputs that cannot be captured in the TFPMM.
4. Based on the organization's ability to capture inputs and its understanding of the model, TFPMM based gainsharing could progress much along the lines of most Scanlon Plans, starting with a partial factor, labor approach and evolving towards a multi or total factor approach (see Moore and Ross, 1983)
5. The Scanlon Plan could be replaced at some later date by the TFPMM as a stage of evolution in the gainsharing effort. As the

organization matures with respect to its ability to accurately measure and track productivity with the TFPMM and its understanding of the TFPMM increases, the TFPMM offers a viable alternative to the Scanlon Plan; the advantages of TFPMM based gainsharing are discussed in Chapter 1, Section 1.3 (page 13).

In summary, it appears the TFPMM can and will work, in a number of ways, to drive and/or support gainsharing in a complex manufacturing environment. At present, I cannot say for certain whether the TFPMM will be used by Xaloy for gainsharing. We're still six months to a year away from having confidence in what the model is telling us and are uncertain as to whether the model can be communicated in such a way that people on the shop floor understand the model (Xaloy is finding that people on the shop floor do not fully understand the multi-cost Scanlon Plan now in operation; the TFPMM is considerably more complex). A listing of summary comments and observations on and about the experience at Xaloy is found at the end of the chapter. The next section examines application of the TFPMM in a white collar organization and how this organization plans to use it to drive gainsharing.

4.2 VIRGINIA PRODUCTIVITY CENTER: DESIGNING A GAINSHARING SYSTEM BASED ON THE TFPMM

4.2.1 Company Description

The Virginia Productivity Center (VPC) was established in 1980 by the State Council for Higher Education in the Commonwealth of Virginia. The VPC is housed in the Department of Industrial Engineering and Operations Research and the College of Engineering at Virginia Tech. In 1982, the VPC became a self-supporting entity and is now recognized as Virginia's Center for

research, development, and application of productivity and performance management approaches and techniques. The VPC is also recognized as an international center for quality and productivity management innovation serving the Commonwealth, Region, U.S., and the World.

The Virginia Productivity Center has three primary missions:

- To strengthen the performance and competitiveness of selected state, national and international organizations;
- To design and develop strategies and techniques that will enable managers to improve their measurement, evaluation, control, and improvement systems; and,
- To provide professional development for a select group of associates and transfer knowledge and wisdom on performance management effectively.

The VPC operates with a clear and explicit set of guiding principles. Specifically, the VPC strives to:

- focus on continual development and improvement of products, services and performance;
- exemplify, in all respects, the concept of "the organization of the future";
- share information, rewards, power, and knowledge and move accountability for problem solving and decision making to the lowest appropriate level;
- employ the five quality checkpoint process in proactively managing total quality (see Koelling, Tenjeras, and Riel, 1987, for a discussion on the five quality checkpoints);
- maintain a long-term view of growth and development in the face of short-term pressures and issues;
- practice what we preach (all products and services are used internally); and,
- foster a culture that respects quality of work life and quality of life.

Table 4-5 depicts the VPC's progress since 1984.

4.2.2 VPC Management Practices

Planning. A planning session is held annually with the VPC Staff. The eight-step planning process described by Sink (1985a, 1985b, 1986/1987) and Sink, Tuttle, and Dhir (1988) is used. The planning process precedes budget development so that the plan drives the budget, and not vice-versa.

Table 4-5. VPC Profile of Progress

	1984	1985	1986	1987
Externally Funded Research	$50,000	$182,000	$211,000	$270,000
VPC Sponsored Research	$0	$13,000	$39,000	$60,000
VPC Consulting Projects	$0	$75,000	$195,000	$450,000
Product Sales	$3,00	$70,00	$130,00	$23,000
Number of Staff	3	5	14	18
Full Time Equivalents	1	2	8	10
Requests Responded To	50	100	500	750
Number of Site Visits to VPC	0	5	6	12

* Data has been disguised to ensue confidentiality

Quarterly reviews are held to monitor progress of the plan and take corrective action where needed.

Project and Program Managers. The VPC is operated like a small business. Faculty members, students, and other staff are assigned projects (short duration efforts) and programs (longer duration efforts that focus on serving the Commonwealth of Virginia and improving the quality of management processes, products, and services) and are expected to manage these efforts. Project and program managers are completely responsible for budgets, communication, coordination, logistics, and as much of the actual execution as appropriate.

Action Teams. In addition to being project and program managers, VPC staff are also action team leaders. An action team is a small group (2-5 people) of VPC staff who have volunteered to tackle a priority roadblock or objective identified during planning sessions or staff meetings.

Measurement and Evaluation. Measurement systems are evolving at three levels. Level 1 measurement focuses on performance at the Center level; three measurement tools and techniques are used: the Total Factor Productivity Measurement Model (TFPMM), PRFORM (the Multi-Criteria Performance Measurement Technique), and traditional cost accounting data/financial ratios. To date, the TFPMM and PRFORM are still in the early stages of development and are not an integral component of the management support system. Section 4.2.3 presents and discusses the VPC's experience to date with the TFPMM.

Level 2 measurement systems focus at the project and program level. Budgetability, effectiveness, quality, and innovation measures are used at this

level. Level 2 measurement is becoming well defined with respect to budget management; not much progress has been made in measuring the other criteria.

The focus of Level 3 measurement is the individual. The measurement tool used here is the performance development report, designed by the Center's Director and a Faculty Associate. Improving performance or declining performance can trigger a development report. Any staff member can initiate a performance development report on anyone else. Co-developers are solicited and used both participatively and consultatively to complete the development report. This helps improve the quality of the report and disperse ownership.

An analogy from the world of sports is useful to explain the logic behind the three levels of measurement (D. Scott Sink, Director of the VPC, gave the following example at a presentation during the World Productivity Forum in Washington D.C., May 1987). Imagine if, in football games, we no longer had a scoreboard for the team, but for individual players and positions. So, we'd have a scoreboard for the wide receiver (e.g. # of passes caught); a scoreboard for the quarterback (e.g. # of yards gained scrambling); a scoreboard for the running back (e.g. total yards gained); and so on. What would the huddle look like? How do you think the football team would perform as a team? Would it matter to any one individual whether the team won or lost? Within such a system, being a team player is a risky strategy to take. Yet, this is how most organizations have designed measurement systems and reward systems. The emphasis is on performing as an individual, then as a group,

then as an organization. This is backwards logic and dysfunctional to becoming a world-class competitor.

The inter-relationships between Level 1, 2, and 3 reporting, then, emphasizes Center level performance as most important; the VPC will not succeed, long-term, unless it performs as a Center. Projects and programs are next in importance since staff members must aggressively manage performance at this level to satisfy clients and improve the quality of products, services, and management processes. However, project and program performance must be evaluated relative to what is happening at the Center level; it's possible to perform well on projects and programs and not succeed as a Center. Individual performance is also critical. However, individual performance is necessary, but not sufficient, for group performance; everyone doing their best is not enough (Deming, 1986).

Reward Systems. Management recognized the need for reward systems that integrated with and supported the Center's longer range strategic objectives. The VPC lives within the guidelines of the University's compensation management system. Traditional reward systems were not seen as what was needed by the organization in 2-5 years. A problem with the university's compensation management system is that it has not been designed for organizations like the VPC; Table 4-6 depicts these differences. The University's compensation management system, therefore, was not seen as meeting the VPC's needs in the next two to five years. One component of the VPC's compensation management system, the performance sharing system, is described in Section 4.2.4. The next section looks at the VPC's application of the

Table 4-6. Comparison of a Typical University Organization with the VPC

Typical University Organization:

- Are almost totally University and State supported.
- Are given budget to serve their internal and external customers.
- Require faculty to play traditional roles: teaching, research, and service.
- Practice an extreme division of labor.
- See their mission and purpose narrowly defined.
- Customers that are price "insensitive" (i.e. many times services are an allocated expense and, therefore, not carefully managed).
- Stress individual performance over group performance.
- Practice incremental budgeting. If payroll costs rise ten percent, they will get a ten percent increase in their payroll budget.
- Just get by levels of performance are all that is required.
- Rely on legislative bodies either within the University or within State government to increase budget or fund developmental requests.

Virginia Productivity Center:

- Almost totally self-supporting with the possible exception of facilities, janitorial services, mail services, and limited salary and wage support.
- Require faculty to play dual roles: professor and small business person.
- Run as an independent cost center. Must practice productivity improvement to fund payroll increases.
- Innovation is extremely critical to survival.
- Rely on their own efforts to find funding sources.
- Fund operating and maintenance expenditures and developmental projects and programs with internally generated funds.
- Have a high ratio of part-time to full-time personnel.
- Larger universities job descriptions do not accurately describe staff members roles and responsibillities.

TFPMM; the TFPMM is an integral component of the performance sharing system design.

4.2.3. The TFPMM at the VPC

Initial Design Session. A team was formed to design the TFPMM application for the Center. The team consisted of the Director and two graduate research associates. The Director had been, and still is, active in TFPMM design and application for an eight year period. The two graduate research associates had been exposed to the TFPMM in a ten week, graduate level class in performance measurement, taught by the Director. All three team members were Industrial Engineers. The Center's Administrative Assistant, who was responsible for accounting and finance was not a team member. In retrospect, this was a critical oversight on the team's part. Development and implementation of the TFPMM would run smoother by involving a person familiar with the accounting system early in the design process.

An IOA was completed by the team to get a complete picture of inputs and outputs (Figure 4-6). Each input was placed within an input class category: labor, materials, capital, energy, and data/information; outputs were also grouped together by type.

The Director felt that calendar year 1986 would be an appropriate base period. The measurement scope was to be quarterly; this scope was in line with current management support system reports on staffing, funding, and budgets.

Data Collection. The two graduate research associates met with the Administrative Assistant, who is responsible for Center level accounting, to explain the effort and to strategize how to collect the needed data. The

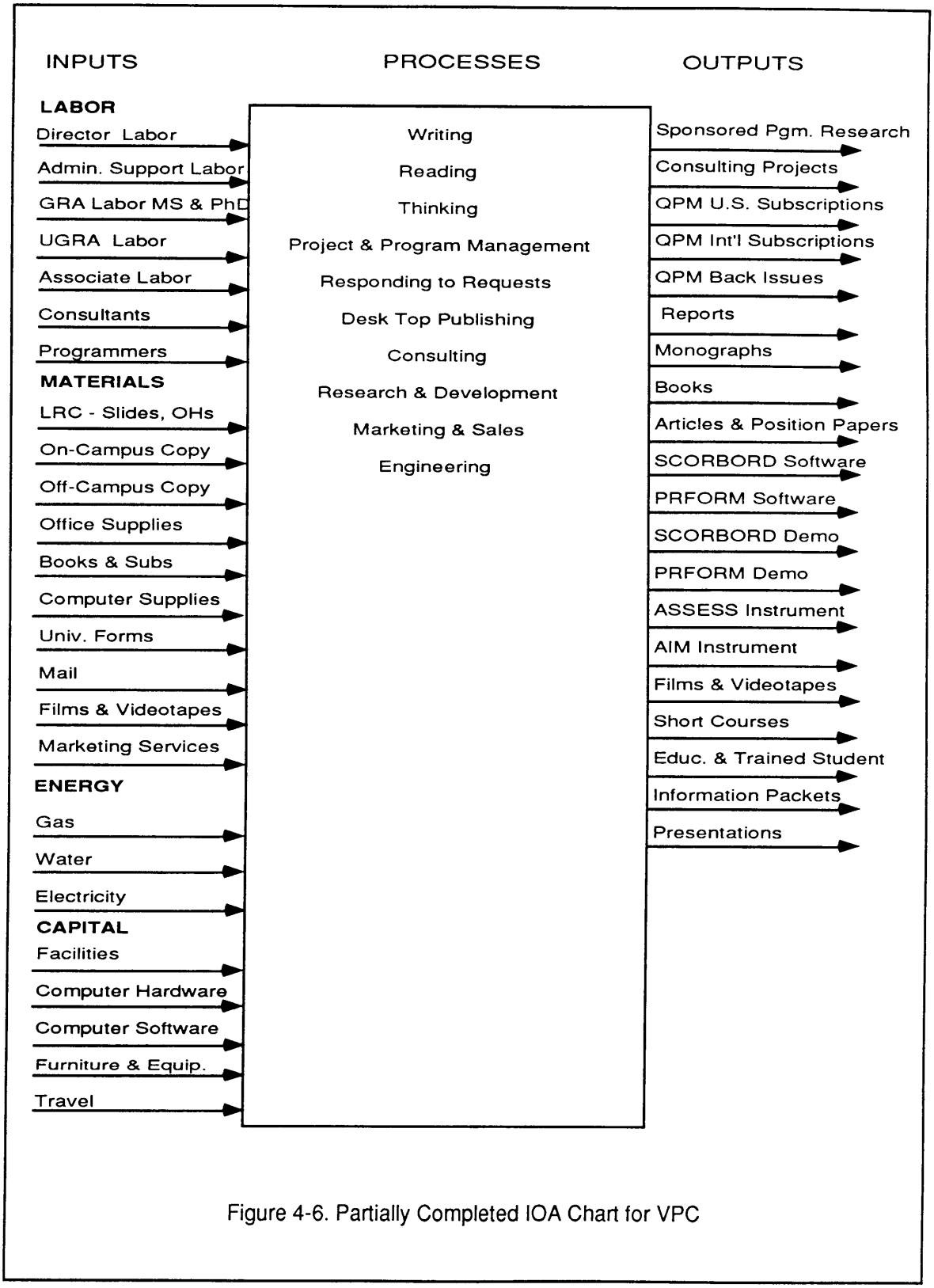


Figure 4-6. Partially Completed IOA Chart for VPC

Administrative Assistant was aware that the TFPMM was a component of the Level 1 measurement system but did not fully understand data requirements and output; this was explained and at the end of this meeting, the Administrative Assistant understood.

A software package was available for the TFPMM, SCORBORD™, but had poor editing capabilities. The team believed there would be a need for extensive editing during the initial stages of development. A spreadsheet version of the TFPMM was programmed using Microsoft Excel. Programming the spreadsheet took three hours. The formulas were taken from Sink (1985a, pages 150-166). Inputting the initial data and debugging the spreadsheet took another 2 hours.

A spreadsheet version of the TFPMM is a "quick and dirty" way to get the model up and running. However, it requires editing formulas when adding or deleting inputs and outputs and lacks flexibility in obtaining graphical output. A software package, designed specifically to run the model and facilitate report writing is a better way to go. The VPC has redesigned SCORBORD™ to correct problems found in the previous version; this new version will be available in 1988.

The first data collection for calendar year 1986 and the first quarter of 1987 took 20 hours and proved to be nothing more than a learning experience. With the exception of labor costs, very little quantity, price, or value data were readily available. This is not to say that the data didn't exist; it just wasn't in a format that was easily accessible or, in the case of university accounting procedures for energy, unusable. What we had with this first attempt was a collection of false data, mistaken data, and inability to collect data (see

Ishikawa, 1985). Unfamiliarity with the accounting system caused a lot of the problems (e.g. not knowing where to find data; double counting data that was in two different locations). We could not come close to tying the model's output to the income statement. Based on this experience, a data collection sheet was designed to facilitate next quarter's data collection (Figure 4-7).

Despite the fact the output from this first run was incorrect, it was presented to the VPC staff in tabular format at a quarterly review meeting. The purpose of this presentation was to simply expose people to the output, create an awareness of what inputs and outputs were being captured, and show people that progress was being made on one of the Level 1 measurement systems. No educational intervention was made. Staff members, in general, were quite knowledgeable on the TFPMM; with the exception of the secretary, everyone had an understanding of how the TFPMM worked.

The second round of data collection took ten hours, but again, did not produce accurate results. First, it was realized that the cost accounting system was set up based on cash flow accounting, not accrual accounting (the practice of matching expenses to revenues). This represents a significant problem when trying to measure productivity since accrual accounting is the more appropriate way to measure productivity. The reason accrual accounting is more appropriate for measuring productivity is that productivity is the relationship between outputs produced by the system during a certain time period and the inputs used to produce those outputs during that time period (see Sink, 1985a); accrual accounting, with its principle of matching, captures outputs and inputs as they occur. To base productivity on cash flow accounting implies that productivity is a relationship between cash flowing

PERIOD:				LOCATION OF
	QUANTITY	PRICE	VALUE	DATA
OUTPUTS				
RESEARCH & CONSULTING	jobs	avg per job	total revenue	
BOOKS, REPORTS, PAPERS	sold	avg selling price	total revenue	
JOURNAL SUBSCRIPTIONS	sold	avg selling price	total revenue	
SOFTWARE SALES	sold	avg selling price	total revenue	
INSTRUMENTS	sold	avg selling price	total revenue	
LABOR				
MANAGEMENT LABOR	hours	avg cost per hour	total cost	
ADMIN. LABOR	hours	avg cost per hour	total cost	
GRA LABOR	hours	avg cost per hour	total cost	
UGRA LABOR	hours	avg cost per hour	total cost	
ASSOCIATE LABOR	days	avg cost per day	total cost	
CONSULTING LABOR	days	avg cost per day	total cost	
PROGRAMMERS	days	avg cost per day	total cost	
MATERIALS				
OFFICE SUPPLIES	orders	avg order cost	total cost	
COMPUTER SUPPLIES	orders	avg order cost	total cost	
LASER PRINTER COPIES	copies	$0.05 per copy	total cost	
IN-HOUSE XEROXING	copies	$0.05 per copy	total cost	
CAMPUS COPY & PRINT SH	jobs	avg job cost	total cost	
OFF CAMPUS COPYING	jobs	avg job cost	total cost	
JOHN WILEY BOOK PUB.	books	cost per book	total cost	
PURCHASED SERVICE				
OVERHEAD PAID				
UNIV. LRC SERVICES	jobs	avg job cost	total cost	
FACSIMILE (FAX)	faxs	avg fax cost	total cost	
CENTRAL MAIL	jobs	avg job cost	total cost	
EXPRESS MAIL	pakages	avg xmail cost	total cost	
MARKETING SERVICES	projects	avg project cost	total cost	
MISC. SERVICES	jobs	avg job cost	total cost	
DATA/INFO				
BOOKS	books	avg book cost	total cost	
SUBSCRIPTIONS	subs	avg sub cost	total cost	
FILMS/VIDEOS	films/videos	avg film/vid cost	total cost	
CAPITAL				
FACILITIES RENT	1780 sq ft	3.25 per sq ft	total cost	
COMPUTER HARDWARE	value	depr rate	depr	
COMPUTER SOFTWARE	value	depr rate	depr	
FURNITURE & EQUIP.	$ assets	depr rate	depr	
TRAVEL	trips	cost/trip	total cost	

Figure 4-7. VPC SCORBORD Data Collection Sheet

into the system for products and services during a certain time period (independent of when outputs were produced) and cash flowing out of the system during that same time period (independent of when the inputs paid for were used). Because of the need to base productivity measurement on accrual accounting data, all of the data for the base period and the next quarter had to be collected by going back to the original paperwork; the cost accounting system was of no help.

Second, measuring capital productivity was a problem. No depreciation schedules existed and purchase records were incomplete. In addition, a decision had not been made as to the time horizon for depreciation of assets and the depreciation method. The second run was cleaned-up and is shown in Table 4-7.

Following the second run, the decision was made to change the base period to fiscal year 86-87 from calendar year 1986. The fiscal year runs from 1 July to 30 June. The reasons for this transition were two-fold. First, the University uses the fiscal year, not the calendar year. Moving to a fiscal year would allow us to better communicate our progress with university officials. Second, fiscal 86-87 is the first year the Center had complete accounting records.

4.2.4 Using the TFPMM to Drive Total Gainsharing System Design

The VPC wanted a reward system that complemented the University system and, at the same time, was more aligned with their strategic vision of what the VPC organization of the future must look like. Management believed that reward systems in the organization of the future will require a n appropriate blend of several approaches. The VPC's "performance sharing"

Table 4-7.VPC TFPMM Run for Example Quarter*
Columns 1-6

	BASE PERIOD			CURRENT PERIOD		
	1	2	3	4	5	6
	QUANTITY	PRICE	VALUE	QUANTITY	PRICE	VALUE
SPONSORED PROGRAMS	1.0	37500.00	37500.00	1.0	33334.55	33334.55
DEVELOPMENT FOUND.	2.0	28920.00	57840.00	5.0	9960.00	49800.00
REPORTS	5.0	30.00	150.00	0.0	0.00	0.00
BOOKS	25.0	45.00	1125.00	24.0	45.00	1080.00
POSITION PAPERS	15.0	5.00	75.00	32.0	6.77	216.64
QPM SUBS. U.S.	30.0	45.00	1350.00	26.0	43.22	1123.72
QPM BACK ISSUES	5.0	5.00	25.00	16.0	3.00	48.00
QPM SUBS. INT'L.	10.0	55.00	550.00	1.0	55.00	55.00
MONOGRAPHS	1.0	40.00	40.00	0.0	0.00	0.00
PRFORM SOFTWARE	2.0	595.00	1190.00	3.0	448.33	1344.99
SCORBORD SOFTWARE	2.0	595.00	1190.00	3.0	585.00	1755.00
PRFORM DEMO	2.0	29.95	59.90	2.0	29.95	59.90
SCORBORD DEMO	2.0	29.95	59.90	0.0	0.00	0.00
PR & SCOR DEMO	2.0	50.00	100.00	8.0	59.37	474.96
ASSESS INSTRUMENT	10.0	5.00	50.00	2.0	5.00	10.00
MISC.	1.0	200.00	200.00	1.0	300.00	300.00
DONATIONS/GIFT	3.0	700.00	2100.00	1.0	3224.79	3224.79
OUTPUTS			**103604.80**			**92827.55**
MANAGEMENT LABOR	780.0	38.02	29655.60	836.0	34.19	28582.84
ADMIN. LABOR	910.0	6.35	5778.50	1130.0	6.11	6904.30
GRA LABOR	2730.0	7.26	19819.80	2626.0	7.45	19563.70
UGRA LABOR	130.0	3.25	422.50	101.0	3.25	328.25
Total In-house Labor			**55676.40**			**55379.09**
ASSOCIATE LABOR	5.0	1250.00	6250.00	11.0	1273.00	14003.00
CONSULTING LABOR	3.0	100.00	300.00	3.0	59.00	177.00
PROGRAMMERS	3.0	225.00	675.00	1.0	500.00	500.00
Total Purch. Labor			**7225.00**			**14680.00**
LABOR			**62901.40**			**70059.09**
OFFICE SUPPLIES	2.0	70.00	140.00	4.0	164.24	656.96
COMPUTER SUPPLIES	3.0	60.00	180.00	0.0	0.00	0.00
Total Supplies			**320.00**			**656.96**
LASER PRINT COPIES	6000.0	0.05	300.00	6534.0	0.05	326.70
IN-HOUSE XEROXING	30000.0	0.05	1500.00	29768.0	0.05	1488.40
COPY CTR/PRINT SHOP	5.0	125.00	625.00	30.0	120.79	3623.70
OFF CAMPUS COPYING	16.0	260.00	4160.00	15.0	53.43	801.45
Total Copying			**6585**			**6240.25**
JOHN WILEY	50.0	33.30	1665.00	50.0	38.30	1915.00
Total Book Publisher			**1665**			**1915**
MATERIALS			**8570.00**			**8812.21**
OVERHEAD	11790.0	1.00	11790.00	4673.48	1.00	4673.48
LRC - Present Matl.	10.0	45.00	450.00	18.0	35.12	632.16
FACSIMILE (FAX)	1.0	5.00	5.00	1.0	5.31	5.31
CENTRAL MAIL	1.0	38.00	38.00	1.0	23.87	23.87
Total Univ. Services			**12283.00**			**5334.82**
EXPRESS MAIL	15.0	20.00	300.00	17.0	11.93	202.81
MARKETING SERVICES	1.0	1000.00	1000.00	3.0	2178.84	6536.52
MISC. SERVICES	2.0	100.00	200.00	4.0	148.25	593.00
Total Other Services			**1500.00**			**7332.33**
PURCHASED SERVICES			**13783.00**			**12667.15**
BOOKS	9.0	20.00	180.00	19.0	30.00	570.00
SUBSCRIPTIONS	18.0	13.75	247.50	18.0	13.75	247.50
FILMS/VIDEOS	1.0	750.00	750.00	2.0	672.50	1345.00
DATA/INFO			**1177.50**			**2162.50**
FACILITIES	1680.0	3.25	5460.00	1780	3.25	5785.00
COMPUTER HARDWARE	9854.0	0.18	1786.00	13941	0.17	2310.00
COMPUTER SOFTWARE	2.0	185.00	370.00	5.0	149.36	746.80
FURNITURE & EQUIP.	3443.0	0.07	248.00	9860	0.07	726.00
TRAVEL	18.0	275.00	4950.00	27.0	351.11	9479.97
CAPITAL			**12814.00**			**19047.77**
INPUTS			**99245.90**			**112748.72**

* Data has been disguised to ensure confidentiality

Table 4-7 Continued. VPC TFPMM Run for Example Quarter*
Columns 7-11

	WEIGHTED	CHANGE	RATIOS	COST/REVENUE RATIOS	
	7	8	9	10	11
	QUANTITY	PRICE	VALUE	BASE	2 QTR CY87
SPONSORED PROGRAMS	1.00	0.89	0.89		
DEVELOPMENT FOUND.	2.50	0.34	0.85		
REPORTS					
BOOKS	0.96	1.00	0.96		
POSITION PAPERS	2.13	1.35	2.88		
QPM SUBS. U.S.	0.87	0.96	0.84		
QPM BACK ISSUES	3.20	0.60	1.92		
QPM SUBS. INT'L.	0.10	1.00	0.10		
MONOGRAPHS					
PRFORM SOFTWARE	1.50	0.75	1.13		
SCORBORD SOFTWARE	1.50	0.98	1.47		
PRFORM DEMO	1.00	1.00	1.00		
SCORBORD DEMO					
PR & SCOR DEMO	4.00	1.19	4.76		
ASSESS INSTRUMENT	0.20	1.00	0.20		
MISC.	1.00	1.50	1.50		
DONATIONS/GIFT	0.33	4.61	1.52		
OUTPUTS	**1.83**	**0.49**	**0.90**		
			0.90		
MANAGEMENT LABOR	1.07	0.90	0.96	0.2862	0.3079
ADMIN. LABOR	1.24	0.96	1.19	0.0558	0.0744
GRA LABOR	0.96	1.03	0.99	0.1913	0.2108
UGRA LABOR	0.78	1.00	0.78	0.0041	0.0035
Total In-house Labor	**1.05**	**0.95**	**1.00**	**0.5374**	**0.5966**
ASSOCIATE LABOR	2.20	1.02	2.24	0.0603	0.1508
CONSULTING LABOR	1.00	0.59	0.59	0.0029	0.0019
PROGRAMMERS	0.33	2.22	0.73	0.0065	0.0054
Total Purch. Labor	**1.98**	**1.03**	**2.04**	**0.0697**	**0.1581**
LABOR	**1.15**	**0.96**	**1.10**	**0.6071**	**0.7547**
OFFICE SUPPLIES	2.00	2.35	4.70	0.0014	0.0071
COMPUTER SUPPLIES					
Total Supplies	**0.88**	**2.35**	**2.07**	**0.0031**	**0.0071**
LASER PRINT COPIES	1.09	1.00	1.09	0.0029	0.0035
IN-HOUSE XEROXING	0.99	1.00	0.99	0.0145	0.0160
COPY CTR/PRINT SHOP	6.00	0.97	5.82	0.0060	0.0390
OFF CAMPUS COPYING	0.94	0.21	0.20	0.0402	0.0086
Total Copying	**1.44**	**0.66**	**0.95**	**0.0636**	**0.0672**
JOHN WILEY	1.00	1.15	1.15	0.0161	0.0206
Total Book Publisher	**1.00**	**1.15**	**1.15**	**0.0161**	**0.0206**
MATERIALS	**1.33**	**0.77**	**1.02**	**0.0827**	**0.0949**
OVERHEAD	0.40	1.00	0.40	0.1138	0.0503
LRC - Present Matl.	1.80	0.78	1.40	0.0043	0.0068
FACSIMILE (FAX)	1.00	1.06	1.06	0.0000	0.0001
CENTRAL MAIL	1.00	0.63	0.63	0.0004	0.0003
Total Univ. Services	**0.45**	**0.97**	**0.44**	**0.1186**	**0.0575**
EXPRESS MAIL	1.13	0.60	0.68	0.0029	0.0022
MARKETING SERVICES	3.00	2.18	6.54	0.0097	0.0704
MISC. SERVICES	2.00	1.48	2.96	0.0019	0.0064
Total Other Services	**2.49**	**1.96**	**4.88**	**0.0145**	**0.0790**
PURCHASED SERVICES	**0.67**	**1.37**	**0.92**	**0.1330**	**0.1365**
BOOKS	2.11	1.50	3.17	0.0017	0.0061
SUBSCRIPTIONS	1.00	1.00	1.00	0.0024	0.0027
FILMS/VIDEOS	2.00	0.90	1.80	0.0072	0.0145
DATA/INFO	**1.81**	**1.02**	**1.85**	**0.0114**	**0.0233**
FACILITIES	1.06	1.00	1.06	0.0527	0.0623
COMPUTER HARDWARE	1.41	0.94	1.33	0.0172	0.0249
COMPUTER SOFTWARE	2.50	0.81	2.03	0.0036	0.0080
FURNITURE & EQUIP.	2.86	1.00	2.86	0.0024	0.0078
TRAVEL	1.50	1.28	1.92	0.0478	0.1021
CAPITAL	**1.35**	**1.10**	**1.49**	**0.1237**	**0.2052**
INPUTS	**1.14**	**1.00**	**1.14**	**0.9579**	**1.2146**

* Data has been disguised to ensure confidentiality

Table 4-7 Continued. VPC TFPMM Run for Example Quarter*
Columns 12-16

	PRODUCTIVITY	RATIOS	WEIGHTED PERFORMANCE INDEXES		
	12	13	14	15	16
	BASE	2 QTR CY87	PRODUCTIVITY	PRICE RECVRY	PROFITABILITY
SPONSORED PROGRAMS					
DEVELOPMENT FOUND.					
REPORTS					
BOOKS					
POSITION PAPERS					
QPM SUBS. U.S.					
QPM BACK ISSUES					
QPM SUBS. INT'L.					
MONOGRAPHS					
PRFORM SOFTWARE					
SCORBORD SOFTWARE					
PRFORM DEMO					
SCORBORD DEMO					
PR & SCOR DEMO					
ASSESS INSTRUMENT					
MISC.					
DONATIONS/GIFT					
OUTPUTS					
MANAGEMENT LABOR	3.49	5.96	1.71	0.54	0.94
ADMIN. LABOR	17.92	26.42	1.48	0.51	0.76
GRA LABOR	5.23	9.94	1.91	0.48	0.91
UGRA LABOR	243.90	577.56	2.35	0.49	1.15
Total In-house Labor	**1.86**	**3.25**	**1.74**	**0.52**	**0.90**
ASSOCIATE LABOR	16.58	13.79	0.83	0.48	0.40
CONSULTING LABOR	344.83	631.95	1.83	0.83	1.53
PROGRAMMERS	153.85	842.60	5.55	0.22	1.23
Total Purch. Labor	**14.35**	**13.28**	**0.92**	**0.48**	**0.44**
LABOR	**1.65**	**2.61**	**1.59**	**0.51**	**0.82**
OFFICE SUPPLIES	714.29	677.09	0.92	0.21	0.19
COMPUTER SUPPLIES					
Total Supplies	**322.58**	**677.09**	**2.08**	**0.21**	**0.43**
LASER PRINT COPIES	344.83	580.30	1.68	0.49	0.83
IN-HOUSE XEROXING	68.97	127.37	1.85	0.49	0.91
COPY CTR/PRINT SHOP	166.67	50.56	0.31	0.51	0.15
OFF CAMPUS COPYING	24.88	48.61	1.95	2.33	4.50
Total Copying	**15.72**	**20.03**	**1.27**	**0.74**	**0.95**
JOHN WILEY	62.11	113.86	1.83	0.43	0.78
Total Book Publisher	**62.11**	**34.30**	**1.83**	**0.43**	**0.78**
MATERIALS	**12.09**	**16.62**	**1.38**	**0.64**	**0.88**
OVERHEAD	8.79	40.57	4.58	0.49	2.25
LRC - Present Matl.	232.56	234.06	1.02	0.63	0.64
FACSIMILE (FAX)	#DIV/0!	37916.98	1.83	0.46	0.85
CENTRAL MAIL	2500.00	4989.08	1.83	0.78	1.43
Total Univ. Services	**8.43**	**34.30**	**4.07**	**0.51**	**2.05**
EXPRESS MAIL	344.83	557.60	1.62	0.82	1.32
MARKETING SERVICES	103.09	63.19	0.61	0.22	0.14
MISC. SERVICES	526.32	473.96	0.92	0.33	0.30
Total Other Services	**68.97**	**50.69**	**0.73**	**0.25**	**0.18**
PURCHASED SERVICES	**7.52**	**20.46**	**2.73**	**0.36**	**0.98**
BOOKS	588.24	498.91	0.87	0.33	0.28
SUBSCRIPTIONS	416.67	766.00	1.83	0.49	0.90
FILMS/VIDEOS	138.89	126.39	0.92	0.54	0.50
DATA/INFO	**87.72**	**89.11**	**1.01**	**0.48**	**0.49**
FACILITIES	18.98	32.77	1.73	0.49	0.85
COMPUTER HARDWARE	58.14	75.55	1.30	0.52	0.68
COMPUTER SOFTWARE	277.78	204.96	0.73	0.60	0.44
FURNITURE & EQUIP.	416.67	274.68	0.64	0.49	0.31
TRAVEL	20.92	25.53	1.22	0.38	0.47
CAPITAL	**8.08**	**10.94**	**1.36**	**0.45**	**0.60**
INPUTS	**1.04**	**1.68**	**1.61**	**0.49**	**0.79**

* Data has been disguised to ensure confidentiality

Table 4-7 Continued. VPC TFPMM Run for Example Quarter*
Columns 17-20

	DOLLAR EFFECTS ON PROFITS			
	17	18	19	20
	PRODUCTIVITY	PRICE RECVRY	JOINT EFFECTS	PROFITS
SPONSORED PROGRAMS				
DEVELOPMENT FOUND.				
REPORTS				
BOOKS				
POSITION PAPERS				
QPM SUBS. U.S.				
QPM BACK ISSUES				
QPM SUBS. INT'L.				
MONOGRAPHS				
PRFORM SOFTWARE				
SCORBORD SOFTWARE				
PRFORM DEMO				
SCORBORD DEMO				
PR & SCOR DEMO				
ASSESS INSTRUMENT				
MISC.				
DONATIONS/GIFT				
OUTPUTS				
MANAGEMENT LABOR	22538.26	-12158.80	-12158.80	-1779.34
ADMIN. LABOR	3409.32	-2715.90	-2369.19	-1675.77
GRA LABOR	17243.23	-10702.69	-8324.32	-1783.78
UGRA LABOR	443.63	-215.48	-177.45	50.70
Total In-house Labor	**43427.59**	**-25611.14**	**-23384.09**	**-5567.64**
ASSOCIATE LABOR	-2312.50	-3312.50	-2750.00	-8375.00
CONSULTING LABOR	249.00	-30.00	-126.00	93.00
PROGRAMMERS	1012.50	-1167.75	270.00	114.75
Total Purch. Labor	**-1083.75**	**-3901.50**	**-3251.25**	**-8236.50**
LABOR	**42772.95**	**-29563.66**	**-25789.57**	**-12580.28**
OFFICE SUPPLIES	-23.80	-260.40	-247.80	-532.00
COMPUTER SUPPLIES				
Total Supplies	**304.00**	**-595.20**	**-83.20**	**-374.40**
LASER PRINT COPIES	222.00	-153.00	-126.00	-57.00
IN-HOUSE XEROXING	1260.00	-765.00	-630.00	-135.00
COPY CTR/PRINT SHOP	-2606.25	-300.00	-168.75	-3075.00
OFF CAMPUS COPYING	3702.40	1164.80	-1955.20	2912.00
Total Copying	**2568.15**	**-1119.45**	**-1777.95**	**-329.25**
JOHN WILEY	1381.95	-1098.90	-699.30	-416.25
Total Book Publisher	**1381.95**	**-1098.90**	**-699.30**	**-416.25**
MATERIALS	**4285.00**	**-2399.60**	**-2913.80**	**-1028.40**
OVERHEAD	16859.70	-6012.90	-4951.80	5895.00
LRC - Present Matl.	13.50	-130.50	-108.00	-225.00
FACSIMILE (FAX)	4.15	-2.85	-2.10	-0.80
CENTRAL MAIL	31.54	-5.32	-15.96	10.26
Total Univ. Services	**16950.54**	**-5895.84**	**-5404.52**	**5650.18**
EXPRESS MAIL	210.00	-33.00	-111.00	66.00
MARKETING SERVICES	-1170.00	-1690.00	-2780.00	-5640.00
MISC. SERVICES	-34.00	-198.00	-180.00	-412.00
Total Other Services	**-990.00**	**-2205.00**	**-2775.00**	**-5970.00**
PURCHASED SERVICES	**15988.28**	**-12129.04**	**-4134.90**	**-275.66**
BOOKS	-50.40	-181.80	-176.40	-408.60
SUBSCRIPTIONS	205.43	-126.23	-103.95	-24.75
FILMS/VIDEOS	-127.50	-307.50	-240.00	-675.00
DATA/INFO	**23.55**	**-624.08**	**-518.10**	**-1118.63**
FACILITIES	4204.20	-2784.60	-2293.20	-873.60
COMPUTER HARDWARE	750.12	-803.70	-714.40	-767.98
COMPUTER SOFTWARE	-247.90	-118.40	-51.80	-418.10
FURNITURE & EQUIP.	-255.44	-126.48	-104.16	-486.08
TRAVEL	1633.50	-3910.50	-2772.00	-5049.00
CAPITAL	**6150.72**	**-7816.54**	**-5894.44**	**-7560.26**
INPUTS	**68479.67**	**-50615.41**	**-41683.28**	**-23819.02**

* Data has been disguised to ensure confidentiality

system, then, represents an early stage of evolution for a reward system that combines profit-based gainsharing, productivity gainsharing, small group bonuses, and individual lump sum payments/bonuses. The system is designed to create "win-win" situations, and recognize the need for Center level, group level, and individual performance.

The VPC's compensation management system is composed of University components and VPC specific components. Table 4-8 depicts the University's components of the VPC's compensation management system. Note that, except for the Director, Co-Director, and Extension Associates, the University system contains no direct financial incentives and/or performance related bonuses for VPC staff members. The Director and Co-Director are faculty members and, under the University's system, faculty members are allowed to participate in consulting activities and pursue outside employment provided that (VPI&SU Faculty Handbook, Section 2.13):

1. The activity is not part of their normal responsibility to the University and is not normally provided through the University's Extension Division or other component of the University;
2. The work undertaken contributes to their professional development; and,
3. The work can be accomplished without interference with their assigned duties and does not ordinarily involve more than one day per week and does not exceed five days in any five week period.

In addition, an evaluation of every faculty's members performance is held each year (VPI&SU Faculty Handbook, Section 2.8). Faculty members' performance in managing, directing, and contributing professionally to the

Table 4-8. University Components of the VPC Compensation Management System

Pay Elements \ Title	DIRECTOR	CO-DIRECTOR	ADMIN. ASSISTANT	OFFICE SERVICE AIDE	SERVICE ASST.	SERVICE SPECIAL.
BASE	$ (academic year)	$ (academic year)	Annual Salary= $ (Step 2) Wage rate=	Annual Salary= $ (Step 1) Wage rate=	Annual Salary= $ (Step 1) Wage rate=	Annual Salary= $ (Step 1) Wage rate=
FRINGES	During the academic year: 23% of base. During the summer: 6.5% of base.	During the academic year: 23% of base. During the summer: 6.5% of base.	28% of base: Required and Optional benefits available	NONE	NONE (if classified wage position)	28% of base: Required and Optional benefits available
INCENTIVES	• Annual Merit Salary Increases • Teaching Awards • 1 day/week for consulting, writing, personal research, etc.	• Annual Merit Salary Increases • Teaching Awards • 1 day/week for consulting, writing, personal research, etc.	NONE	NONE	NONE	NONE
LEAVES	• Educational leave • Military leave • Civil leave • Annual leave • Sick leave • Leave without pay • Special leave	• Educational leave • Military leave • Civil leave • Annual leave • Sick leave • Leave without pay • Special leave	Classified salaried employees are entitled to several types of leave. See Section 3 for details	NONE	NONE	NONE

Table 4-8 Continued. University Components
of the VPC Compensation Management System

Title / Pay Elements	GRADUATE RESEARCH ASSISTANTS				UGAs	EXTENSION ASSOCIATES	
	STEP 1	STEP 2	STEP 3	STEP 4		VIRGINIA	INTERNATIONAL
BASE	$ /mth $ /yr	$ /mth $ /yr	$ /mth $ /yr	$ /mth $ /yr	$ during academic year and $ during the summer	$ (twelve months)	$ (twelve months)
FRINGES	Possibly a tuition waiver thru the IEOR dept	Possibly a tuition waiver thru the IEOR dept	Possibly a tuition waiver thru the IEOR dept.	Possibly a tuition waiver thru the IEOR dept.	NONE	During the academic year: 23% of base. During the summer: 6.5 % of base	During the academic year: 23% of base. During the summer: 6.5% of base:
INCENTIVES	NONE	NONE	NONE	NONE	NONE	• 1 day/week for consulting, writing, personal research. • Annual Merit Salary Increases	• 1 day/week for consulting, writing, personal research. • Annual Merit Salary Increases
LEAVES	NONE	NONE	NONE	NONE	NONE	• Educational Leave • Military Leave • Civil Leave • Annual Leave • Sick Leave • Leave without pay • Special leave	• Educational leave • Military leave • Civil leave • Annual leave • Sick leave • Leave without pay • Special leave

VPC is considered in this evaluation. Salary adjustments are based on merit and, therefore, are not automatic. Recommendations for salary adjustments originate with the Department Head and are reviewed by the Dean, the University Provost, and the President.

One of the goals, then, of VPC specific components of the compensation management system is to "fill the gaps" left by University components. The VPC's components of the compensation management system are depicted in Table 4-9. The VPC's performance sharing system is the mechanism for administering performance related bonuses. A Performance Council administers the system. Members of this council are: the Director, Co-Director, Administrative Assistant, and three rotating staff members. The council's role with respect to each component is discussed along with that component.

4.2.4.1 Productivity Gainsharing. The TFPMM is used to calculate the dollar effects on profits due to changes in productivity. To date, there are a total of 29 inputs to the TFPMM. However, only certain inputs (those that are directly controllable) are used for productivity gainsharing (Table 4-10).

Table 4-11 depicts an example gainsharing calculation based on column 17 of the TFPMM. Labor and material productivity gains are shared 50-50 between the Center and participants. Of the Center's share of total participant labor productivity gains, 50 percent is set aside into an account to fund base pay increases for the upcoming fiscal year and to fund education and training expenses; in our example, this amounts to $5,261.64 (50 percent of $10,523.28). Capital productivity gains are shared 80-20; this is consistent with the sharing ratio on capital advocated by Fein (1981).

Table 4-9. VPC Components of the Compensation Management System

Title / Benefits	FACULTY	ADMIN. ASSISTANT	OFFICE SERV. AIDE	GRAs	UGAs	EXTENSION ASSOCIATES
DIRECT FINANCIAL		• $125/mth •Performance sharing	• Performance sharing	• Performance sharing	• Performance sharing	
INDIRECT FINANCIAL AND NON-FINANCIAL	• VPC Christmas dinner • Educational training • Conferences	• VPC Christmas dinner • Educational training • Conferences	• VPC Christmas dinner • Educational training • Conferences	• VPC Christmas dinner • Educational training • Conferences • Professional development opportunities	• VPC Christmas dinner • Educational training • Conferences • Professional development opportunities	• VPC Christmas dinner • Educational training • Conferences • Professional development opportunities

Table 4-10. Inputs Used for Center Level Productivity Gainsharing

INPUTS	INCLUDED IN GAINSHARING CALCUATION
MANAGEMENT LABOR	
ADMIN. LABOR	X
GRA LABOR	X
UGRA LABOR	X
Total In-house Labor	
ASSOCIATE LABOR	
CONSULTING LABOR	
PROGRAMMERS	
Total Purch. Labor	
LABOR	
OFFICE SUPPLIES	X
COMPUTER SUPPLIES	X
Total Supplies	
LASER PRINTER COPIES	X
IN-HOUSE XEROXING	X
CAMPUS COPY & PRINT SHOP	X
OFF CAMPUS COPYING	X
Total Copying	
JOHN WILEY BOOK PUB.	
Total Book Publisher	
MATERIALS	
OVERHEAD PAID	
UNIV . LRC SERVICES	X
FACSIMILE (FAX)	X
CENTRAL MAIL	X
Total Univ. Services	
EXPRESS MAIL	X
MARKETING SERVICES	
MISC. SERVICES	
Total Other Services	
PURCHASED SERVICES	
BOOKS	
SUBSCRIPTIONS	
FILMS/VIDEOS	
DATA/INFO	
FACILITIES RENT	
COMPUTER HARDWARE	X
COMPUTER SOFTWARE	X
FURNITURE & EQUIP.	X
TRAVEL	X
CAPITAL	

Table 4-11. VPC Productivity Gainsharing Calculation for Example Quarter*

	COMPANYS SHARE PRODUCTIVITY	PARTICIPANTS SHARE PRODUCTIVITY	TO RESERVE POOL	AVAILABLE FOR DISTRIBUTION
SPONSORED PROGRAMS				
DEVELOPMENT FOUND.				
REPORTS				
BOOKS				
POSITION PAPERS				
QPM SUBS. U.S.				
QPM BACK ISSUES				
QPM SUBS. INT'L.				
MONOGRAPHS				
PRFORM SOFTWARE				
SCORBORD SOFTWARE				
PRFORM DEMO				
SCORBORD DEMO				
PR & SCOR DEMO				
ASSESS INSTRUMENT				
MISC.				
DONATIONS/GIFT				
OUTPUTS				
MANAGEMENT LABOR	22,481.63	0.00		
ADMIN. LABOR	1,699.25	1,699.25		
GRA LABOR	8,601.60	8,601.60		
UGRA LABOR	222.44	222.44		
Total In-house Labor	**33,004.91**	**10,523.28**		
ASSOCIATE LABOR	-2,313.22	0.00		
CONSULTING LABOR	248.97	0.00		
PROGRAMMERS	1,010.17	0.00		
Total Purch. Labor	**-1,054.08**	**0.00**		
LABOR	**31,950.83**	**10,523.28**	**2,630.82**	**7,892.46**
OFFICE SUPPLIES	-11.91	-11.91		
COMPUTER SUPPLIES				
Total Supplies	**-11.91**	**-11.91**		
LASER PRINT COPIES	111.13	111.13		
IN-HOUSE XEROXING	628.21	628.21		
COPY CTR/PRINT SHOP	-1,303.16	-1,303.16		
OFF CAMPUS COPYING	1,856.16	1,856.16		
Total Copying	**1,292.35**	**1,292.35**		
JOHN WILEY	1,381.76	0.00		
Total Book Publisher	**1,381.76**	**0.00**		
MATERIALS	**2,662.20**	**1,280.44**	**320.11**	**960.33**
OVERHEAD	16,900.87	0.00		
LRC - Present Matl.	6.72	6.72		
FACSIMILE (FAX)	4.15	0.00		
CENTRAL MAIL	31.54	0.00		
Total Univ. Services	**16,943.28**	**6.72**		
EXPRESS MAIL	104.48	104.48		
MARKETING SERVICES	-1,170.11	0.00		
MISC. SERVICES	-34.02	0.00		
Total Other Services	**-1,099.65**	**104.48**		
PURCHASED SERVICES	**15,843.62**	**111.21**	**27.80**	**83.41**
BOOKS	-50.62	0.00		
SUBSCRIPTIONS	205.40	0.00		
FILMS/VIDEOS	-127.59	0.00		
DATA/INFO	**27.19**	**0.00**	**0.00**	**0.00**
FACILITIES	4,206.17	0.00		
COMPUTER HARDWARE	593.14	148.28		
COMPUTER SOFTWARE	-198.35	-49.59		
FURNITURE & EQUIP.	-205.13	-51.28		
TRAVEL	1,306.35	326.59		
CAPITAL	**5,702.18**	**374.00**	**93.50**	**280.50**
INPUTS	**56,186.02**	**12,288.93**	**3,072.23**	**9,216.70**

* Data has been disguised to ensure confidentiality

The use of 50 percent of the Center's share of labor productivity gains to fund next year's base pay increases is a form of "buy-back" that recognizes the base should change every year (regardless of whether or not you've exceeded a specified ceiling) and avoids a problem of buy-back schemes advocated by Fein (1981) with Improshare and Dar-el (1986) with Shred-Cost: difficulty in buying-back the base as a lump-sum (Thor and Bullock, November 1986, panel discussion at the American Productivity Center's Conference on Pay for Performance). This approach also provides a mechanism to allow productivity gains to drive base pay increases.

The reason the base should change every year is the goal is constant improvement: do more tomorrow better than you did today. Performance over last year should be the benchmark. To use a base more than a year old is sending a message that constant improvement is not the goal. For example, last year you could have had a ten percent improvement over the base year; this year you could have had a five percent improvement. You got worse, but the gainsharing plan still paid. This type of approach is not promoting the levels of performance needed to beat the new competition. The point is, you've already performed better than last year, why still use last year as the base.

Changing the base year every year requires constant performance improvement above and beyond the levels of performance that resulted in bonuses being earned in previous years. On the surface, it appears that the company is taking away potential bonus earnings and not giving anything back. However, by pouring labor productivity and price recovery gains back into base pay increases and education and training, the company is, in effect, buying back part of the base.

But what if productivity in the current year falls below that of the base? In this case, the base should be left unchanged (assuming the base still reflects market conditions). The focus is on excellence, not sub-standard performance. Again the goal is to get better. Every organization has setbacks. When a football team has a losing season after winning the championship the prior season, what's their goal for next season? First place or second from last place?

The participants share of productivity gains are summed to arrive at the total bonus sum (see Table 4-11). In our example, this amounted to $12,289.93. 25 percent of this total bonus sum, $3,072.23, goes to a reserve pool and is added (subtracted) from the existing balance; the purpose of the reserve pool is to compensate the Center for periods where performance fell below that of the base. Of the bonus available for distribution, 70 percent is used for Center level productivity gainsharing; 20 percent is used for small group bonuses; and, 10 percent is used for individual lump sum bonuses. So, in our example, of the $9,216.70 available for distribution: $6,451.69 drives Center level productivity gainsharing; $1,,843.34 drives small group bonuses; and, $921.67 drives individual lump sum bonuses.

The reason behind using productivity gains at the Center level to drive lower level reward systems is to ensure we're not paying groups and/or individuals twice for the same performance (see Sections 4.2.4.2 and 4.2.4.3).

The productivity gainsharing bonus is distributed as a percent of participating payroll. Each participant's bonus, then, is equal to the bonus percentage times their base pay. In our example, participating payroll is $26,020.80. The bonus, as a percent of participating payroll, is 24.8 percent

($6,451.69/$26,020.80). Bonuses are paid out in cash. The Center's compensation management committee is now considering allowing graduate students and undergraduate students the option of taking the bonus in the form of a tuition waiver (i.e. indirect financial); this policy, however, has not been set yet.

4.2.4.2 Small Group Bonuses. Small group gainsharing is increasing in popularity (see O'Dell, 1987). The problem with many of these small group gainsharing systems is two-fold. First, the gains may not be true gains; performance is measured relative to goals that have been translated to a dollar amount and tied to a gainsharing fund (see Thor, 1987). Often, these dollar amounts are best guesses and not data based. Second, cost-benefit analysis is used to determine, on paper, whether a gain has occurred. Cost-benefit tracking to validate the gain is poorly done, if done at all, and is often incorrect due to the nature of cost accounting systems. (Eiler, Goletz, and Keegan, 1982; Kaplan, 1984). Oftentimes, costs shift from one area to another, rather than disappear bottom line (Eiler, Goletz, and Keegan, 1982). Third, there are interdependencies among groups in any organization. If you were to draw a Venn diagram of each small group's contribution to total performance, we would see overlap. Small group gainsharing often does not recognize this overlap exists and pays each small group bonus independently of others.

The VPC's small group bonuses avoids these problems by letting Center level productivity gains drive these bonuses. 20 percent of the Center level gains are set aside to fund small group bonuses Here, the Performance Council plays a key role. Performance of groups is reviewed using Level 2 reports.

The Council then distributes the small group bonus pool to eligible groups. Group members then decide how to split the bonus.

4.2.4.3 Individual Lump-Sum Bonuses. The performance of anybody is the combination of many factors: the individual, the people the individual works with, the job, materials, equipment, customers, management, and environmental conditions (Deming, 1986). These factors will produce unbelievably large differences between people. Deming (1987) depicts the causes of individual performance with a simple equation:

$$y + a_y = p_a$$

where y is the performance of a management system y;

a_y is the interaction of individual a within the system y; and,

p_a is the performance of individual a.

Deming's point is this: you have two unknowns (y and a_y) and one equation -- the equation cannot be solved. In addition, the apparent differences between people arise almost entirely from the action of the system that they work in, not from the people themselves. The problem is that most of our performance appraisal and merit rating systems ignore this fundamental point (see Kanter and Brinkerhoff, 1980). To determine which part of 'p_a' is 'y' and which part is 'a_y' we must collect data on 'p_a,' develop control charts, and track over time. Individual performance falling outside either the upper or lower control limits indicates the presence of assignable causes (Grant and Leavenworth, 1972).

For example, consider the "red bead" experiment cited by Deming (1986, pages 110-112). Six people take part in this simple experiment. Each person is given a jar containing 4000 beads (20 percent red and 80 percent white) and

asked to draw, blindfolded, a sample of 50 beads. The goal is to produce white beads; customers will not accept red beads. The results are:

Name	Number of red beads produced
Mike	9
Peter	5
Terry	15
Jack	4
Louise	10
Gary	8
Total	51

Simple inspection of the number of red beads produced indicates people vary greatly in performance. However, if we apply statistical theory to this data set we find all six people fall within the calculated limits of variation that could arise from the system they work in:

$x = 51/6 = 8.5$ (average number of red beads per worker)

$p = 51/(6 \times 50) = 0.17$ (average proportion red)

Calculation of limits of variation attributable to the system:

Upper and lower limit = $x \pm 3\sqrt{x(1-p)}$

Upper limit = 16 and lower limit = 1

There is no evidence in this data that Jack, who produced 4 red beads, will be in the future a better performer than Terry, who produced 15 red beads. Everyone accordingly should receive the same raise except for differences in seniority (Deming, 1986).

The VPC plans to incorporate this concept in determining individual lump sum bonuses. The ten percent of the bonus pool remaining after Center level gainsharing and small group bonuses is for individual lump sum

bonuses. The Performance Council will review Level 1 reports (presented differently for the purpose of evaluation - see Meyer, Kay, and French, 1965 - note: the compensation management committee has not yet designed this form) and plot data on a control chart. Anyone below the lower control limit does not receive a bonus (again, unless the assignable cause of poor performance is beyond the individual's control). Everyone inside the control limits receives the same bonus. Anyone above the upper control limit receives an additional 10 percent bonus. The bonus is calculated as a percent of participating payroll.

4.2.4.4 "Profit" based Gainsharing

Profit based gainsharing differs from profit sharing in one subtle, but very important way. In profit based gainsharing, a profit benchmark is established and, if profits exceed the benchmark, the profits are shared between the company and participants. In profit sharing, no profit benchmark is established; a certain percentage of whatever profit is made is set aside to distribute to participants.

The VPC's form of "profit" is generated surpluses from products and services deposited in a university development foundation account. Monies deposited in this account are used to finance internal development projects (e.g. management support system development, resource center development, total quality management research, educational material development, etc.); professional development (e.g. payment of education and training expenses, conference travel, etc.) and "give-away" or partial cost break-even extension activities within the state (e.g. presentations at conferences and professional association meetings; Senate Productivity Award workshop and conference for

the State of Virginia). The account balance also provides operating funds in times when business is slow.

The VPC's profit-based gainsharing formula is based on three pieces of information: revenues, costs, and progress towards Development Foundation surpluses. The difference between revenues and costs is the surplus or "profit"; the difference between this profit and the fiscal year profit goal, if positive, represents the gain. What this formula represents, then, is "profit based" gainsharing; through the planning and budgeting process, an acceptable level for Center-level profits was established and any surpluses over and above this benchmark results in gainsharing. If the Center has exceeded their development foundation account goal, 25 percent of the balance over the goal amount is shared. If the Center falls short of the goal, reserve pool funds are used to compensate the fund up to the goal. 100 percent of the remaining reserve pool funds are distributed to participants as a percent of participating payroll. Table 4-12 depicts an example calculation under two conditions: 1) surpluses exceeding the goal and 2) surpluses falling short of the goal.

The purpose of fiscal year-end profit based gainsharing is two-fold. First, if the Center wins bottom line, everyone wins. Second, if the Center loses, everyone feels the loss. Again, why have the players win while the team loses.

In summary, the purpose of the VPC's performance sharing system is to:

- Share rewards
- Create organizational commitment, not financial attachment and discourage self-serving beliefs, attitudes, intentions, and behaviors.
- Provide flexibility in and help control payroll costs

Table 4-12. Example VPC "Profit-based" Gainsharing Calculations*

Year in which goal was exceeded		
Revenues	$765,800.00	
Less Costs	$515,500.00	includes performance sharing bonuses
Surplus (Profit)	$250,300.00	
Target Surplus	$175,000.00	
Gain (Loss)	$75,300.00	
Available for Distribution (25% of Gain)	$18,825.00	
Year in which goal was not met		
Revenues	$619,850.00	
Less Costs	$418,500.00	includes performance sharing bonuses
Surplus (Profit)	$201,350.00	
Target Surplus	$212,220.00	
Gain (Loss)	($10,870.00)	
Reserve Fund Balance	$17,500.00	
Available for Distribution	$6,630.00	

* Data has been disguised to ensure confidentiality

- Provide a mechanism for productivity gains to drive the next fiscal year's payroll increases
- Communicate to people that the VPC works as a team and wins/loses as a team.

As such, it represents an early prototype of what reward systems in the organization of the future should/must look like.

4.3 LESSONS LEARNED

4.3.1 A Methodology for Implementing the TFPMM

The process of productivity measurement seems simple enough at the outset. You simply assign outputs from the system to the numerator and the inputs used to produce those outputs to the denominator. This process, however, is not as easy as it appears for several reasons (Sink, 1985a). Most systems:

- Have multiple tangible and intangible products or services;
- Are faced with continual price and cost changes;
- Are redesigning products, services, and processes on an ongoing basis;
- Must consider other performance measures;
- Have a variety of categories, types, and levels of input resources, each with their own characteristics.

The methodology described here for implementing the TFPMM is based on the Xaloy and VPC experience. It is designed to assist managers with the process of productivity measurement. The management team responsible for the performance of the system being measured should complete each step; staff and support personnel should be used when and where appropriate.

Step 1 - Planning for Improved Measurement Systems

Planning for improved measurement systems is a sub-component of the performance improvement planning process. It involves systematically thinking through the design and development of measurement systems that will support improvement efforts over the next two to five years (see Rossler, 1987, and Sink, Tuttle, and Dhir, 1988, for a tutorial on planning for improved measurement systems). If a performance improvement planning process similar to the one described by Sink, Tuttle, and Dhir (1988) was executed, the management team responsible for measurement system design will have a completed IOA chart (IOA is a necessary step in the design of a measurement system - see Sink, 1985a. For information on "how-to-do" IOA see Sink, (1985a, 1986/1987), Sink and Rossler (1987), Sink, Tuttle, and Dhir (1988), and Chapter 3, Section 3.5). and knowledge of specific goals, objectives, and action items to improve the performance of the system along with key performance indicators (KPI's). The KPI's tell the management team the impact (positive, negative, or indifferent) these interventions are, in fact, having on system performance. Planning for improved measurement systems addresses the question: what measurement tools will we need in the next 2-5 years to evolve these KPI's into an effective instrument panel to let the management team know how they are doing. For example, the management team may identify productivity as a KPI. What measurement tools do we need to provide this information? (e.g. plant level productivity measurement models, white collar productivity measurement tools, new cost accounting structure); in addition to the TFPMM, there are number of other firm and plant level measurement tools available (APC, 1978; Davis 1955; Britney and Kudar, 1987; Cosgrove 1987; Craig

and Harris 1973; Miller 1984; Sumanth 1984; van Loggerenberg and Cucchiaro 1981-82). Each of these techniques has their advantages and disadvantages. The decision to use one over the others is based on the type of organization being measured, data availability, and purpose for measurement (see Sink, Tuttle, and DeVries, 1984).

Before moving on to describe Step 2 of the methodology, a pragmatic issue with respect to planning needs to be addressed: how much time and resources does an organization want to devote to planning. Planning for sub-components of a management system - for example, measurement systems, reward systems - could consume an organization's resources and paralyze it. Both Xaloy and VPC management allowed measurement system development to be guided by the overall strategic plan; the VPC also took this approach with reward system design. Therefore, a formal planning process, facilitated in a retreat-like setting, is not necessary for this important first step.

Step 2 - Base Period Selection

Productivity is a relative measure. Selecting a base period, therefore, is a critical decision since it establishes the period against which the current period will be compared. Therefore, the base period should be as representative of normal business conditions as possible. The selection of a base period depends on (adapted from Sumanth, 1984):

- whether the quality of outputs has changed;
- the frequency with which outputs change (i.e.product/service mix, design changes, new products/services);
- the demand pattern for output (seasonal, trend, horizontal, cyclical, unpredictable);

- shifts among input resources;
- the price of outputs;
- data availability;
- whether the quality of inputs has changed;
- new inputs (e.g. material substitutions, new equipment, hiring); and,
- changes in cost drivers and factor dominance.

Standards, estimates, historical data, and/or goals can be used in establishing the base period. Some combination of these data sources is probably the best approach; the reason being that data will be available for some inputs and outputs and not others, and some changes in inputs and outputs are certain to happen (e.g. new product design).

There is a strong case for using a recent period as the base for several reasons. First, from a pragmatic business standpoint, the purpose of productivity measurement is to improve business operations and competitive position so as to enhance accomplishment of longer-term goals of survival, profitability, missions, and so forth. Second, adjustments made for new products, changes in quality, the character of old products/services, and shifts in the quality and kinds of inputs are reduced. In addition the least difficulty is likely to be encountered in assembling the necessary data.

The measurement scope (or measurement frequency) selected should reflect a representative "snapshot" of performance for the system you are measuring. Typical scopes for the TFPMM are monthly, quarterly, annually, and annually updated quarterly.

Step 3 - Design and Engineer Data Collection Strategy

Step 3 involves thinking through data needs. A strategy for collecting data for both the base and current period needs to be developed. Individuals not on the design team that will be involved in the data collection effort need to be brought up to speed on the model. Cost driver analysis can be used to target inputs where time and effort should be spent collecting data. A data collection work sheet needs to be developed so there is continuity from period to period.

Step 4 - Collect Data and Track Over Time

The management team needs to collect data and track performance over time to ensure the measure:

1. Is a valid measure of productivity over time;
2. Is reliable;
3. Is precise and accurate;
4. Is an accepted measure of productivity;
5. Helps to create line of sight;
6. Is easy to administer;
7. Is flexible enough to meet changing internal and external conditions.

Data collected in this step can be used to refine the base period, refine and develop systems for data collection, and gain expertise with the TFPMM.

Step 5 - Visibility System Development

The focus of this step is visibility system design and development. Managers should be exposed to the model's output for a six to twelve month period (depending on measurement scope); this would allow people to gain a

better understanding of the model, learn cause-and-effect relationships, and develop preferences for how they would like the data portrayed. Workshops can be held to educate various audiences and elicit feedback to improve the quality of information being provided by the model. Surveys can be conducted to evaluate, assess, and analyze people's understanding of and use of the model's output. Integration with existing visibility systems should also take place.

Step 6 - Integration with Existing Measurement and Management Systems

Step 6 involves formulating answers to several key questions/issues as to how the TFPMM could/should:

- Integrate with and support the business planning and the performance improvement planning process.
- Integrate with existing decision support systems;
- Support existing and potential reward systems (e.g. productivity gainsharing, management bonuses);
- Be monitored and evaluated and refined and changed.

Step 7 - Continuous Evolution and Development

The systems we manage are dynamic and changing. As a result, the design, development, implementation, and continuing evolution of a measurement effort is not a simple or an easy thing to do. It requires patience, persistence, consistence, and hard work. However, we must apply these newer measurement techniques in such a way that the instrument panel which we use to assess the performance of our operations will be appropriate for these operations.

4.3.2 A Problem with How Outputs and Inputs are Aggregated

There appears to be a problem with how you aggregate outputs and inputs in the TFPMM. Table 4-13 shows a TFPMM run for the same example quarter as shown in Table 4-7. The difference between Table 4-13 and Table 4-7 is how the outputs have been aggregated. Table 4-7 considers each of the VPC's 17 outputs individually; the TFPMM run in Table 4-13 takes these 17 outputs and groups them into 5 major categories -- 1) research, consulting, gifts, and miscellaneous; 2) books, reports, and papers; 3) software sales; 4) QPM subscriptions; and, 5) instruments. The level of aggregation for inputs is the same in Table 4-13 as the level of aggregation for inputs in Table 4-7.

Table 4-14 compares the quantity, price, and value change ratios for the output (columns 7, 8, and 9) and the dollar effects on profits (columns 17, 18, 19, and 20) for the two runs. The level of aggregation affects the quantity and price weighted change ratios and, therefore, effects the dollar values obtained for productivity, price recovery, and joint effects. The reason dollar effects change is because quantity and price change ratios are used to calculate them (see Figure 4-4 for TFPMM formulas).

Why does the TFPMM produce different results depending on how you aggregate inputs and outputs? Common sense would suggest that if we're using the same input and output data, it shouldn't matter how you aggregate inputs and outputs. A simple example, using a subset of the output data from Table 4-7 and 4-13 demonstrates why this is not the case (a special thanks to Mr. Antonio Pineda and Mr. Jordan Tenjeras for their assistance in isolating the cause of this problem).

Table 4-13.VPC TFPMM Run for Example Quarter
with Outputs Grouped into 5 Major Categories*
Columns 1-6

	BASE PERIOD			CURRENT PERIOD		
	1	2	3	4	5	6
	QUANTITY	PRICE	VALUE	QUANTITY	PRICE	VALUE
RESEARCH & CONSULTING	7.0	13948.57	97639.99	8.0	10832.00	86656.00
BOOKS, REPORTS, PAPERS	46.0	30.21	1389.66	56.0	23.15	1296.40
JOURNAL SUBS. (QPM)	45.0	42.78	1925.10	43.0	28.52	1226.36
SOFTWARE SALES	10.0	259.98	2599.80	16.0	227.18	3634.88
INSTRUMENTS	10.0	5.00	50.00	2.0	5.00	10.00
OUTPUTS			**103604.55**			**92823.64**
MANAGEMENT LABOR	780.0	38.02	29655.60	836.0	34.19	28582.84
ADMIN. LABOR	910.0	6.35	5778.50	1130.0	6.11	6904.30
GRA LABOR	2730.0	7.26	19819.80	2626.0	7.45	19563.70
UGRA LABOR	130.0	3.25	422.50	101.0	3.25	328.25
Total In-house Labor			**55676.40**			**55379.09**
ASSOCIATE LABOR	5.0	1250.00	6250.00	11.0	1273.00	14003.00
CONSULTING LABOR	3.0	100.00	300.00	3.0	59.00	177.00
PROGRAMMERS	3.0	225.00	675.00	1.0	500.00	500.00
Total Purch. Labor			**7225.00**			**14680.00**
LABOR			**62901.40**			**70059.09**
OFFICE SUPPLIES	2.0	70.00	140.00	4.0	164.24	656.96
COMPUTER SUPPLIES	3.0	60.00	180.00			
Total Supplies			**320.00**			**656.96**
LASER PRINTER COPIES	6000.0	0.05	300.00	6534.0	0.05	326.70
IN-HOUSE XEROXING	30000.0	0.05	1500.00	29768.0	0.05	1488.40
CAMPUS COPY & PRINT SH	5.0	125.00	625.00	30.0	120.79	3623.70
OFF CAMPUS COPYING	16.0	260.00	4160.00	15.0	53.43	801.45
Total Copying			**6585.00**			**6240.25**
JOHN WILEY BOOK PUB.	50.0	33.30	1665.00	50.0	38.30	1915.00
Total Book Publisher			**1665.00**			**1915.00**
MATERIALS			**8570.00**			**8812.21**
OVERHEAD PAID	11790.0	1.00	11790.00	4673.48	1.00	4673.48
UNIV. LRC SERVICES	10.0	45.00	450.00	18.0	35.12	632.16
FACSIMILE (FAX)	1.0	5.00	5.00	1.0	5.31	5.31
CENTRAL MAIL	1.0	38.00	38.00	1.0	23.87	23.87
Total Univ. Services			**12283.00**			**5334.82**
EXPRESS MAIL	15.0	20.00	300.00	17.0	11.93	202.81
MARKETING SERVICES	1.0	1000.00	1000.00	3.0	2178.84	6536.52
MISC. SERVICES	2.0	100.00	200.00	4.0	148.25	593.00
Total Other Services			**1500.00**			**7332.33**
PURCHASED SERVICES			**13783.00**			**12667.15**
BOOKS	9.0	20.00	180.00	19.0	30.00	570.00
SUBSCRIPTIONS	18.0	13.75	247.50	18.0	13.75	247.50
FILMS/VIDEOS	1.0	750.00	750.00	2.0	672.50	1345.00
DATA/INFO			**1177.50**			**2162.50**
FACILITIES RENT	1680.0	3.25	5460.00	1780	3.25	5785.00
COMPUTER HARDWARE	9854.0	0.18	1786.00	13941	0.17	2310.00
COMPUTER SOFTWARE	2.0	185.00	370.00	5.0	149.36	746.80
FURNITURE & EQUIP.	3443.0	0.07	248.00	9860	0.07	726.00
TRAVEL	18.0	275.00	4950.00	27.0	351.11	9479.97
CAPITAL			**12814.00**			**19047.77**
INPUTS			**99245.90**			**112748.72**

* Data has been disguised to ensure confidentiality

Table 4-13 Continued. VPC TFPMM Run for Example Quarter
with Outputs Grouped into 5 Major Categories*
Columns 7-11

	WEIGHTED	CHANGE	RATIOS	COST/REVENUE RATIOS	
	7	8	9	10	11
	QUANTITY	PRICE	VALUE	BASE	EXAMPLE QTR
RESEARCH & CONSULTING	1.14	0.78	0.89		
BOOKS, REPORTS, PAPERS	1.22	0.77	0.93		
JOURNAL SUBS. (QPM)	0.96	0.67	0.64		
SOFTWARE SALES	1.60	0.87	1.40		
INSTRUMENTS	0.20	1.00	0.20		
OUTPUTS	**1.15**	**0.78**	**0.89**		
MANAGEMENT LABOR	1.07	0.90	0.96	0.2862	0.3079
ADMIN. LABOR	1.24	0.96	1.19	0.0558	0.0744
GRA LABOR	0.96	1.03	0.99	0.1913	0.2108
UGRA LABOR	0.78	1.00	0.78	0.0041	0.0035
Total In-house Labor	**1.05**	**0.95**	**1.00**	**0.5374**	**0.5966**
ASSOCIATE LABOR	2.20	1.02	2.24	0.0603	0.1509
CONSULTING LABOR	1.00	0.59	0.59	0.0029	0.0019
PROGRAMMERS	0.33	2.22	0.74	0.0065	0.0054
Total Purch. Labor	**1.98**	**1.11**	**2.20**	**0.0697**	**0.1581**
LABOR	**1.15**	**0.97**	**1.12**	**0.6071**	**0.7548**
OFFICE SUPPLIES	2.00	2.35	4.69	0.0014	0.0071
COMPUTER SUPPLIES					
Total Supplies	**0.88**	**1.03**	**0.90**	**0.0031**	**0.0071**
LASER PRINTER COPIES	1.09	1.00	1.09	0.0029	0.0035
IN-HOUSE XEROXING	0.99	1.00	0.99	0.0145	0.0160
CAMPUS COPY & PRINT SH	6.00	0.97	5.80	0.0060	0.0390
OFF CAMPUS COPYING	0.94	0.21	0.19	0.0402	0.0086
Total Copying	**1.44**	**0.49**	**0.71**	**0.0636**	**0.0672**
JOHN WILEY BOOK PUB.	1.00	1.15	1.15	0.0161	0.0206
Total Book Publisher	**1.00**	**1.15**	**1.15**	**0.0161**	**0.0206**
MATERIALS	**1.33**	**0.64**	**0.85**	**0.0827**	**0.0949**
OVERHEAD PAID	0.40	1.00	0.40	0.1138	0.0503
UNIV. LRC SERVICES	1.80	0.78	1.40	0.0043	0.0068
FACSIMILE (FAX)	1.00	1.06	1.06	0.0000	0.0001
CENTRAL MAIL	1.00	0.63	0.63	0.0004	0.0003
Total Univ. Services	**0.45**	**0.99**	**0.45**	**0.1186**	**0.0575**
EXPRESS MAIL	1.13	0.60	0.68	0.0029	0.0022
MARKETING SERVICES	3.00	2.18	6.54	0.0097	0.0704
MISC. SERVICES	2.00	1.48	2.97	0.0019	0.0064
Total Other Services	**2.49**	**1.77**	**4.41**	**0.0145**	**0.0790**
PURCHASED SERVICES	**0.67**	**1.08**	**0.72**	**0.1330**	**0.1365**
BOOKS	2.11	1.50	3.17	0.0017	0.0061
SUBSCRIPTIONS	1.00	1.00	1.00	0.0024	0.0027
FILMS/VIDEOS	2.00	0.90	1.79	0.0072	0.0145
DATA/INFO	**1.81**	**1.01**	**1.83**	**0.0114**	**0.0233**
FACILITIES RENT	1.06	1.00	1.06	0.0527	0.0623
COMPUTER HARDWARE	1.41	0.94	1.32	0.0172	0.0249
COMPUTER SOFTWARE	2.50	0.81	2.02	0.0036	0.0080
FURNITURE & EQUIP.	2.78	0.97	2.70	0.0024	0.0078
TRAVEL	1.50	1.28	1.92	0.0478	0.1021
CAPITAL	**1.35**	**1.09**	**1.48**	**0.1237**	**0.2052**
INPUTS	**1.14**	**0.97**	**1.11**	**0.9579**	**1.2147**

* Data has been disguised to ensure confidentiality

Table 4-13 Continued. VPC TFPMM Run for Example Quarter
with Outputs Grouped into 5 Major Categories*
Columns 12-16

	PRODUCTIVITY	RATIOS	WEIGHTED	PERFORMANCE	INDEXES
	12	13	14	15	16
	BASE	EXAMPLE QTR	PRODUCTIVITY	PRICE RECVRY	PROFITABILITY
RESEARCH & CONSULTING					
BOOKS, REPORTS, PAPERS					
JOURNAL SUBS. (QPM)					
SOFTWARE SALES					
INSTRUMENTS					
OUTPUTS					
MANAGEMENT LABOR	3.49	3.75	1.07	0.86	0.93
ADMIN. LABOR	17.93	16.62	0.93	0.81	0.75
GRA LABOR	5.23	6.26	1.20	0.76	0.91
UGRA LABOR	245.22	363.41	1.48	0.78	1.15
Total In-house Labor	**1.86**	**2.04**	**1.10**	**0.82**	**0.90**
ASSOCIATE LABOR	16.58	8.68	0.52	0.76	0.40
CONSULTING LABOR	345.35	397.63	1.15	1.32	1.52
PROGRAMMERS	153.49	530.18	3.45	0.35	1.21
Total Purch. Labor	**14.34**	**8.36**	**0.58**	**0.70**	**0.41**
LABOR	**1.65**	**1.64**	**1.00**	**0.80**	**0.80**
OFFICE SUPPLIES	740.03	426.03	0.58	0.33	0.19
COMPUTER SUPPLIES					
Total Supplies	**323.76**	**426.03**	**1.32**	**0.76**	**1.00**
LASER PRINTER COPIES	345.35	365.13	1.06	0.78	0.82
IN-HOUSE XEROXING	69.07	80.15	1.16	0.78	0.90
CAMPUS COPY & PRINT SH	165.77	31.81	0.19	0.80	0.15
OFF CAMPUS COPYING	24.90	30.59	1.23	3.78	4.64
Total Copying	**15.73**	**12.60**	**0.80**	**1.57**	**1.26**
JOHN WILEY BOOK PUB.	62.22	71.65	1.15	0.68	0.78
Total Book Publisher	**62.22**	**71.65**	**1.15**	**0.68**	**0.78**
MATERIALS	**12.09**	**10.45**	**0.86**	**1.21**	**1.05**
OVERHEAD PAID	8.79	25.52	2.90	0.78	2.26
UNIV. LRC SERVICES	230.23	147.27	0.64	1.00	0.64
FACSIMILE (FAX)	20720.91	23857.91	1.15	0.73	0.84
CENTRAL MAIL	2726.44	3139.20	1.15	1.24	1.42
Total Univ. Services	**8.43**	**21.59**	**2.56**	**0.78**	**2.01**
EXPRESS MAIL	345.35	350.85	1.02	1.30	1.32
MARKETING SERVICES	103.60	39.76	0.38	0.36	0.14
MISC. SERVICES	518.02	298.22	0.58	0.52	0.30
Total Other Services	**69.07**	**31.90**	**0.46**	**0.44**	**0.20**
PURCHASED SERVICES	**7.52**	**12.87**	**1.71**	**0.72**	**1.24**
BOOKS	575.58	313.92	0.55	0.52	0.28
SUBSCRIPTIONS	418.60	481.98	1.15	0.78	0.89
FILMS/VIDEOS	138.14	79.53	0.58	0.87	0.50
DATA/INFO	**87.99**	**56.07**	**0.64**	**0.77**	**0.49**
FACILITIES RENT	18.98	20.62	1.09	0.78	0.84
COMPUTER HARDWARE	58.01	47.54	0.82	0.83	0.68
COMPUTER SOFTWARE	280.01	128.96	0.46	0.96	0.44
FURNITURE & EQUIP.	417.76	172.83	0.41	0.80	0.33
TRAVEL	20.93	16.07	0.77	0.61	0.47
CAPITAL	**8.09**	**6.88**	**0.85**	**0.71**	**0.61**
INPUTS	**1.04**	**1.06**	**1.01**	**0.80**	**0.81**

* Data has been disguised to ensure confidentiality

Table 4-13 Continued. VPC TFPMM Run for Example Quarter
with Outputs Grouped into 5 Major Categories*
Columns 17-20

	DOLLAR EFFECTS ON PROFITS			
	17	18	19	20
	PRODUCTIVITY	PRICE RECVRY	JOINT EFFECTS	PROFITS
RESEARCH & CONSULTING				
BOOKS, REPORTS, PAPERS				
JOURNAL SUBS. (QPM)				
SOFTWARE SALES				
INSTRUMENTS				
OUTPUTS				
MANAGEMENT LABOR	2360.53	-3627.70	-787.00	-2054.17
ADMIN. LABOR	-522.18	-1070.58	-142.34	-1735.09
GRA LABOR	3755.62	-4939.78	-649.56	-1833.73
UGRA LABOR	158.21	-94.24	-14.27	49.70
Total In-house Labor	**5752.18**	**-9732.30**	**-1751.02**	**-5731.14**
ASSOCIATE LABOR	-6553.79	-1509.15	-349.06	-8412.01
CONSULTING LABOR	45.42	56.08	-10.13	91.37
PROGRAMMERS	552.19	-975.57	527.21	103.83
Total Purch. Labor	**-5956.19**	**-2428.64**	**-1041.20**	**-9426.03**
LABOR	**-204.01**	**-12160.94**	**-1835.01**	**-14199.96**
OFFICE SUPPLIES	-118.80	-219.71	-193.21	-531.72
COMPUTER SUPPLIES				
Total Supplies	**88.45**	**-79.86**	**-9.75**	**-1.16**
LASER PRINTER COPIES	18.72	-66.92	-10.13	-58.33
IN-HOUSE XEROXING	238.69	-334.60	-50.66	-146.56
CAMPUS COPY & PRINT SH(	-3030.38	-118.37	84.14	-3064.60
OFF CAMPUS COPYING	889.79	2377.17	-347.05	2919.91
Total Copying	**-1883.18**	**1857.29**	**1232.40**	**1206.51**
JOHN WILEY BOOK PUB.	252.07	-621.40	-56.23	-425.56
Total Book Publisher	**252.07**	**-621.40**	**-56.23**	**-425.56**
MATERIALS	**-1542.66**	**1156.03**	**727.22**	**340.59**
OVERHEAD PAID	8901.44	-2629.93	-398.15	5873.36
UNIV. LRC SERVICES	-291.87	-1.58	63.84	-229.61
FACSIMILE (FAX)	0.76	-1.43	-0.17	-0.84
CENTRAL MAIL	5.75	5.65	-1.28	10.12
Total Univ. Services	**8616.08**	**-2627.28**	**-476.75**	**5512.05**
EXPRESS MAIL	5.42	54.13	6.01	65.56
MARKETING SERVICES	-1848.61	-1401.90	-2391.45	-5641.96
MISC. SERVICES	-169.72	-141.11	-103.25	-414.09
Total Other Services	**-2012.91**	**-1488.89**	**-1774.40**	**-5276.19**
PURCHASED SERVICES	**6603.17**	**-4116.16**	**-124.11**	**2362.89**
BOOKS	-172.75	-130.15	-106.08	-408.98
SUBSCRIPTIONS	37.47	-55.21	-8.36	-26.10
FILMS/VIDEOS	-636.46	-89.80	52.17	-674.08
DATA/INFO	**-771.73**	**-275.16**	**-49.85**	**-1096.74**
FACILITIES RENT	501.61	-1217.93	-184.39	-900.71
COMPUTER HARDWARE	-452.99	-287.57	-15.43	-755.99
COMPUTER SOFTWARE	-498.98	-11.25	94.42	-415.81
FURNITURE & EQUIP.	-404.65	-48.33	4.09	-448.90
TRAVEL	-1725.61	-2474.15	-852.15	-5051.91
CAPITAL	**-2580.63**	**-4039.23**	**-849.33**	**-7469.20**
INPUTS	**1504.13**	**-19435.46**	**-2983.35**	**-20914.68**

* Data has been disguised to ensure confidentiality

Table 4-14. Comparison of Output Change Ratios and the Resulting Change in Dollar Effects for Different Levels of Output Aggregation

	Weighted Change Ratios			Dollar Effects on Profits			
	Quantity	Price	Value	Productivity	Price Recovery	Joint Effects	Profits
From Table 4.7: 17 Outputs, Not Aggregated by Product or Service Line	1.83	0.49	0.90	$68,841	($50,635)	($42,033)	($23,826)
From Table 4.13: Outputs Aggregated by Product or Service Line into 5 Major Categories	1.15	0.78	0.89	$1,504	($19,435)	($2,983)	($20,914)

Let us assume we only have two broad categories of outputs, n_1 and n_2. Let n_1 represent the output category QPM Subscriptions composed of QPM - U.S., QPM - International, and QPM - Back Issues. Let n_2 represent the output category Books, Reports, Papers, and Monographs composed of books, reports, papers, and monographs. The quantity and price data for n_1 and n_2 are:

		Quantity	Price	Value	Quantity	Price	Value
n_1	QPM - U.S.	30	45.00	1350.00	26	43.22	1123.72
	QPM - Int'l.	10	55.00	550.00	1	55.00	55.00
	QPM - Back	5	5.00	25.00	16	3.00	48.00
	Total n_1	45	42.78	1925.00	43	28.53	1126.72
n_2	Books	25	45.00	1125.00	24	45.00	1080.00
	Papers	15	5.00	75.00	25	6.77	216.64
	Reports	5	30.00	150.00	0	0	0.00
	Monographs	1	40.00	40.00	0	0	0.00
	Total n_2	46	30.22	1390.00	46	23.15	1296.64

The formula for column 7, quantity change, is (Sink, 1985a, page 155):

$$\sum_{i=1}^{n} Q_{i2}\, p_{i1} \Big/ \sum_{i=1}^{n} Q_{i1}\, p_{i1}$$

The value of output quantity change for n_1 and n_2 using individual quantities and prices is:

$$\frac{[(26)(\$45.00) + (1)(\$55.00) + (16)(\$5.00)] + [(24)(\$45.00) + (32)(\$5.00) + (0)(\$30.00) + (0)(\$40.00)]}{[(30)(\$45.00) + (10)(\$55.00) + (5)(\$5.00)] + [(25)(\$45.00) + (15)(\$5.00) + (5)(\$30.00) + (1)(\$40.00)]}$$

$$= \frac{\$1305 + \$1240}{\$1925 + \$1390} = \frac{\$2545}{\$3315} = 0.77$$

If we consider using group total quantity and average price to calculate quantity change, the formula for column 7 becomes:

$$\left[\sum_{j=1}^{n1} Q_{j2} \left[\frac{\sum_{j=1}^{n1} Q_{j1}\, p_{j1}}{\sum_{j=1}^{n1} Q_{j1}}\right] + \sum_{j=1}^{n2} Q_{j2} \left[\frac{\sum_{j=1}^{n2} Q_{j1}\, p_{j1}}{\sum_{j=1}^{n2} Q_{j1}}\right]\right] \Bigg/ \left[\sum_{j=1}^{n1} Q_{j1} \left[\frac{\sum_{j=1}^{n1} Q_{j1}\, p_{j1}}{\sum_{j=1}^{n1} Q_{j1}}\right] + \sum_{j=1}^{n2} Q_{j1} \left[\frac{\sum_{j=1}^{n2} Q_{j1}\, p_{j1}}{\sum_{j=1}^{n2} Q_{j1}}\right]\right]$$

The value of output quantity change for n_1 and n_2 is:

$$\frac{(43)(\$42.78) + (56)(\$30.22)}{(45)(\$42.78) + (46)(\$30.22)} = \frac{\$1839.54 + \$1692.32}{\$1925.10 + \$1390.12} = \frac{\$3531.86}{\$3315.22} = 1.06$$

The reason for this different result (0.77 vs. 1.06) lies in the fact that in calculating the base period average price for a particular group of outputs, we are obtaining a weighted base period average price but any one particular group's total quantity for the current period reflects a different weighting. So, in calculating quantity change ratios in column 7, we applied a different weighting to a weighted average price by multiplying the weighted average base period price by the current periods total quantity. There are only two conditions under which the use of aggregate quantities and average prices will give the same quantity and price change ratios as individual quantities and prices:

1. When the average price is a simple, not weighted, average.
2. When the current period quantities for each individual input or outputs equals the corresponding base period input or output quantities.
3. When the distribution of current period quantities of inputs or outputs is simply an order of magnitude different than the distribution of the corresponding base period quantities of inputs or outputs.

This finding has serious implications for TFPMM application in any organization. First, for certain inputs, such as tooling and office supplies, the only practical way of capturing these in the model is use quantity and value and back into an average price or use price indexing and back into an average quantity. This however, creates the same problem just identified. Second, how

you aggregate inputs and outputs affects the productivity and price recovery dollar effects. This creates a serious dilemma when trying to use the TFPMM for gainsharing. Depending on how you capture inputs and outputs, you could be paying for something you're not getting or getting something you're not paying for.

A possible solution to this problem is found in the work of Hayzen (1987). Hayzen uses "new" quantity and prices to calculate the change in productivity and price recovery whereas the TFPMM defines productivity using base period price weighting and price recovery using base period quantity weighting Hayzen's model defines a value $q_{np} * p_{np}$ which is the value of output at new period quantities and prices had productivity and price recovery remained unchanged from the base period; changes in the current period are then based on values for quantities and prices had productivity and price recovery remained constant. What Hayzen's approach does for us is ensure we are not using a different weighting or applying a different distribution of quantity and price data to this period's quantity and price data. A problem with Hayzen's approach is the changes in joint effects become a part of the price recovery component. Further research and development will need to take place to resolve these problems.

4.3.3 Summary Observations and Comments

1. Involve key individuals early in the process of designing, developing, and implementing a TFPMM application and TFPMM based gainsharing. The design team should consist of an accountant, an industrial engineer, an information systems specialist, and one or two managers who are very knowledgeable about the system being measured.

2. A thorough IOA must be done for the unit of analysis (see Sink, 1985a); a complete picture of inputs and outputs cannot be obtained without it. Managers and engineers tend to view IOA as a useless exercise. However, IOA is much more difficult than appears at first glance; to do one right, a facilitator, knowledgeable in measurement, should guide the process.
3. Focus on cost drivers during initial design and development of a TFPMM application and TFPMM based gainsharing. The goal should be to capture 80-95 percent of costs (see Frost, Wakely, and Ruh, 1974). As such, the majority of time and resources should be spent on gathering the data for major cost drivers (applying Pareto's 80/20 rule). Quantity and price data for smaller cost categories may not be available; when this occurs, surrogate quantity and price data may have to be used. If surrogates are not possible to obtain, a Scanlon Plan measurement is useful for supplementing TFPMM output.
4. The TFPMM will not meet all of an organizations productivity measurement needs; you will need multiple measurement and evaluation systems to meet your productivity measurement needs and your performance measurement needs (Sink, 1985a).
5. Capital is tricky and complex to measure and capture at the firm and plant level (Thor, 1986). Leaving capital out of the TFPMM in the early stages of design and development is wise if members of the design team do not feel comfortable with capital. We may have approached the Xaloy application differently with respect to capital had someone from accounting been on the design team.

6. A data collection sheet similar to the one shown in Figure 4-7 is necessary to ensure accuracy in data collection.
7. Designing, developing, and implementing a TFPMM application requires knowledge, patience, persistence, and consistence. First, the TFPMM takes considerable expertise to get up and running; the probability of effective implementation decreases without a knowledgeable, experienced person on the design team (Sink, Tuttle, DeVries, and Swaim, 1983). A mistake at Xaloy was not including someone familiar with the accounting system on the design team. Second, you will probably have false starts. An important activity is to continue to collect data, run the model, show the output to management, and continuously refine and evolve the inputs and outputs.
8. The best base period is a mixture of goals, historical data, standards, and estimates. The quality, quantity, price, and mix of inputs and outputs are dynamic. As a result, you will rarely have complete data to construct a base period.
9. Best fit applications of the TFPMM are in organizations with a stable product mix, relatively short process cycle times (i.e. less than one month), and few design and engineering changes (Sink, 1985a). The TFPMM will work in a manufacturing "job shop" environment and a white collar/knowledge worker service firm if you're willing to settle for a less than "perfect" measure for productivity and are willing to be a "chef" with respect to application design. Again, the application is not as straightforward as it would be in a process industry (i.e. food processing), however, it works well with some re-design.

10. Considerable educational intervention on, and experience with, the TFPMM is required before it becomes an effective and integral component of an organization's management support system. Exposing management to TFPMM output, even if the output is not entirely correct, helps facilitate this process.
11. Considerable educational intervention, at all levels, is required if the TFPMM is to be used effectively for gainsharing. The TFPMM is much more complex than traditional gainsharing formulas and calculations.
12. Don't view the TFPMM as a mutually exclusive alternative to gainsharing. Depending on the type of organization, it will take anywhere from 1-3 years to gain enough confidence with the model to use it for gainsharing. Your organization may be ready for gainsharing before this time period. There is nothing wrong with starting with other gainsharing plans, let's say a Scanlon Plan, and evolving towards a TFPMM based plan. In addition, the TFPMM can be used as a component of a "family of measures" approach to gainsharing.

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5.0 WHERE WE'VE BEEN AND WHERE WE SHOULD GO

For research to be useful, it should accomplish what it set out to do. In this chapter, I list my objectives and state how I believe each one was satisfied. Areas of future research are also identified.

To provide the reader with an improved understanding of gainsharing's role in the performance management process.

To understand where gainsharing fits in the performance management process, it was necessary to examine the management process in general and then, more specifically, an aspect of the general management process, the performance management process. In Chapter 2, Section 2.1 (beginning on page 29), three state-of-the-art management process models were presented graphically and discussed to communicate the management process: the POLCA model of management, the Management System Model, and the Performance Management Process. Together, these three models provided a reasonably complete conceptualization of the management process. The first model examined, the POLCA model (Figure 2-1, page 30) was the more traditional of the three and the most complete and detailed relative to the functions and roles of managers. Elements of the last two models reviewed could be seen in this

model. The second model reviewed, the Management System Model (Figure 2-2, page 33), was less complete in detail but focused on two critical aspects of the management process: problem-solving and decision-making. The model also made explicit the critical, and often complex, interrelationships between who manages, what is managed, and what is used to manage. The combination of these first two models provides an excellent framework for identifying, diagnosing, and solving management process problems. The third model highlighted yet another aspect of the management process. The Performance Management Process model (Figures 2-3 and 2-4, pages 35 and 36) focused attention on the management basics of planning, action planning, and effective implementation and on the critical interrelationships between measurement and evaluation and control and improvement. Where, then, does gainsharing fit in the performance management puzzle?

To answer this question, attention was focused on how excellent organization's performance management efforts evolve: Stage 0 - Improving Performance through Execution of the Basics; Stage 1 - Performance Improvement Planning; Stage 2 - Improved Measurement, Evaluation, and Reward Systems; Stage 3 - Integrated Planning; Stage 4: Employee Involvement through Problem-solving, Decision-making, Implementation, and Follow-through (management of cultural support systems); and, Stage 5 - Building on Excellence. Figure 2-6, page 43, depicted these stages of evolution over time. Brief case study examples were given to illustrate each stage. Gainsharing, was identified as a Stage 5 intervention, in that it can help to address many of the major questions and issues facing the organization that has successfully

reached impressive levels of performance and wishes to maintain and build on excellence.

In Section 2.3 (beginning on page 54), I presented a number of reasons why gainsharing is a "lag" and not a "lead" strategy for improvement:

1. Gainsharing is not needed to achieve acceptable, or even motivated, levels of performance. What is keeping U.S. organizations from the levels of performance needed to compete in a global economy is the presence of low quality management processes, not the absence of gainsharing.
2. There is a need to move beyond quick fixes. Performance improvement is hard work. Implementing a gainsharing effort without fixing fundamental flaws in the general management process will not result in the levels of performance needed to compete in a global economy.
3. Money can motivate, but has many traps for the unwary or unsophisticated. Basing your improvement efforts solely on a financial reward system is tenuous, at best.
4. Performance is not the same as motivation. Many organizations implement reward systems such as gainsharing because they believe declining performance is due to a lack of motivation, money is a motivator, so money is the button to push to improve performance. Motivation, however, is just one of many factors in the performance equation. Second, motivation is an individual phenomenon; motivated individual performance does not necessarily translate into group performance.

5. There is a difference between organizational commitment and attachment. You can buy attachment: it's simply a function of actual and perceived costs, investments, and benefits. Commitment, on the other hand, takes longer to build and requires high quality systems and processes.
6. Gainsharing has strategic implications. Implementing gainsharing without thinking through what performance means to the system could make things worse.
7. The measurement component of gainsharing is just one dial on the instrument panel needed to assess performance and create line of sight. Gainsharing, by itself, will not provide the insight needed to target control and improvement interventions. As such, it needs to be complemented and supplemented by other measurement systems. If the organization does not have these measurement systems developed, gainsharing will be less effective than it could or should be.
8. Gainsharing design, implementation, and ongoing maintenance requires you to be a chef, not a cook. Gainsharing approaches implemented off the shelf will more than likely fail.
9. Gainsharing involves a number of critical decisions for which a participative strategy is best. If the organization is immature or inexperienced with participative management and the management of participation, the quality of the design will not be as high as it could or should be.

10. There is no such thing as a free lunch. Gainsharing has costs associated with it. Perhaps the most critical of these costs are those that are sociological and psychological in nature.
11. Gainsharing is not a mutually exclusive alternative. Reward systems that assume people are motivated by single needs and single job related outcomes will be less effective than they could or should be. The organization of the future, therefore, will have to make use of an appropriate blend of reward systems which must be strategically thought through to ensure congruence with one another and with strategic thrusts..
12. Why pay for something you should already be getting? If the organization is performing at JGB (just get by) levels and gainsharing is installed, any improvement up to acceptable and motivated performance levels is performance they paid for in the first place and weren't getting.

To highlight the role of gainsharing in the compensation management process.

At the beginning of Chapter 3, I presented reasons why compensation or pay is considered such an important and critical dimension for U.S. organizations trying to achieve, maintain, and/or build on excellence? Compensation or pay:

- Can influence performance;
- Is an important cost;
- Is a potential source of system wide problems;

- Is important to individuals;
- Is malleable both in policy and practice;
- Can affect change interventions system wide;
- Is visible and tangible; and,
- Is a systemic factor, linking certain, critical, major aspects of the organization.

I then presented a graphical representation of an organization's compensation management system (Figure 3-1, page 82). The compensation management system was shown to be divided into two major categories: financial compensation and non-financial compensation. Gainsharing was identified as a group level reward system that falls under the general category of pay for work and performance (a financial component of the pay system). Group level reward systems, such as gainsharing, fit in well with management systems that promote cooperation, coordination, and aggressive levels of performance. Gainsharing was also seen as a way to help an organization control labor costs since it is a "variable" component within the pay for work and performance dimension.

The other major part of the reward system, which consisted of non-financial rewards, was much more difficult to classify and its components far more complex than was the case for direct and indirect financial rewards and components. Non-financial rewards are all the work situation-related rewards that relate to people's psychological and sociological well being. However, there is a close interrelationship between financial and non-financial rewards; the line between these two major categories may at first glance be sharply defined, but soon blurs as they interact and blend together. The

structuring of features, components, and dimensions into an effective compensation management system, therefore, requires 1) an understanding of the sociological and behavioral relationships between work, financial rewards, and non-financial rewards; 2) tools and techniques for identifying job content (e.g job analysis, job descriptions, job evaluations, job structure); 3) tools and techniques for determining pay (e.g. compensation surveys, pay policy lines, and pay structures) 4) valid and accepted measures and measurement systems for evaluating group and individual performance (e.g. performance appraisal, Management by Objectives, collaborative MBO, gainsharing, work measurement); and, 5) systems for planning, budgeting, administering, evaluating, and improving the compensation system.

To succinctly review both traditional and newer approaches to gainsharing and present an approach for evaluating various gainsharing approaches.

There are a number of excellent books which describe, in detail, various gainsharing plans and approaches; the interested reader is referred to these references listed at the back of Chapter 3, beginning on page 129: Dar-el, 1986; Doyle, 1983; Fein, 1981; Frost, Wakely, and Ruh, 1974; Lesieur, 1958; Moore and Ross, 1978, 1983; O'Dell, 1981. What I attempted to do in Section 3-2 (beginning on page 88) was to organize, in tabular format, what has been written to date on various gainsharing plans and approaches and provide an executive overview of what's available. Table 3-2 (pages 89 - 94) was a result of this effort. Table 3-2 depicts characteristics of both traditional and newer gainsharing approaches across a number of critical dimensions:

- measurement
- improvement focus
- calculation of gain (loss)
- line of sight
- best fit applications
- unit of analysis
- participants
- measurement scope/frequency of payout
- sharing ratio
- data requirements
- advantages
- potential problems

- management philosophy
- management philosophy
- underlying theory and/or assumptions
- management style and process

The text in Section 3-2 provides narrative relative to each of these dimensions. The dimensions identified are design variables; application of a particular approach may or may not look the same within or along all dimensions depending on organizational characteristics. The section does, however, provide a nice overview of what's available and would be useful to managers beginning to investigate various alternatives.

An outcome of this effort was an attempt to formulate a list of questions managers can use to select a gainsharing approach. To date, there has been no formal decision tree approach developed for selecting a gainsharing approach. Full development of a formal decision tree was beyond the scope of this research. However, a first cut at a list of questions was taken to spark dialogue among academicians and practitioners in the field; integration of these questions with the work of Moore and Ross, Ross and Ross, and Hauck (see page 104) may take us one step closer to developing a decision tree for selection of a gainsharing technique:

1. Is there a common organizational pursuit - process, project, program, problem, and perplexity - for the unit of analysis being considered for gainsharing?
2. Which of the seven criteria (effectiveness, efficiency, quality, productivity, innovation, quality of work life, and profitability/budgetability) are critical dimensions of performance?

3. What input factors dominate? In what areas are the unit of analysis' cost drivers?
4. What data is available?
5. How "measurement and business-wise" are people within the unit of analysis being considered for gainsharing? What type of macro level measurements are they used to seeing (e.g. financial, physical, mixed)?
6. What are markets for products and services like? Are there trends, seasonal patterns, cycles, no clear pattern? Is there a single market or are markets highly differentiated?

This list of questions provides a useful scheme for classifying and evaluating various gainsharing approaches. A next step would be to clean this list up (i.e. add to, modify) and develop a decision tree a management team can use to select a gainsharing approach.

To present a planning process for improved reward systems and gainsharing systems.

Several methodologies for gainsharing design and development have been documented in the literature (see Doyle, 1983; Moore and Ross, 1978; O'Dell, 1981; Schuster, 1987, listed at the back of Chapter 3, page 128). There are two major shortcomings of these methodologies. First, they do not address the integration of and interfaces between business planning, performance improvement planning, human resource planning, reward system planning, and gainsharing system planning, nor provide a planning process. Poor planning is often a source of gainsharing failure. Second, the specific tools

and techniques needed to execute each step have not been communicated. An eight-step methodology was proposed here that considers the interrelationship between various types of planning and identifies specific tools and techniques. The steps are based on the performance improvement planning process described by Sink (1983, 1985a, 1985b, 1987) and Sink, Tuttle, and Dhir (1988) (again, the references are listed at the back of Chapter 3, beginning on page 129):

1. Organizational Systems Analysis.
2. Planning Assumptions.
3. Strategic Objectives.
4. Action Items.
5. Action Teams.
6. Project Management.
7. Measure, Assess, and Evaluate.
8. Manage Effective Implementation.

Recycle and constantly improve process.

These steps are discussed in detail, in Section 3.5 (beginning on page 108). While this process has proved successful in a number of organizations for performance improvement planning, it has not been applied to planning for gainsharing systems (see Sink, Tuttle, and Dhir, 1988, for example case study applications of organizations who have used the planning process). Next steps would be to expose academicians, practitioners, and managers involved with gainsharing to the planning process, elicit and then use their feedback to enhance the process, apply the process to gainsharing system design, and then focus on constant improvement of the process.

To communicate how two organizations, one manufacturing, one white collar, designed and implemented a Total Factor Productivity Measurement Model (TFPMM) application.

Chapter 4 was devoted to describing two case study applications. Both case studies differed from typical case studies on gainsharing and measurement which are anecdotal in nature, documenting "one shot" success stories. I had (and still continue to have) experience with both organizations. What I attempted to do in Chapter 4 was capture that experience as best I could. I did not enter either organization with a rigid research design. Instead, I observed and recorded anything which I believed to be of significance in communicating to you, the reader, the process of designing, developing, and implementing a TFPMM application and how you could then use the TFPMM to drive gainsharing.

To compare and contrast a manufacturing organization's Scanlon Plan calculation with the TFPMM.

Xaloy case study data for an example period was used to compare and contrast a Scanlon Plan Calculation with the TFPMM (Section 4.1.4, beginning on page 157). At present, the TFPMM captures roughly 60 percent of the total costs captured in the Scanlon Plan; as the TFPMM application at Xaloy matures and evolves, this percentage should go to 90-95.

In comparing Scanlon Plan calculation with TFPMM output, I found a significant difference between the resulting dollar effects on profits due to changes in productivity when data used for the Scanlon Plan calculation was not price weighted; the Scanlon Plan, in this case, underestimated the negative

change in profits due to productivity. There was no significant difference between the TFPMM and the Scanlon Plan when the current period data was price weighted (i.e. the effects in price changes from the base to the current period were not considered).

To evaluate an application of how the TFPMM could be used, in one manufacturing organization, to support an existing Scanlon Plan.

Based on the Xaloy case study experience, it appeared that the TFPMM could be used at Xaloy to support and/or drive gainsharing in five different ways:

1. Support the Scanlon Plan by providing insight into changes that are occurring (e.g. quantity and price weighted changes, productivity ratios and indexes). The TFPMM is a more complete productivity measurement tool than a Scanlon Plan calculation.
2. Provide information that can be used to remove the effects of price recovery and joint effects from the Scanlon Plan calculation. This does not mean to imply that price recovery and joint effects could not/should not be shared. However, by isolating the dollar effects due to productivity, price recovery, and joint effects, participants would know the real source of any gain (loss).
3. A Scanlon Plan calculation could be used to complement a TFPMM based gainsharing system by capturing inputs that cannot be captured in the TFPMM.
4. Based on the organization's ability to capture inputs and its understanding of the model, TFPMM based gainsharing could

progress much along the lines of most Scanlon Plans, starting with a partial factor, labor approach and evolving towards a multi or total factor approach.

5. The Scanlon Plan could be replaced at some later date by the TFPMM as a stage of evolution in the gainsharing effort. As the organization matures with respect to its ability to accurately measure and track productivity with the TFPMM and its understanding of the TFPMM increases, the TFPMM offers a viable alternative to the Scanlon Plan; the advantages of TFPMM based gainsharing were discussed in Chapter 1, Section 1.3 (page 13).

Generalization of these findings is difficult, if not impossible, given a single data point (i.e. the Xaloy case study). However, the TFPMM is being used, in one form or another, in approximately 50-100 U.S. companies. It does appear that the TFPMM can be applied in a variety of settings for the purpose of productivity measurement. We could assume, therefore, that the TFPMM could be used for gainsharing in similar ways in organizations that are using the model. Further research should be conducted to test the validity of this assumption.

To communicate how a white collar organization plans to use the TFPMM to drive gainsharing.

The VPC's proposed gainsharing design was presented and discussed in detail in Section 4.2.4 (beginning on page 182). The next step would be to document the implementation of this system in case study fashion. Additional

research should be conducted to determine the applicability and transferability of the VPC's approach to other white collar settings.

To present and discuss a methodology for TFPMM implementation.

There is no methodology documented in the literature as to how to go about implementing the TFPMM. Based on the Xaloy and VPC experience, a seven-step methodology was proposed (see Section 4.3.1, page 202):

1. Planning for improved measurement systems.
2. Base period selection.
3. Design and engineer data collection strategy.
4. Collect data and track over time.
5. Visibility system development.
6. Integration with existing measurement and management systems.
7. Continuous evolution development.

Next steps would be to apply this methodology in a variety of organizational settings and continue to refine and evolve it.

To assist managers and practitioners with the development of measurement and reward systems.

I believe the thesis accomplished this objective by providing an appropriate blend of rigor (theory) and relevance (experience and techniques) on topics such as measurement; performance management; compensation management; gainsharing; gainsharing system design,

development, and implementation; and TFPMM design, development, and implementation.

In summary, managing for improved performance in the 80's, 90's, and beyond will not be a simple or easy thing to do. While the performance management process and its various subcomponents, such as gainsharing, are easy to conceptualize, they are very difficult to operationalize in such a way that the orgnaization grows, survives, and competes long-term. What I have attempted to do, through this research, was provide managers and practioners with a better understanding of gainsharing and productivity measurement so they may be better equipped with the knowledge and skills needed to design the management sytems of the organization of the future.

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