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Aligning Hierarchical Goals in an Organization: The Path From Training to Performance

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ALIGNING HIERARCHICAL GOALS IN AN ORGANIZATION: THE PATH FROM TRAINING TO PERFORMANCE

by

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ABSTRACT

ALIGNING HIERARCHICAL GOALS IN AN ORGANIZATION: THE PATH FROM TRAINING TO PERFORMANCE

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Training is a multi-billion-dollar industry, and with the advent of the training technology revolution and the possibilities it provides to business and government, as well as to the academic community, it is important to determine if the money invested in training by these communities is providing the expected performance on the part of those who are trained. This can be done by quantitatively evaluating the relationship between training and performance.

This study extends the scholarly literature by developing the concept of organizational alignment through a combination of Human Performance Technology literature and traditional engineering methodologies. Organizational training and performance is studied to evaluate aspects of the relationship. An experimental study was conducted within a chain organization seeking to develop the best method of training. Quantitative and qualitative results are collected in an attempt to validate the findings.

The findings of the research indicate that training does not necessarily guarantee performance. Although organizations are investing billions of dollars in training development and deployment for employees, the training may not deliver the desired or expected performance for the organizations. The research shows that a principal cause of training not leading to performance is the lack of

organizational goal alignment between levels of the organization. This was seen through the results of the performance and causal analyses combined with engineering methods. Lastly, this research concludes that modeling and simulation is an appropriate method by which to achieve organizational alignment. Taking a broader view of simulation and considering its iterative nature for planning and evaluation can allow organizations to proactively align their organizations at all levels.

This work is dedicated to my best friend and life partner, from whom I receive support and encouragement on a daily basis, and also to my parents, who have always supported my endeavors.

ACKNOWLEDGMENTS

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TABLE OF CONTENTS

LIST OF TABLES

List of Figures

CHAPTER 1

INTRODUCTION[1]

Today's economy demands increased corporate flexibility, the use of advanced technologies, and increased responsiveness to customers' needs, which requires the workforce to consistently perform (Jacob and Jones, 1995). Many of today's service organizations are chain establishments whose essential element for success is "consistency." Each chain strives to deliver the same quality, service, and consistency no matter where a customer may be in the world. When customers choose to do business with a chain operation, such as one that sells retail clothing, building supply, or fast food, the customer assumes that the service offered and the quality of product will be the same across all outlets. However, this is often not the case, which brings into question how quality and performance can differ when all personnel who perform the same or similar jobs are supposedly trained according to the same organizational standard. This "corporate consistency" is especially important when one considers that chains boast that their products are "always and everywhere the same" (Schlosser, 2001). For example, if a customer was shopping for a computer and that computer's components were built in multiple locations, including overseas, the buyer would still count on the final product being built to standard. However, what is assumed in the hardware world does not always hold true in the training world. This situation raises the question of the relationship between training and performance.

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[1] The reference model for this work is the *Engineering Management Journal*.

Every year corporations spend astronomical amounts of money on the training and education of their employees. This training is as much a critical performance improvement factor as is any other attempt at restructuring work or the work environment. All attempts to improve productivity in the workplace should be reflected in the bottom line of higher corporate profits and pleased stockholders.

Corporations often struggle to guarantee consistent product quality and customer service as changes in policy, training, management, organization, and equipment occur. All too often corporations turn to training as the catalyst to guarantee performance. However, the design of training systems has long been ignored by the engineering community, which has not always communicated with the training and development community and vice versa.

Business interest in the linkage between training and performance improvement has been heightened with the advent of the growth of training technology and the possible performance improvement ramifications of its future use. All companies employ people, and all people require training. On the surface, it would seem that the better a person is trained, the better that person would perform. Of course the amount and nature of training carries a price, and an employer must be ready to decide how much training he or she can afford as compared to improved performance. This research is devoted to quantifying an aspect of the relationship between training and human performance within an organization and identifying some essential factors that will result in training leading to expected performance.

PROBLEM

With the recent "explosion" of training technology and the impact of the internet on training delivery applications, industry, academia, and the government have become increasingly interested in the correlation between training and performance expectations. Since most "corporations are not in the business to educate employees but to make money (Becker, 1981)," it is imperative for training to deliver the expected performance to corporations and customers. One new area of exploration is the examination of training and its relationship to performance. The idea of engineers and engineering managers looking holistically at training operators for the systems they produce in order to deliver an expected performance to specifications, may seem odd at first, but with the maturation of human performance technology and the work of experts (Gilbert, 1978; Kaufman, 1982, 2000; Mager & Pipe, 1970, 1997; and Rummler, 1972, 1999) has come the acknowledgment that the ability to produce consistent quality outputs involves examining the integration of the human dynamic within the structured work setting. While training might have once been seen solely in the education realm of the trainer or human resources specialist, as this discipline leaves the classroom and becomes a direct input to corporate performance it becomes as much a part of the cost and consequences formulae as the more traditional inputs to return on investment computations. Today, an estimated $60 billion is spent each year on developing America's workers (Robinson and Robinson, 1998). That $60 billion is expected to return sufficient performance to cover the investment costs, but is also seen as being directly

related to improved profit margins. Typically, less than 30% of what people learn is ever actually used on the job (Robinson and Robinson, 1998); therefore, one can rightfully begin to question the value of the investment, especially when trainers seem content to assess their value by number of graduates, days of training, and favorable evaluation sheets, rather than on the impact of company outputs. Let us not forget that corporate management uses those same measures to make decisions based on the expectation that graduates of their training will deliver the performance required for the organization to prosper. The necessity of studying the effects of this relationship - whether training actually leads to performance - is heightened by the continuing development of the global economy and the economic impact that training and performance has on chain organizations.

Purpose of Study

This research's major purpose is to quantify this aspect of the relationship between training and performance in a chain organization and to identify some essential factors that result in training leading to anticipated performance. The empirical work conducted as part of this research comes from a global corporation that is concentrating on training and performance improvement. The purpose of the research will be addressed by: 1) synthesizing the literature of training and human performance technology; 2) identifying key factors that impact training and performance in a chain organization; 3) investigating training and performance methodologies being used to affect the bottom line in a chain

organization; and 4) developing a theoretical base methodology for training and performance evaluation.

Hypotheses

In addressing the problem to be investigated in this study the following hypotheses will be tested:

Hypothesis 1: There is no significant difference between the steps that employees are trained to follow and the steps those employees actually follow.

Hypothesis 2: There is no significant variability in the production process.

Hypothesis 3: Training leads to expected performance.

Organization Selection

The organization selected had to deliver the appropriate data to test the hypotheses. To that end, the research was undertaken in a multibillion-dollar chain company in the service industry that had three divisions engaged in attempting to define the best method of training for required employee performance. The selected organization was committed to training and performance improvement. The selected organization strongly believed that successful training helped employees deliver excellence to the customer.

The specific sites were selected by the organization based on their being representative of the entire organization.

On-site video cameras were installed at each of the selected sites for collecting data. On-site visits took place mostly in the local area. All employees selected for observation were considered trained by their supervisors.

Research Limitations

The limitations of the study were not only defined by the research strategy but also by the selected organization. With that in mind, the research limitations of this study were: (1) the target population was limited to those selected by the service organization, (2) though limited to the local area, findings from the study would be considered representative of all organizations and have impact globally, (3) the interactions required to collect information were limited, with the majority of on-site visits being restricted to the local area for accessibility, and (4) the focus of the study was limited to the preparation of selected core products.

Significance of the Study

This research will contribute to the body of knowledge by synthesizing the literature of training and performance technology and aligning it with strategic planning. This will be done by coupling training and Human Performance Technology (HPT) principles with engineering methodologies that are currently used to quantitatively evaluate individual and organizational performance.

This study will examine aspects of training and performance factors of a multibillion-dollar service organization. Through a study of the organization's training and performance factors, this research will provide corporations with a management tool that will allow evaluations of their organizations to determine if their training interventions will generate the expected performance.

This research will extend the current literature by developing an enhanced definition of training and a theoretical based methodology for organizations to evaluate training and performance. This is a significant contribution because it

represents a completely new, yet literature-based, perspective of evaluating organizational performance relative to training and performance from top to bottom.

SUMMARY

This research will provide an enhanced perspective of training and demonstrate a methodology for evaluating an organization at all levels. The purpose of the study was to quantify aspects of the relationship between training and performance and demonstrate how a methodology can be used to evaluate organizational and training objectives against performance gains. The research does this by examining the connection between training and performance. The result is a methodology for evaluating organizational and individual performance, with organizational and training objectives.

CHAPTER 2

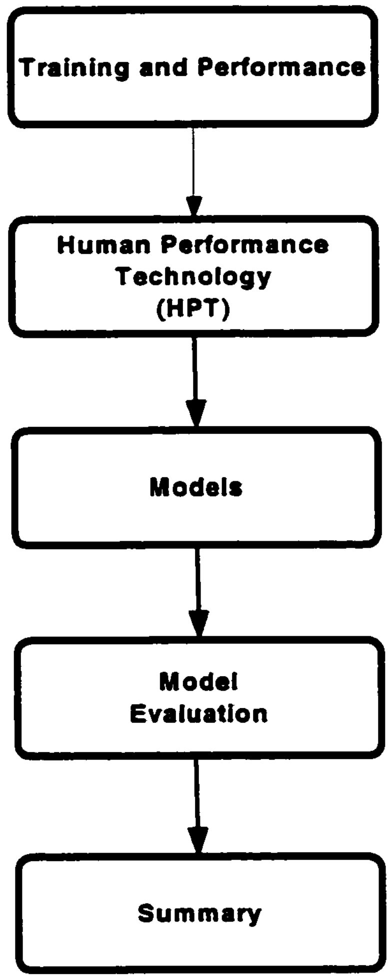
LITERATURE REVIEW

The purpose of the literature review is to develop the theoretical foundation of the study and establish the basis for the research within the context of the current literature. To assist in identifying the literature requirements for this research, a literature map has been developed (See Figure 2.1). Based on this map, the literature review begins by describing and defining training and its development. It then puts these elements in context by presenting an explanation on the discipline of Human Performance Technology (HPT). Here the ideas of needs assessment and performance analysis as shown by Gilbert, 1978; Kaufman, 1982, 2000; Mager & Pipe, 1970, 1997; and Rummler, 1972, 1999, as well as Harless' (1970) concept of front-end analysis and its relationship to performance technology, are summarized. This will begin to establish the foundation for understanding the role of training on individual and group performance and the derivative impact on organizational performance.

The review then discusses the relationship of training and performance in organizations today. This section is followed with the literature from the discipline of HPT and a look at the limitations of the models that are currently available for examining top-to-bottom training and performance alignment within organizations. This literature helps to develop the theoretical foundation for this work. It was combined with traditional engineering and training concepts by building a bridge between the theory and application. The chapter concludes with a summary of the literature and a discussion of the strategy for developing a

methodology that would allow for evaluation and alignment of an organization's training objectives and performance.

Figure 2.1. Literature Flow Chart



Training

Training programs and interventions continue to play a strategic role in organizations. Today's economy demands increased flexibility, the use of advanced technologies, and an increased responsiveness to customers' needs, and it requires the workforce to consistently perform (Jacob and Jones, 1995). Training is one of the critical elements in the delivery of quality and consistency

to the consumer, as expressed by The Employee Best Practice Guidelines (BPG) in "Collaborative" (2000):

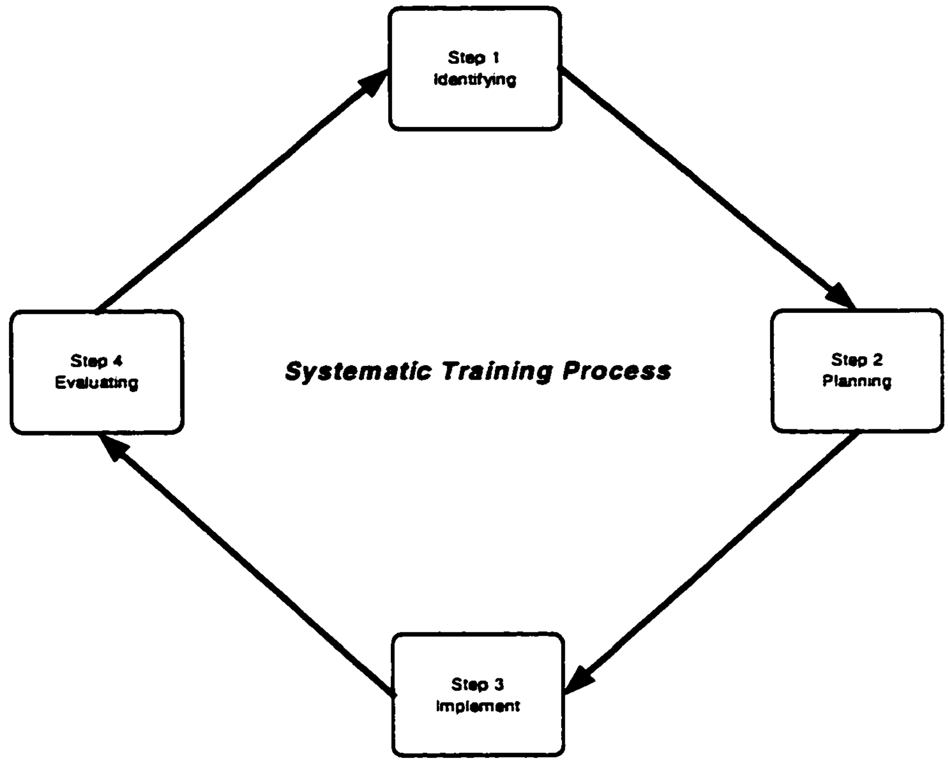
> Employee training supports adaptive, productive workplaces that capitalize on investments in both technology and workforce skills to boost productivity. Employee training is firm-focused and is an *essential element of a firm's overall performance improvement plan.* Training assists a firm to achieve
>
> - Effective utilization of technology resources;
> - Decentralized decision making;
> - Improved work processes by measurably improving worker knowledge, skills, and ability; and
> - Full customer satisfaction and profitability.
>
> Training links technical, occupation-specific skills development with broad-based foundational skills such as teamwork, problem solving, leadership and initiative, resource allocation, customer service, communications, and commitment to lifelong learning to meet the requirements of today's and tomorrow's workplace.

The BPG stresses the linkage between employee training and the organizational focus requirement for achieving overall organizational performance.

The global economy has also forced successful organizations to depend on employees that are capable of performing complex tasks. However, while some tasks are becoming more complex, other performance tasks are completely changing. This consistent change drives the need for a variety of employee expertise and the corporate world's support for the development and sustainment of that expertise (Jacobs and Jones, 1995).

Training involves teaching information or procedures that are directly relevant to the performance of a particular set of tasks, such as driving a car or making a product (Gordon, 1994). In general, a basic model of training follows a four-step process (Figure 2) as shown by Kenney, Donnelly, Reid (1979).

Figure 2.2. Basic Four-Step Training Process



Adapted from Kenney, Donnelly, Reid (1979).

Step 1 identifies what training is required; Step 2 plans the appropriate steps to meet the needs of the training; Step 3 implements the training as designed in step 2; and Step 4 evaluates if the training is satisfying the original requirement. This description is set forth as a generic interpretation of training as there are many systematic models to consider. The evaluation of training is the critical step in the development and use of a model.

Even as attitudes have changed and systematic training methodologies have been developed and utilized, some of the following features of training noted by Kenney, Donnelly, Reid, (1979) exist today:

- Training is not an integral part of operations
- Training has low priority and is, at best, a peripheral management responsibility; employees are largely responsible for their own training;

- More attention may be paid to the presentation of documentation and written programs than to the actual training

In an effort to continually avoid these pitfalls, the training community recognized the need to consider all aspects of the system when developing training.

One of the best success stories of addressing the aforementioned elements of the traditional approach to training was implemented by the U.S. Military. *Military Contributions to Instructional Technology* (1986) acknowledges that traditional approaches did not ensure:

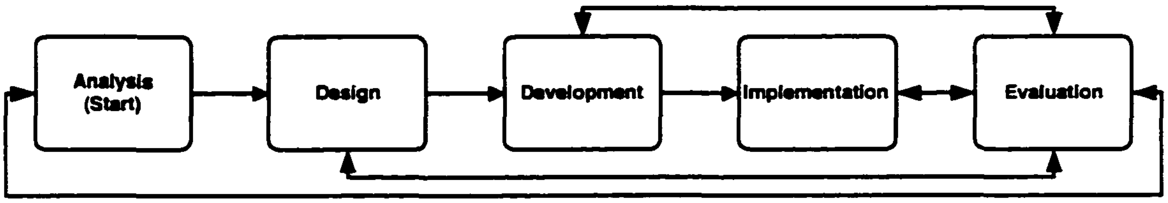
- That training matched job requirements
- The quality of training developed
- Training guaranteed performance
- That training was systematically evaluated

These problems were critical when considering that in the military, students or trainees are paid a full salary during training; thus, any ineffectiveness or inefficiency would prove costly. Additionally, the military trains for life and death situations, and ineffectiveness or inefficiency in training job competencies can not be tolerated.

With that level of seriousness in mind, the military began developing an approach to stabilize the structure of the training development process. Montague and Wulfeck (1986) assert that the military wanted to ensure the "relevance of training for people's jobs, and to make training efficient." Interestingly, this approach was adapted from a similar approach used in the development of weapons systems in Operations Research and Systems Engineering (Churchman, 1968), and from that the Instructional Systems Development (ISD) model. ISD was a way of determining what trainees needed

to know and ensuring that it was learned. It is important to note that this was only the beginning of a systems approach to training. However, it did move the four-step generic model presented earlier into a systematic model (see figure 3).

Figure 2.3. Instructional Systems Development Model



Adapted from Instructional Systems Development

This systematic model starts with analysis of the instructional requirement for the job or task, then determines the gap in instruction. The gap is defined as the difference between "what is" and "what should be" occurring. Next, the program is designed with the objectives and testing linked to the requirement gap identified during the analysis. The instruction materials are then developed according to the design. As the instruction is implemented, performance evaluation data is collected and material revised as necessary so that the training package meets the prescribed instructional requirement and guarantees performance.

Many operational ISD models exist today that use this phased approach. What is important to note is that the development of the ISD model was not only critical to the military to ensure efficiency and effectiveness in training but also crucial to the establishment of the HPT field. The Handbook of Human Performance Technology (1999, 1992) declares that "the concepts, theories,

and practices of ISD are among the most significant conceptual underpinnings of HPT."

Human Performance Technology (HPT)

HPT spawns from general systems theory and its application to organizations. HPT views a system as a "complex grouping of human beings and machines for which there is an overall objective" (Checkland, 1972). The utilization of systems or a systems approach is imperative to HPT. The systematic framework was essential for an organization to achieve improved performance. Ackoff (1972) posed the question "what is an organization?" and defined it in a speech entitled "The Second Industrial Revolution" as:

> ... a unique kind of system. It is a system which has a purpose of its own, which consists of parts that have purposes of their own, and is itself part of a larger system which has purposes of its own. Thus, a corporation has purposes, it has parts with purposes, and it is part of an economy of society, which has purposes.

This definition aligns with HP technologists' holistic view of organizations in that it seeks to address the impact of change and encourages performance analysis, rather than supporting interventions or instruction to fix what may not be a training problem. This approach means looking at the gap between "what is" and "what should be" relative to the organizational performance. It is important to understand HPT as it is defined in the field as shown below (Table 2.1).

Table 2.1. Select Definitions of Human Performance

Author and Year	Definition of HPT
ASTD (1992)	"A systemic approach to analyzing, improving, and managing performance to the workplace through the use of appropriate and varied interventions."
Benefit and Tate (1990)	"[Human] Performance Technology is the systematic process of identifying opportunities for performance improvement, setting performance standards, identifying performance improvement strategies, performing cost/benefit analysis, selecting performance improvement strategies, ensuring integration with existing systems, evaluating the effectiveness of performance improvement strategies [and] monitoring performance improvement strategies."
Gilbert (1978,96)	"The purpose of [human] performance [technology] ...is to increase human capital, which can be defined as the product of time and opportunity...technology is an orderly and sensible set of procedures for converting potential into capital."
Harless (1992)	"The process of analysis, design, development, testing, implementation, and evaluation of relevant and cost-effective interventions on worthy human performance.
Jacobs (1988)	"Human performance technology represents the use of the systems approach in a number of different forms, depending upon the problem of interest and professional activity required."
Rosenberg (1990)	"The total performance improvement system is actually a merger of systematic performance analysis with comprehensive human resource interventions. And the science of linking the total system together is known as human performance technology."
Rothwell (1996)	"A systematic process of discovering, and analyzing important human performance gaps, planning for future improvements in human performance, designing and developing cost-effective and ethically justifiable interventions to close performance gaps, implementing the intervention and evaluating the financial and non-financial results."
Stolovitch and Keeps (1999)	"An engineering approach to attaining desired accomplishments form human performers. HP technologies are those who adopt a systems view of performance gaps, systematically analyze both gap and system, and design cost-effective and efficient interventions that are based on analysis data, scientific knowledge, and documented precedents, in order to close the gap in the most desirable manner."

Source: Rothwell, Hohne, and King (2000). Handbook of Human Performance Technology (1992)

While several authors have defined HPT. Stolovitch and Keeps (1999) classify the definitions into two categories: one that focuses on methods and processes, like Rosenburg, and the other focuses on the outcomes, like that of Gilbert. Stolovitch and Keeps (1992) acknowledge that "no single definition commands universal agreement"; however, from these definitions they list specific characteristics that emerged:

- *HPT is systematic.* – It is applied methodologically.
- *HPT is systemic.* – It identifies human performance gaps as systems elements.
- *HPT is grounded in scientifically derived theories and the best empirical evidence available.* – It uses scientific research or documents evidence it seeks to achieve expected human performance.
- *HPT is open to all means, methods, and media.* - It seeks to utilize the most effective and efficient resources to obtain performance at the lowest cost.
- *HPT is focused on achievements that human performers and the system value.* – It focuses on the "bottom-line results" – what should be accomplished.

HPT utilizes the techniques and concepts of many disciplines that are listed as follows:

- Systems
- Learning Psychology
- Instructional Systems Design
- Analytical Systems
- Cognitive Engineering
- Information Technology
- Ergonomics and Human Factors
- Psychometrics
- Feedback Systems
- Organizational Development
- Intervention Systems

Since the composition of HPT is made up of techniques and concepts from these disciplines, a systematic framework became imperative to connect the components together, develop models, and implement HPT models in practice

(Rosenberg, Coscarelli, Hutchison, 1992). Largely, the works of Skinner, Gilbert, Mager, Harless, and Rummler form a majority of the foundation on which HPT and performance analysis is built (Rosenberg, Coscarelli, Hutchison, 1999). Table 2.2 lists these noted individuals along with a major principle or concept the individual is credited for contributing to the discipline.

Table 2.2. Major Contributors to the Discipline of Human Performance Technology in contribution order

Individual	Major Principle or Concept Attributed to This Individual
B. F. Skinner	Behavior can be influenced by the responses that are given to that behavior (for example, operant conditioning).
Tom Gilbert	The absence of performance support in the work environment, and not the absence of knowledge or skill, is the single greatest block to exemplary performance.
Robert Mager	Learning objectives must be defined in performance terms. Therefore, each objective needs to define the following: • What the learner is to do • The conditions under which performance is to occur • The quality or level of performance considered acceptable.
Joe Harless	Effective performance solutions require analysis of the system in which the performer is working before proceeding with the interventions. Joe Harless invented the term *front-end assessment*.
Geary Rummler	Three levels of performance must be aligned in order to sustain exemplary human performance; change in just one level will be insufficient. The three levels are as follows: • Process • Organization • Job/performer.

Source: Robinson and Robinson (1998).

The 50+ year evolution of this discipline has been "as a result of experience, reflection, and conceptualization of professional practitioners striving to improve human performance in the workplace (Stolovitch and Keeps, 1992)." As the International Society for Performance Improvement (2001) explains that HPT is basically a set of procedures and methods, along with a strategy for problem solving and for realizing opportunities to enhance the performance of people, which can be applied to large organizations, small groups, and individuals.

HPT takes a systematic look at the combination of three processes: performance analysis, cause analysis, and intervention selection. The International Society for Performance Improvement (ISPI, 2001) explains the three aforementioned processes as follows:

> **Performance Analysis**
>
> The human performance technology approach begins with performance analysis, which examines the organization's performance requirements in light of its objectives and its capabilities. It is the identification of the current or anticipated deficiencies in workforce performance or competence.
>
> Central to the process is the comparison of two specific descriptions of the workforce. The first, the desired state, describes the competencies and abilities of the workforce that are necessary to carry out the organization's strategy and achieve its mission. The second, the actual state, describes the level of workforce competence and ability as it currently exists.
>
> The performance gap is the difference between these two states. It represents a current or anticipated performance problem to be solved, or an opportunity for performance improvement. The ultimate goal of performance technology is to close or eliminate this gap in the most cost-effective manner.

Cause Analysis

Cause analysis identifies specific factors that contribute to the performance gap. Solutions to performance problems often fail to achieve their intended goals because they are selected to treat only visible symptoms rather than underlying causes. When the root causes of a problem are uncovered and eliminated, however, the likelihood of significantly reducing or eliminating problems is greatly enhanced. Cause analysis is thus the critical link between identified performance gaps and their appropriate interventions and is a major strength of the performance technology approach.

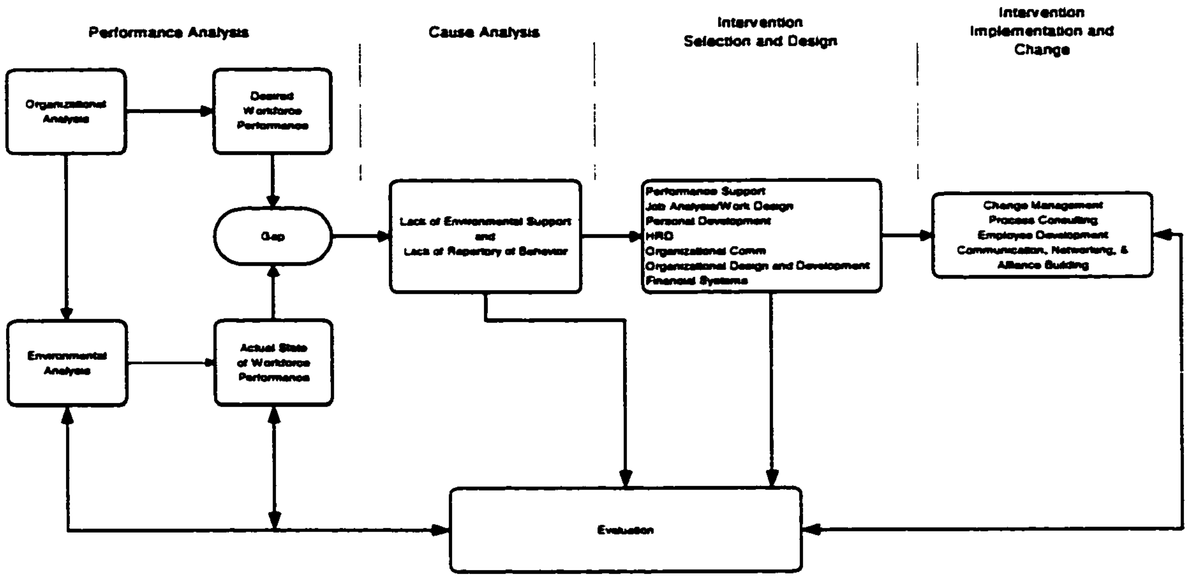
Intervention Selection and Design

Intervention selection involves a systematic, comprehensive, and integrated response to performance problems and their causes as well as to performance improvement opportunities. More often than not, the selected response is a combination of interventions, representing a multifaceted approach to improving performance. How a response is constructed is based on its cost-effectiveness and the overall benefit to the organization. The evaluation of its success is directly tied to the reduction of the original performance gap, which is measured in terms of performance improvement and organizational results.

Comprehensive interventions often result in significant changes throughout the organization. The implementation of any performance intervention thus must pay careful consideration to changing management issues to ensure acceptance at all organizational levels. Finally, evaluation of those changes provides new data for the ongoing performance analysis process.

The HPT model displays the combination of the systematic processes utilized when seeking to improve worker performance. This model is utilized as the basis of several models in the discipline, each with its own uniqueness (Figure 2.4).

Figure 2.4 Human Performance Technology Model



Source: www. ISPI .org, 2001

MODELS

Models have also traveled an evolutionary path from people to abstractions of reality and visuals of the real world. Silvern (1975) describes different types of models:

(1) Artist model is a 'real life' object. A painter creates his version of the real life object or model.
(2) Mathematical Models are abstractions …ideal representations of logical truths
(3) Training Models are used for producing behavioral change in humans by the process of learning a physical device. It is not the 'real-life' object but it is a replica of that object. Its purpose is to communicate information or actions about the real-life object. This use is different than the artist model or model prisoner, but is like the mathematical model in that it is a replica of the 'real-life' object.

Mize and Cox (1968) describe a model as a representation of the real system. Profozich (1998) notes that as technology changes and advances have made the real systems more complex and difficult to analyze. Rechtin and Maier (1997) suggest that models have taken on a life of their own. Models have become tools of communication, guides, and enablers in the development of systems.

HP technologists developed models to communicate the integration of disciplines, as well as to serve as guides for application of models.

Human Performance Technology Models

As stated earlier, HP technologists use a systematic approach for modeling to effectively interconnect and communicate the techniques and methods of the several disciplines utilized in the field. Several models have evolved over time by building on the lessons learned in the field, each with its own role to play. Table 2.3 provides a list of just a few individuals that have focused on applying HPT at varying levels of an organization.

Table 2.3 Select Authors and Models

Author(s) and Year	Models
Gilbert (1978)	Levels of Vantage Point (six levels)
Kaufman(1985)	Organizational Elements Model (OEM)
Rummler and Brache (1988)	Organizational Levels of Performance
Tosti and Jackson (1987, 1989)	Organizational Alignment Model

Source: Handbook of Human Performance Technology (1992)

Gilbert (1978) expanded the work of performance improvement relative to tasks with his six "levels of vantage point." This work was significant, as it was the first to introduce the integration of several levels of interventions and their interrelationships.

Kaufman (1985) focused on the externals of organizations rather than their internal accomplishments. He suggests that in order "to obtain a more complete view of organizations and their efforts and results a ...societal view is required'" (Kaufman, 1983). The Organizational Elements Model requires that

each of the elements "fit together and work interdependently with each other and the organization, not independently of the survival and self-sufficiency of society" (Kaufman, 1985).

Comparable to Gilbert and Kaufman, Rummler and Brache articulated that organizations should be viewed at varied levels. They suggest that an organization is "an adaptive system" that exists as part of a larger environment (Rummler and Brache, 1992).

Tosti and Jackson (1987, 1989) incorporated the application of HPT to cultural change by looking at two distinct paths: one, considering "what needs to be done (strategic goals)" and the other, "how should it be done (emphasizing values)."

Theses models look at multiple levels of organizations in order to address training and performance. These models are looking at a slice of an organization within the context of improving human performance and thus assuming it will impact organizational performance. Gordon (1994) explained that "training programs [interventions] alone are insufficient to address the amount and complexity of information retrieved and used in many such jobs. In addition to the sheer amount of material that must be retrieved and mentally integrated at the time of job performance, there is the additional problem of retention."

The synthesis of the literature reveals that most of the contributors to the field have backgrounds in instruction and training. With that in mind, the discipline recognizes that the systematic approach to training coupled with a holistic view of an organization is required in order to develop an effective

intervention. The phased approach presented in the HPT Model shows the Intervention Selection and Design phase after the first two phases of Performance Analysis and Cause Analysis. HP technologists recognize that creating training for the sake of creating training does not address the issue of performance. Taylor and Felten (1993) write that it is not that training interventions are not helpful; it is the over-reliance on these interventions for producing the new skills required, without the appropriate follow-up and re-enforcement.

Training can help organizations have a competitive advantage. However, while training may well be the problem, it should not be the primary focus until a performance analysis has led one to objectively conclude that "fixing" training will fix performance. Training programs and interventions can be developed that have worthy goals and performance objectives, but if implemented in an arena where training is not the problem, or the only problem, and is not aligned with the organization's goals and objectives, management may be disappointed with the overall results. By expanding the use of models prior to interventions, organizations could align individual and team training objectives with organizational objectives by developing a methodology for evaluating the impact of one on another.

Evaluation of Training Models

Evaluation is a continual process throughout the development and implementation of a training model. Shrock and Geis (1999) explain that "evaluation is the process of collecting information and feeding it back to those

who need the information so that the system can succeed." The literature highlights four basic concepts of evaluation shown in Table 2.4:

Table 2.4 Concepts of Evaluation

Concepts of Evaluation
Formative and summative evaluation
The methodological continuum from controlled experiments to qualitative evaluations
Evaluation as certification
Kirkpatrick's four levels of evaluation (1959)

Source: Handbook of Human Performance Technology (1992)

Scriven (1967) is credited for differentiating between formative and summative evaluation.

FORMATIVE AND SUMMATIVE

Formative evaluation seeks to provide information while development is still underway and can be modified or revised before additional time or money is spent. This is generally done by using:

- Tryouts of the intervention with small groups or individuals
- Alpha testing - formative evaluation within the development team
- Beta testing - formative evaluation with a select group of target users

With today's costly technologies, it is important to decrease uncertainty in proposed solutions. Years of research substantiate that the contribution of formative evaluation has been to improve processes and products (Shrock and Geis,1999).

Formative evaluation of an individual usually takes the form of diagnostic testing to see where the performer is having difficulty.

Smith and Brandenburg (1991) describe summative evaluation as having five phases:

- Planning
- Materials development
- Data collection
- Analysis
- Reporting

Summative evaluations are said to be time consuming and extremely costly. They should be conducted and planned with extreme care. These evaluations typically lead to a "go/no go" decision.

Summative evaluation of an individual may take the form of an end-of-course assessment, a placement test to determine whether instruction is needed, or certification test (Shrock and Geis, 1999).

Methodological Continuum

The methodological continuum has a vast range from experimental evaluation to naturalistic evaluations. The design of an experimental evaluation requires careful planning with clear specifications: independent variables and dependent variables that are operationalized, and selected measurables; at the other end of the continuum is naturalistic evaluation, which mainly deals with observations, document analysis, and interviews (Shrock and Geis, 1999).

Evaluation as Certification

The global economy and its competition has forced a regenerated interest in competence of the workforce. Eyres (1998) explains that certification

has the expectation that individuals will have more than the minimum necessary skill or competence.

KIRKPATRICK'S FOUR LEVELS OF EVALUATION

Kirkpatrick (1959) developed a classification scheme for training evaluations that looked at four levels (Table 2.5):

Table 2.5: Kirkpatrick's Four Levels of Evaluation

Kirkpatrick's Four Levels of Evaluation
Level 1 - Reaction to training: Data collected via a questionnaire asks participants to rate the course materials, course instructor, support visuals, and so on. Most commonly conducted of the four.
Level 2 - Learning from training: Determines whether participants met the course objectives. Level 2 measures take the form of performance or cognitive tests that are grounded in course objectives.
Level 3 - Transfer of learned skills to the job: Data collected either on-site observations of performance or the questioning of those who are in position to observe the on the job performance trainee.
Level 4 - Impact of training on organizational results: Level 4 return on investment evaluation is typically approximations of training's effect on the bottom line.

Adapted from Handbook of Human Performance Technology (1999)

Kirkpatrick's four levels of evaluation are well known in the world of training development and human performance technology. Training and development practitioners generally use Level 1 and 2 evaluations. These evaluations are generally questionnaires and cognitive tests respectively. These types of evaluations are probably the ones that most persons are exposed to when participating in a training or educational course. Level 3 and 4 evaluations

are not frequently used but discussed and written about. The data collection for Level 3 is considered much more feasible than Level 4. The data for Level 3 evaluations is collected through onsite observations of performance and/or the interview of those who are able to observe the performance on the job.

Dionne (1996) writes in *Human Resource Development Quarterly* that Level 4 evaluation [productivity analyses] is difficult. The practitioners of HPT suggest that the best way to conduct a Level 4 evaluation is to "use either a controlled experiment or a multiple regression analysis." The control and measurements that both of these methods require are considered by most organizations as an interference or barrier (Shrock and Geis, 1999). Therefore, Level 4 evaluations tend to be approximations of the effect training has on the bottom line.

Thus, the evaluation of a training system is considered from a holistic perspective but may not be evaluated in a holistic manner. Taken individually, the levels provide necessary feedback at different intervals of implementation. Note that the evaluation focuses on the performance of the individual until Level 4 incorporates the perceived impact on the organization's bottom line. However, the ability to efficiently and effectively remove perceived barriers of Level 4 evaluation would allow for timely application and begin to consider the impact at other levels of the organization.

Therefore, to address the gap in the literature this work extends the theoretical foundations of training and organizational performance and considers a literature-based methodology for training and performance evaluation.

SUMMARY

A summary of the literature shows that there are models that focus on human performance and that predict assumed human performances' impact on the bottom line, but there are no models exist that look from the top of the organization through to execution. The literature review started with a summary of training and human performance technology. The major theme of the training and performance literature is that the development and implementation of training utilizes a systematic approach to the development and implementation of its training systems and interventions.

The literature review concludes with a look at HPT models, as well as the evaluation literature. Here, a gap in the literature is identified. The literature does not discuss the extension of the theoretical foundation of organizational performance. Although work has been done extensively in the theory of organizational performance, little has been done to take the theories and apply a methodology to determine a quantifiable approach to performance thus making it difficult to quantify aspects of the relationship between training and performance. Further, the concept of assessing an organization from the top level to the execution level could provide a holistic interpretation of an organization's evaluation and alignment process. However, by extending the literature through the development of an organizational alignment methodology, the relationship between training and performance is enhanced.

Chapter 3

Quantitative Research Design and Methodology

Research Context

This research began as a collaborative project looking to define best method of training for a global chain organization in a service environment. The organization is comprised of the worldwide operations of three separate divisions and each division has proprietary products and emphasizes a production process with high quality, and competitive prices. With the research effort, the organization wanted to determine the most effective way to train the approximately one million new employees hired each year. As the organization incorporated new products globally, the organization wanted to be sure there would be an improvement in efficiency and effectiveness based on the execution of their training.

Moreover, the progression of co-locating product lines has added to training complexity. The co-location of product lines, putting two or even three production lines under one roof, has resulted in the organization being the world's blended product line leader with a business that accounts for $1 billion in annual sales. Having more than one product line under the same roof allows for greater flexibility to serve the customer, coupled with the organization's desire to increase flexibility to serve the customer and to generate higher cash flows has driven blended product lines. The organization believed that the enhancement of training would assist in the elimination of redundancy, develop common templates, and reduce costs by increasing duplication and volume of training

materials. A streamlined and consistent approach to training would have an integral part in maintaining a competitive advantage in the industry.

Assuming the expectations for enhanced training were true, the research focused on developing a standard for performance. The organization did have an elaborate set of standards captured in a store document referred to as the Organizational Standard (OS). However, the OS spoke primarily to accomplishment of a certain number of steps in a procedure, versus the time it should take to complete distinct tasks. This research focused the organization in determining an engineered time standard which would measure the "time it should take an average trained operator (working at a normal pace) to perform an operation (manual time and process time) based on established and documented work conditions and specified work methods plus allowances" (Zandin, 1990). The commitment to a time standard was crucial to the holistic look at production since an employee could have conceivably delivered a product that was complete in every way, but worked so slowly as to make the establishment fail its production goals. On the other hand, an employee focusing only on speed could produce products fast, but if steps were missed, the output could fail to be up to OS product standards. For purpose of the study, the research focused on selected core production lines, and if the approach proved valuable, the approach of applying a baseline time to operational tasks could be expanded to as many tasks as desired by the company.

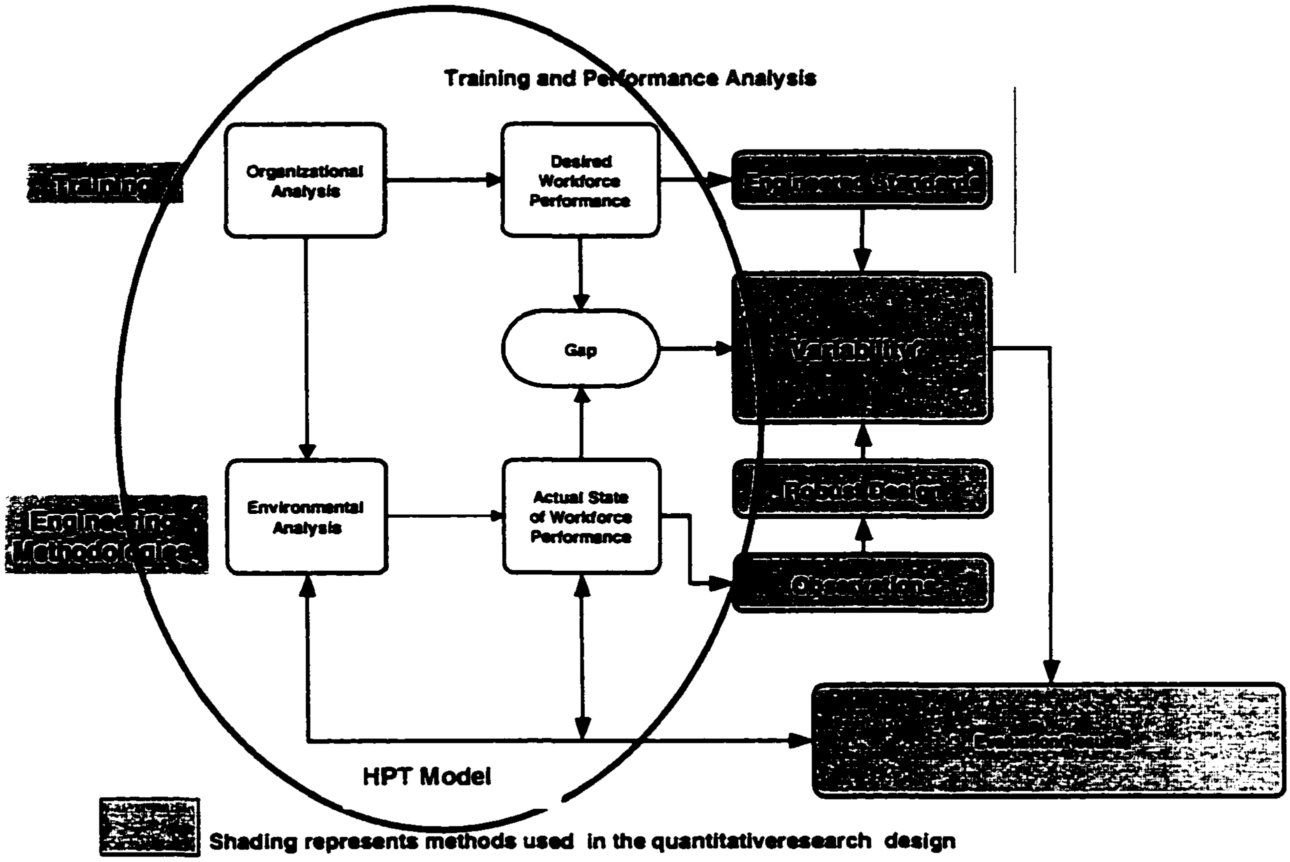
The utilization of engineered time standards in the service industry is not new. The work done previously by Donno and Swart (1981) and Heuter and

Swart (1998) measured work by using time studies in Research and Development (R&D) establishments. Their institution of slow-motion videotapes and video analysis was used to develop labor standards. The effective and efficient use of engineered time standards (engineered standard) was chosen, based on the success of their work. This approach facilitated the development of the research design and methodology.

Design and Methodology

The methodology utilized to test the hypotheses in this study was a combination of Human Performance Technology and Engineering methodologies. The systematic approach to training and performance as set forth by HPT was used as the theoretical foundation for examining aspects of the relationship between training and performance with supporting quantitative engineering methodologies. A visual representation of the research design is depicted in Figure 3.1. This visual depiction shows the elements of the Performance Analysis (shown in white) with the engineering methods and techniques (shown in gray) used to evaluate aspects of the training and performance relationship and to test the stated hypotheses.

Figure 3.1: Quantitative Research Design



Adapted from ISPI.org, 2001

The hypotheses to be tested are as follows:

> **Hypothesis 1:** There is no significant difference between the steps that employees are trained to follow and the steps those employees actually follow.
>
> **Hypothesis 2:** The organization's training system does not deliver the knowledge required for the employees to do the job.
>
> **Hypothesis 3:** Training leads to expected performance.

Human Performance Technology Method

Prior to the performance analysis, the researcher reviewed the organization's training and performance literature. The review defined the foundation for understanding what the training materials should accomplish. Once the researcher completed the review of the training literature, participation in the training was the next and best step for the researcher to understand how the training was utilized. This step was followed with a second and closer review of the actual training material and the recording of the steps required for completing the preparation of products. During the second review, the researcher documented the steps for completing the procedure. With this background knowledge, the researcher continued with on-site observations of those employees responsible for producing or managing the core products. This observation assisted in understanding how employees applied the skills for which they were trained.

Organizational and Environmental Analysis

The organizational and environmental analysis is paramount to the process of HPT and to this study, in that it facilitated the comparative analysis of two distinct descriptions of the workforce: 1) the desired state, which is the description of the abilities and competencies of the workforce required to execute the strategy and mission of the organization; and, 2) the actual state which is the ability and competency as it really is or currently exists.

DESIRED STATE

The desired state for this study was defined as the time it should take to prepare the product utilizing the appropriate method. This was determined by developing an engineered time standard. An engineered time standard is the "time it should take an average trained operator (working at a normal pace) to perform a task or do a job based on established and documented work conditions and specified work methods plus allowances" (Zandin, 1990). The engineered time standard was developed by utilizing the Maynard Operation Sequence Technique (MOST). Zandin (1990) explains MOST analysis as follows:

> A complete study of an operation or suboperation consisting of one or several method steps and corresponding sequence models, as well as appropriate parameter time values and total normal time for the operation (a job or task, consisting of one or more work elements) or suboperation (discrete, logical and measurable part of an operation).

The MOST work measurement technique extends the early work of Gilbreth and Taylor and their work in time and motion studies. The development of fundamental time data represents one of the most significant contributions of industrial engineering and is defined in the literature as:

> the analysis of the methods, of the materials, and of the tools and equipment used, or to be used in the performance of a piece of work –an analysis carried on with the purposes of (1) finding the most economical way of doing this work; (2) standardizing the methods, materials, tools, and equipment; (3) accurately determining the time required by a qualified and properly trained person working at a normal pace to do the task; and (4) assisting in training the worker in the new method...Although these parts may

> be considered separately, no one of them can be omitted entirely without seriously impairing the value of the study. (Barnes, 1958)

The engineered time standard was developed by the researcher and validated by the organization through its department that normally develops standards for planning and operations. Once the engineered standard was developed and validated, the standard was then used as the desired standard or performance metric for meeting the requirements of the organization.

The use of time and motion studies are universally accepted by both labor and management as yielding fair standards that reflect what normal employees working at normal pace can be expected to accomplish (Zandin, 1990). Utilizing the data collected, a base line was developed for actual performance. Additionally, this data was used to comprehensively examine the variability in performance of team members.

Actual State

The actual state, namely the performance of the employees as measured by time required by employees to accomplish their assigned task, could potentially be affected by a number of factors. In order to determine if some of the factors affected performance, the Taguchi method, which will be defined later, was used. Thus, the observation data collected would be used in the development of the Taguchi Orthogonal Array (OA). This design allowed for the exploration of each selected major factor individually and collectively (Creswell, 1994) as identified by the organization as impactful to performance but also provided a means to

quantitatively evaluate the factors that may have impact on the performance of employees.

The Taguchi Method has been used to effectively improve performance characteristics of many products and processes. In some instances, if there is large variation it could be due to the lack of having or following standard operating procedures or situations where there are hard to control inputs that affect the outputs of the process (www. itl.nist.gov, 2002).

Taguchi Method

The Taguchi Method was developed by Dr. Genichi Taguchi to meet the challenge of producing quality products (Phadke, 1989). Phadke (1989) explains that "Taguchi developed the foundations of Robust Design and validated its basic philosophies by applying them in the development of many products." Robust Design builds on the science of statistical experimental design based on the work of Sir Ronald Fisher in the 1920's (Phadke, 1989). Fisher is credited with finding the principles of experimental design and the analysis of variance (ANOVA) technique, for data analysis. These methods utilize matrix experiments and more specifically orthogonal arrays (OA) to plan and study decision variables. Taguchi provided tabulated sets of standard orthogonal arrays to fit a specific project (Phadke, 1989).

In order to employ the Taguchi method the eight-step process was utilized (Phadke, 1989):

Step 1: Identify the Main Function

For this study, the process identified was the production of the product, including the steps that deliver the quality and consistency required by the organization and the consumer.

Step 2: Identify the Objective

The objective or the measurable output from the investigation was identified as the performance of trained employees as measured by the actual time it took to complete the preparation of the product. This would allow for a quantifiable means for determining how long a production worker should take given the optimal conditions in the work environment, and hence what performance is expected after training.

Step 3: Identify the Design Factors and Data Collection

The objective of this part of the investigation was to determine the factors that have significant effect on employee performance. These five factors were hypothesized to be: time of day, day of week, training level of the person being observed, unit demand, and following the procedures as stated by the Organizational Standard. Of the five factors, those that were considered uncontrollable by the researcher were 1) demand; and 2) whether or not the production worker followed all of the defined steps in the procedure. However, all of these factors were considered major variability factors initially, as each was considered to have impact. Each factor was defined at two levels as depicted in the following Table 3.1.

Table 3.1: Two-Levels of Main Effects

	Main Effects	High	Low
A	Time of Day	Peak	Off-peak
B	Day of Week	Weekend Day	Week Day
C	Trained	Veteran	New
D	Type	High Demand	Low Demand
E	Procedures	2 or less steps missed	3 or more steps missed

STEP 4: DESIGN THE EXPERIMENT AND SELECT THE ORTHOGONAL ARRAY

For this study , Taguchi's L_{16} Orthogonal Array was selected. Taguchi's Orthogonal Array allowed five factors to be studied at two levels, with 16 experiments. All interactions were initially hypothesized as significant for this study. Using an L_{16} array allows for studying factors utilizing 16 experiments as opposed to 32,768 (2^{15}) required by a full factorial design.

STEP 5: CONDUCT THE MATRIX EXPERIMENT AND RECORD DATA

The sixteen experiments were collected and recorded (see Table 3.2). The results of the analysis are developed in the next chapter.

Table 3.2: L_{16} Orthogonal Array

	Time of Day	Day of Week	Training	Type	Procedures	Prep Time
1	-1	-1	-1	-1	-1	
2	-1	-1	-1	-1	-1	
3	-1	-1	-1	1	1	
4	-1	-1	-1	1	1	
5	-1	1	1	-1	-1	
6	-1	1	1	-1	-1	
7	-1	1	1	1	1	
8	-1	1	1	1	1	
9	1	-1	1	-1	1	
10	1	-1	1	-1	1	
11	1	-1	1	1	-1	
12	1	-1	1	1	-1	
13	1	1	-1	-1	1	
14	1	1	-1	-1	1	
15	1	1	-1	1	-1	
16	1	1	-1	1	-1	

Step 6: Analyze the Data

The data was analyzed utilizing the science of statistical experimental design based on the work of Sir Ronald Fisher in the 1920's (Phadke, 1989). Fisher is credited with finding the principles of experimental design and the technique that will be utilized in this study, analysis of variance (ANOVA) and a second order mathematical model.

Step 7: Interpret Results

The interpretation of results was done in the following chapter by selecting the optimum levels for the selected variance factors; and, by using the mathematical model to predict the results for the optimum conditions.

Step 8: Run a confirmation experiment to verify predicted results

The purpose of the confirmation is to verify the optimum conditions that come from the matrix experiment. This is a crucial step because if the observed and projected measurements match then one can consider the investigated conditions. However, if they do not match then it can be concluded that the matrix experiment failed, and additional research is required.

Data Collection

The data was collected based on the design of the experiment given the identified factors. The sixteen matrix experiments were collected from data extracted from onsite videotaped observations. Video cameras were placed in different establishments, which followed the same process, to capture the

product preparation process. The data collection followed the approach used by Heuter and Swart (1998). For this study, an observation was defined, as the actual time required to prepare the product. Fifteen hours per day of video taped observations per establishment became the source for the experimental data collection. In order to get the cameras placed, there were several legal hurdles that had to be cleared in order to get authorization. This authorization was followed by a contractual confidentiality agreement. Once the cameras were placed in the establishments, the organization's management decided that it would be best to leave the cameras in for approximately 4 weeks to gather data and see if there were any patterns found from the video analysis. This resulted in the collection of approximately 6300 hours (See Table 3.3).

Table 3.3: Total Hours Planned for Collection

Division	#/Division	Hours/Day	Days/Week	Weeks	Hrs/Division
1	5	15	7	4	2100
2	5	15	7	4	2100
3	5	15	7	4	2100
~ Total Hours Planned for Collection					6300

The first week of video was not used, as this week was considered as the week of adjustment for those involved in the study. The environments were reviewed to understand the similarities and differences. Time studies were conducted by reviewing videotapes to collect the data. The collection was done consistently at the peak time and off peak time as established by the selected organization, consistent with the requirements of the Taguchi design. Once the times were determined the data was collected utilizing work sampling techniques (Hansen, 1960). The data collection was done in increments decided by random

number generation. The random number generator was used to remove the bias of starting at a given time every time in the production process. Observations came from each division and concentrated on performance of tasks associated with one selected core product. The organization believed that if there were similar identifiable patterns across divisions then the research should focus on one division to streamline the research and analysis. Streamlining the analysis would give time and resource to better determine why and if the patterns exist. Initial review suggested that one selected core production line would be better suited for the study.

Research Methodology and Design Summary

This chapter laid out the methodology for this study. The theoretical foundation was developed in the literature review with the understanding that there are no models that quantitatively evaluate the relationship between training and performance. The robust design methodology was used to assign variability. Additionally, it allowed for the synthesis of engineering methodologies with training and human performance technology methodologies. The analysis of the data and the interpretation of the results will be presented in the next chapter.

Chapter 4

Quantitative Research Results

This chapter presents the research results and is divided into two sections. The first section, Performance Analysis, explains the developments and findings between desired state and actual state. The second section, robust design analysis, explains the identified major factors that were hypothesized as causes of variability in training and implementation.

Performance Analysis

Desired State

To develop the time standard for the selected core product in the division identified by the organization, data was collected via on-site observations. The engineered standard was developed by using the Maynard Operation Sequence Technique (MOST), and after proper validation by the organization's department of operations and engineering, was determined to be 9.3 minutes. This engineered standard would then expand the definition of "trained" by suggesting that a production worker has to: 1) pass the written exam; 2) pass the practical exam; and 3) pass within the standard time and meet the other required existing quality and safety standards.

The newly developed time standard was now considered for integration into the development of training programs for future training. Definitive time standards were believed to allow for the evaluation of performance, determine staffing requirements, and facilitate management of the overall organizational operations.

The standards would assist management by building a time baseline from which to predict the impact of new products, processes, and procedures, as well as facilitate the planning necessary to insure operations supported corporate goals.

Actual State

This standard was anticipated to assure that trained employees would deliver anticipated performance and that such employee performance would lead to the unit meeting its operational and financial goals. To verify this expectation, the organization suggested that data continue to be collected via video analysis. The time study and work sampling observations, identified in Table 4.1, were extracted from the videotapes.

Table 4.1: Time Study and Work Sampling Observations

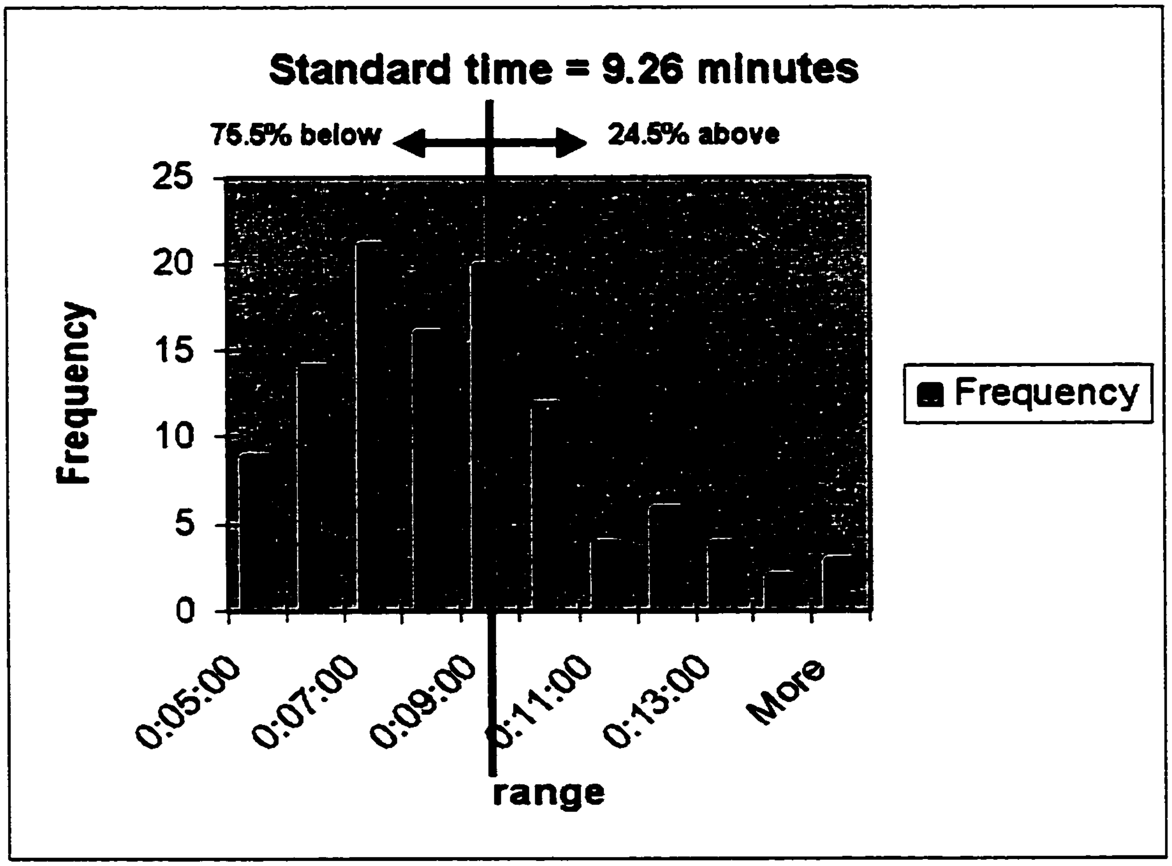
Division	Observations	Time Studies
1	90	10
2	120	10
3	**396**	**153**
Totals	606	173

Bold = Selected Division

The results were surprising!

Actual observed production times had a wide distribution (Figure 4.1). 75.5% of the actual production times fell below the engineered standard while 24.5% were above the standard.

Figure 4.1. Observed Production Time Histogram



The variability was so great that additional investigation was required to understand what could cause such a large difference in performance, especially among employees that were considered equally trained. This data collection was used to test Hypothesis 2.

Hypothesis 2: There is no significant variability in the production process.

Based on the findings of the null hypothesis, Hypothesis 2, was rejected as there was clearly quite a bit of variability with 75.5% falling below the engineered standard. At this point, possible causes for the variability were hypothesized in the following questions:

- Was the training not delivering the knowledge required to complete the operation?
- Was everyone observed considered trained?
- Was management involved in conducting the training and follow-up?
- Did it matter what time of day or day of week training occurred?
- Did production demand change performance?

To answer the above questions, a methods analysis was conducted with continued video analysis. With the apparent variability across divisions, the organization suggested that the focus of the research return to one division to concentrate the video analysis effort.

The analysis of the video addressed three categories: 1) Employee Performance, 2) Management Performance, and 3) Health and Safety. The findings in each are detailed in the following sections.

Employee Performance

The results presented in this section focused on the preparation of the selected core product, from the identified division as derived from video analysis of multiple productions, at four separate establishments. The analysis revealed that *trained employees* were performing as they have been trained to perform

only 3% of the time. The utilization of the grid shown in Table 4.2 provided a tabular format for collecting and analyzing the procedure.

The production procedure was broken down into steps; each step represented a required element for completing the operation. If any of the steps were omitted or modified it was deemed an error or deviation from the procedure.

Table 4.2: Deviation Matrix

1	2	3	4	5	n-1	n	PROBABILITY
			ERROR	ERROR	ERROR	ERROR	0.24
ERROR	ERROR		ERROR	ERROR	ERROR	ERROR	0.24
ERROR			ERROR	ERROR	ERROR	ERROR	0.08
			ERROR				0.06
			ERROR		ERROR	ERROR	0.06
							0.03
	ERROR		ERROR	ERROR	ERROR	ERROR	0.03
ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	0.03
			ERROR			ERROR	0.02
			ERROR		ERROR		0.02
		ERROR	ERROR	ERROR	ERROR	ERROR	0.02
ERROR			ERROR		ERROR	ERROR	0.02
					ERROR		0.01
					ERROR	ERROR	0.01
				ERROR	ERROR	ERROR	0.01
		ERROR	ERROR		ERROR	ERROR	0.01
	ERROR				ERROR	ERROR	0.01
	ERROR		ERROR		ERROR	ERROR	0.01
ERROR					ERROR	ERROR	0.01
ERROR				ERROR	ERROR	ERROR	0.01
ERROR			ERROR		ERROR		0.01
ERROR	ERROR				ERROR		0.01
ERROR	ERROR				ERROR	ERROR	0.01
ERROR	ERROR			ERROR	ERROR	ERROR	0.01
ERROR	ERROR		ERROR		ERROR	ERROR	0.01

The collection of this methods analysis data was used to test the null hypothesis, Hypothesis 1.

Hypothesis 1: There is no significant difference between the steps that employees are trained to follow and the steps those employees actually follow.

The result was that employees completed all the tasks required for the operation 3% of the time, leading to the rejection of Hypothesis 1. Ironically, the employees would modify all the tasks required for the operation 3% of the time. Thus, as long as each of the steps in the operation (Table 4.3) was deemed critical to leading to a successful outcome (the company emphatically believed this), the impact of employees not following operational procedures would result in a product that did not meet the intentions of the company.

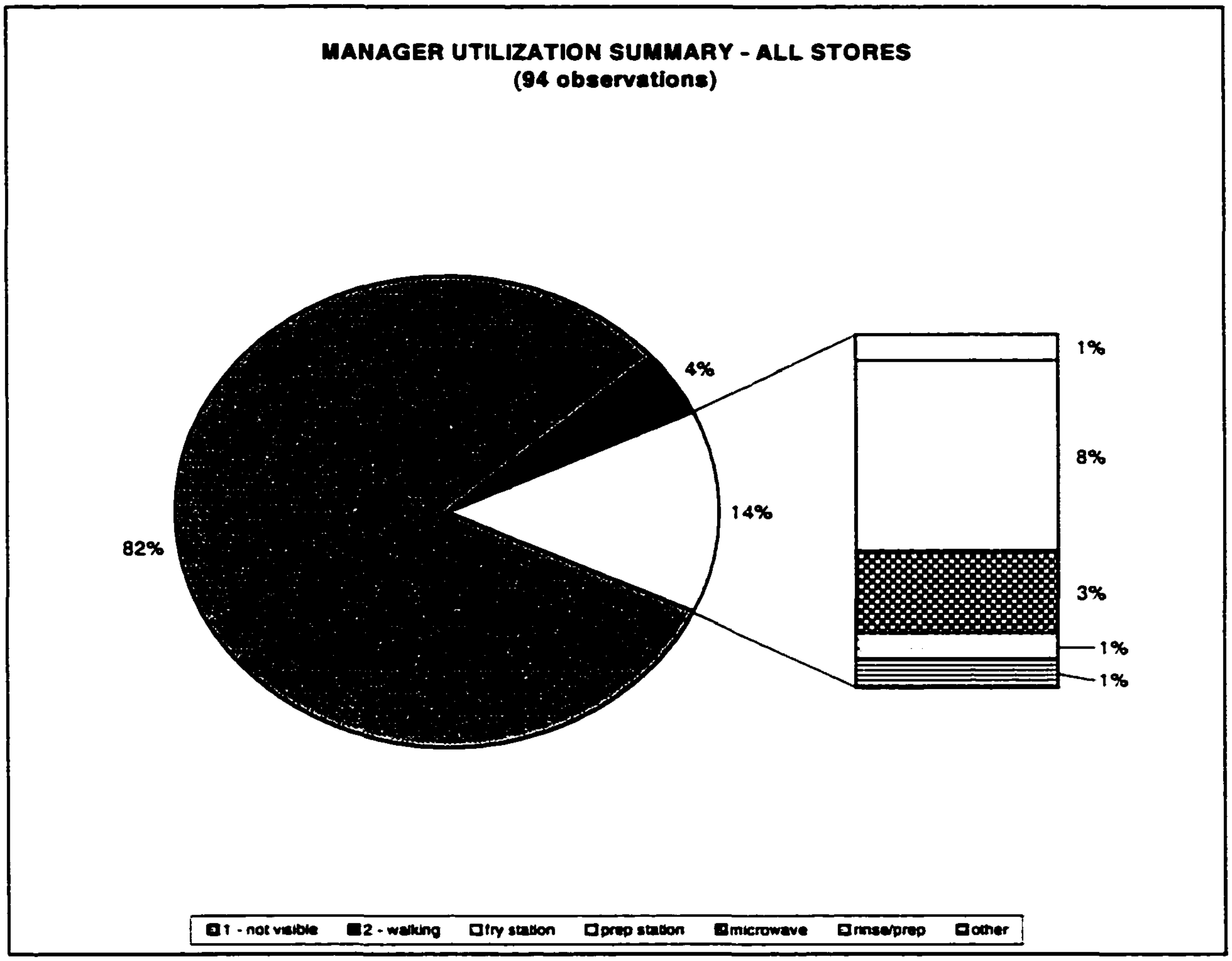
Table 4.3: Probability of Deviation Matrix

NUMBER OF DEVIATIONS	PROBABILITY	PROBABILITY OF THIS MANY OR MORE DEVIATIONS
0	0.03	1.00
1	0.07	0.97
2	0.05	0.90
3	0.11	0.85
4	0.31	0.73
5	0.15	0.43
n-1	0.24	0.27
n	0.03	0.03

Management Performance

Management performance was defined as the presence of management/supervisory personnel in the production area. Observations indicated that 82% of the time there was no supervision on the production floor (Figure 4.2). This data was obtained by focusing the observation of the videotapes on the production area in the establishment and taking observations at what the organization defined as crucial points in the production process. Only 18% of the time was there a supervisor or management person on the production floor observing or giving feedback to the production workers.

Figure 4.2: Manager Utilization Summary



Health and Safety

Observations from the videotapes revealed health and safety infractions took place 96% of the time. These infractions were not separated from minor to major, as all infractions that affect health and safety were considered major. These infractions were identifiable deviations from company policies.

Robust Design Analysis

In an attempt to assign variability to causes, the research continued with the development of the robust design.

As shown in the previous chapter, the analysis results were recorded in Step 5.

STEP 5: CONDUCT THE MATRIX EXPERIMENT AND RECORD DATA

The sixteen experiments were collected and recorded (see Table 4.4).

Table 4.4: Matrix Experiment Results

	Time of Day	Day of Week	Training	Type	Procedures	Prep Time
1	-1	-1	-1	-1	-1	8.75
2	-1	-1	-1	-1	-1	7.38
3	-1	-1	-1	1	1	12.38
4	-1	-1	-1	1	1	10.73
5	-1	1	1	-1	-1	7.12
6	-1	1	1	-1	-1	6.98
7	-1	1	1	1	1	10.44
8	-1	1	1	1	1	12.38
9	1	-1	1	-1	1	9.88
10	1	-1	1	-1	1	7.65
11	1	-1	1	1	-1	6.85
12	1	-1	1	1	-1	6.57
13	1	1	-1	-1	1	9.88
14	1	1	-1	-1	1	8.22
15	1	1	-1	1	-1	13.05
16	1	1	-1	1	-1	12.12

STEP 6: ANALYZE THE DATA

The analysis results of the matrix experiments for product preparation times are presented in the preceding table. When the effect of one factor depends on the level of another, an interaction exists (Phadke, 1989). For this study, it was difficult to determine which interactions would have the strongest effects because all of them were hypothesized to have impact on training. Therefore, all sixteen two-factor interactions were

selected initially in this case. These interactions are listed below in Table 4.5.

Table 4.5: Identified Interactions

AB	Time of day **X** Day of Week	BC	Day of Week **X** Training
AC	Time of day **X** Training	BD	Day of Week **X** Demand Type
AD	Time of day **X** Demand Type	BE	Day of Week **X** Procedures
AE	Time of day **X** Procedures	CD	Training **X** Demand Type
BC	Day of Week **X** Training	CE	Training **X** Procedures
		DE	Demand Type **X** Procedures

The Taguchi method has a systematic and streamlined approach for studying interactions. This ability for interactions evaluation was a primary reason for using orthogonal arrays.

The response table shown (Table 4.6) below reveals two interactions with strong effects and two interactions that were included while the remaining interactions were thrown out. The response table results, led to the analysis of the five main effects and only four interactions (AB, AC, AD, BD). Additionally, the regression analysis done with five factors and all of the interactions did not allow enough degrees of freedom for errors to be shown (See Appendix 1). This required a first round reduction of insignificant interactions and a second regression analysis for experiment evaluation.

Table 4.6: Response Table

	A	B	C	D	E	AB	AC	AD	AE	BC	BD
1	9.2775	10.024	8.48	10.57	10.20	8.59	9.99	9.79	9.64	9.46	9.09
-1	9.52	8.77	10.31	8.23	8.60	10.21	8.81	9.00	9.16	9.35	9.71
Delta	-0.24	1.25	-1.83	2.33	1.59	-1.62	1.18	0.79	0.48	0.12	-0.61

STEP 7: INTERPRETATION OF RESULTS

The ANOVA resulted in P-values that were less than .05 and was therefore included in the model; these values are shown below Table 4.7.

Table 4.7: P-values

Factors and Interactions	***P-value***
Time of Day (A)	0.596930262
Day of Week (B)	**0.028163536**
Training (C)	**0.005610056**
Type (D)	**0.001713896**
Procedure (E)	**0.010510981**
AB	**0.009884566**
AC	**0.034827199**
AD	0.118893344
BD	0.208271945

The model would include the following main effect variance factors: Day of Week (B), Training (C), Demand (D), and Procedure (E). These factors would include two interactions AB and AC. Additionally, the Significance F value of .0048 < .05 suggested the development of a good model. Traditionally, the results of a well-deployed training program deliver a trained team member **(C)** that can work any day of the week **(B)** in a high demand establishment, **(D)** following the appropriate procedures **(E)**. This premise held true for the variance factors selected. The regression analysis delivers this second order model:

Y = 9.356 + .667*B-.957*C+1.124*D+.839*E-.850*AB+.632*AC

$$\boxed{\mathbf{14.425 = 9.356 + .667(+1) - .957(-1) + 1.124\,(+1) + .839(+1) - .850(-1) + .632(+1)}}$$

The levels, which result in delivering the requirements of a well-deployed training system, were considered the factors for the design that predicted 14.425 minutes for product preparation time.

STEP 8: RUN A CONFIRMATION EXPERIMENT TO VERIFY PREDICTED RESULTS

Next, the confirmation experiment was performed to verify predicted results. This was done by taking sixteen additional observations of the product preparation process and finding the average preparation time. Surprisingly, it was 9.13 minutes a delta of 5.295 minutes.

This delta of 5.295 minutes coupled with the presumed and observed significant deviations in the procedure suggested that additional research was required. The significant delta suggested that the variability cannot be explained with this model, although the model was found to be a good model. As stated in the methodology chapter, if there is large variation it could be due to the lack of having or following standard operating procedures or situations where there are hard to control inputs that affect the outputs of the process (www. itl.nist.gov, 2002). It was determined by the analysis and organization that the variability in procedures definitely required more attention, understanding, and observations.

By combining the engineering methodology with the HPT methodology in the research design the investigation continued with the Cause Analysis.

In order to determine why employees who are trained deliberately choose not to perform according to their training, a causal qualitative analysis was performed.

Results Summary

This chapter delivers the results of the Performance Analysis and Robust Design. The results obtained via quantitative methodologies reveal that there was significant variability in the product preparation process and that there was also a significant difference between the defined steps for the process and those steps actually being followed, resulting in the rejection of Hypothesis 1 and 2. The findings also indicate that management/supervision condones their employees deviating from trained procedures if it appears to help the people at the execution level meet their goals. However, this quantitative research could not explain the causes for these modifications at the point of execution. The next chapter develops the methodology for the Causal Analysis.

CHAPTER 5

QUALITATIVE RESEARCH METHODOLOGY AND DESIGN

In an effort to determine the causes for the observed variability in the performance of trained employees, a case study design was employed. The purpose of this design was to develop possible explanations for why employees were modifying the procedures at the point of execution (Leedy, 1997).

The study design extends the quantitative design to include a qualitative causal analysis that allowed for the quantitative findings to be shared with the front line employees. The possible causes for the variability were only speculation and required validation. The researcher hypothesized that this could be done by enlisting those who worked on the front line to explain the observed behaviors.

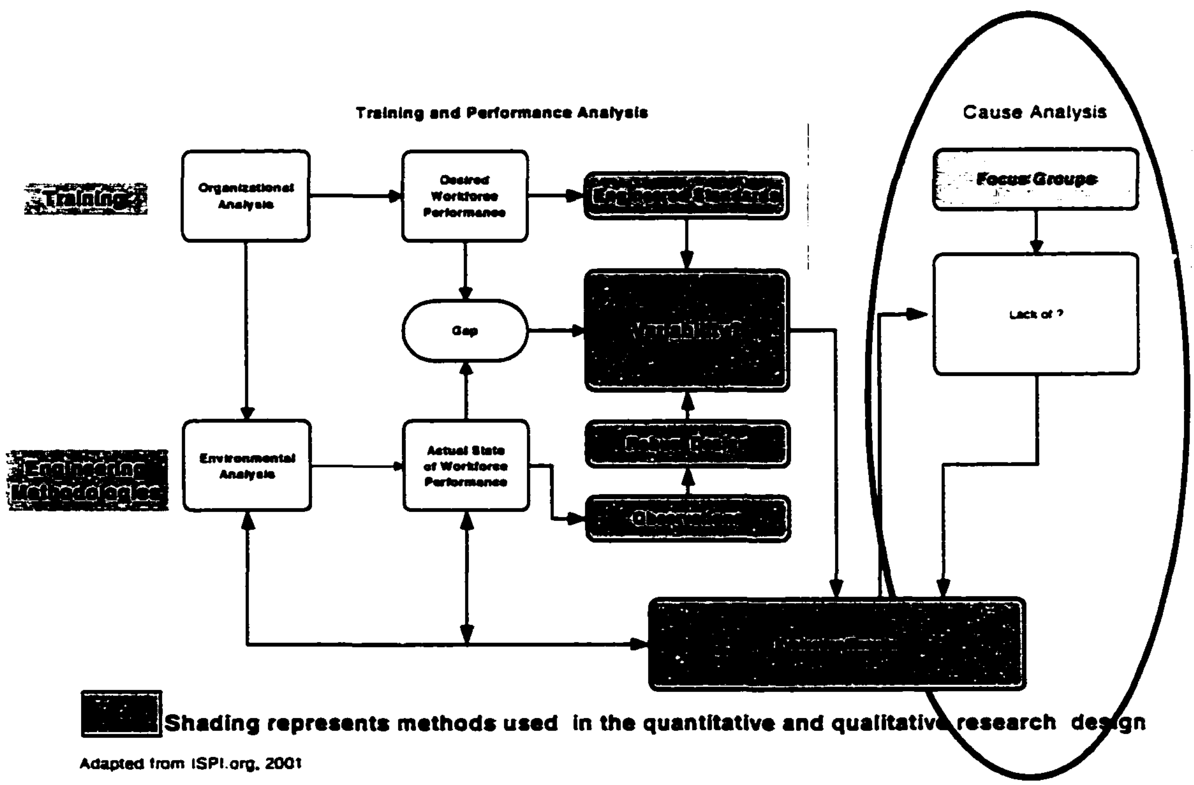
The causal analysis was done by setting up focus groups outside of the markets where observational data was collected. Ideally, a representative sample of the division's units would have been the best method for data collection. However, the organization limited the researcher's access to the units and gave approval for four focus groups in markets that would not cause large economical impact to the research budget.

CAUSE ANALYSIS

Cause Analysis was also the next step in the HPT model. The causal analysis attempts to identify the factors that specifically contribute to the gap in performance. ISPI (2001) suggests that Cause Analysis is the "critical link between identified performance gaps and their appropriate interventions and is a

major strength of the performance technology approach." This analysis was done through focus groups. The collection of focus group data allowed for validation of quantitative data collected during the development of the factorial design and the Performance Analysis and allowed for a comparison of observational data and focus group data. The observational data was used to formulate discussions for focus groups to get perspectives of those persons who do and manage the jobs at the level of execution (See Figure 5.1). Additionally, it allowed for insight into the way training and performance is perceived by those executing on the front line.

Figure 5.1: Quantitative and Qualitative Research Design



After the markets were identified, the focus groups were conducted utilizing the following process:

Focus groups consisting of managers and production workers would be shown a sequence of video clips. A series of seven video clips were extracted from the collection of videotapes. Each clip illustrated a particular type of observed behavior in the division. These clips are listed below:

- Clip 1: The production worker was completing a product and the work area was uncluttered and clean. (Note: This employee was being directly observed by management and visitors to the establishment.)

  NOTE: The remainder of the clips describe task completion captured on video but with the absence of a supervisor or visitors.

- Clip 2: The same production worker was completing the same operation the next day (without supervision) and was totally modifying the procedure.
- Clip 3: A Health and Safety violation was identified within the context of the production process.
- Clip 4: Employee totally modified the production process, no steps in the production process were followed according to standard.
- Clip 5: Employee incorporated a new step in the production procedure (considered a short cut).
- Clip 6: Employee broke down the production area early in violation of policy and thereby created a health and safety issue.
- Clip 7: New employee performed the production operation.

Each focus group session consisted of showing the audience one video clip at a time and eliciting responses and information from the group discussion based on their responses to the following questions:

1) What is happening?
2) Have you seen this type of behavior, engaged in it, or condoned it?
3) Why is the subject not following the established procedures?
4) Do you think that established procedures are required to yield a quality product?
5) In your opinion, which prescribed steps, if any, can be eliminated without compromising quality?
6) Do you as a manager require adherence to procedures?
7) Does your manager require that you adhere to procedures?
8) Do you, as a manager, spend time in the production area or do you delegate responsibility for the production area to a production worker?

SUMMARY

This chapter laid out the methodology for the qualitative causal analysis. The process employed used focus groups and observational data to examine the variability in performance. The foundational elements of the methodology were steeped in the HPT model's Cause Analysis.

The analysis of the data and the interpretation of the results will be presented in the next chapter.

CHAPTER 6

QUALITATIVE RESEARCH RESULTS

This chapter presents the qualitative research results and discusses the findings of the causal analysis. The purpose of the causal analysis was to attempt to determine if the quantitative findings would be supported by the qualitative investigation.

CAUSE ANALYSIS

The cause analysis, as described in Chapter 5, utilized focus groups to collect data. These focus groups were held with employees that were considered to be trained experts. The focus groups were assembled (See Table 6.1 and 6.2) to identify the factors that specifically contributed to the gap in performance but also to assess the extent to which the findings are endemic to the company.

Table 6.1: Number of Managers and Establishments Represented

	Managers	No. of Establishments
Market 1	8	8
Market 2	5	5

Table 6.2: Number of Employees and Establishments Represented

	Prod. Workers	No. of Establishments
Market 1	7	6
Market 2	3	3

Focus groups consisting of managers and production workers were shown a sequence of video clips, as discussed in the previous chapter. Care was taken to insure that the focus groups were selected from geographical locations outside of where the videotapes were collected so that personnel bias did not influence the discussion.

Focus group findings were equally surprising!

All participants in the focus groups agreed that personnel know what to do but choose not to comply with the corporate standards. Managers offered that they do not have time to supervise for compliance with corporate standards, due to their heavy workload. Additionally, managers delegate responsibility to production workers and do not inspect/enforce the use of correct procedures for production, while production workers skip steps they felt were unnecessary to production.

Focus group members were universal in their belief that adjustments to corporate standards and goals were necessary for the accomplishment of the broader and imminent task of getting the product to the customer. If an employee violated a rule of safety, or if a step or two was skipped during the production process, then that became an acceptable compromise in order to get the product out to the customer in a timely fashion.

The observations, as well as the focus groups, confirmed that adjustments to corporate policies, planning, and objectives were being made at the point of execution. Employees made the decision as to what was important at the moment, and while the product might have been delivered to the customer within

some acceptable timeframe, the consistency of quality, and/or service often became the necessary tradeoff. This goes a long way to explain why a chain establishment that has enough variance in its service and products may find it difficult to deliver the quality and consistency a chain advertises to its customers.

What is important is the impact created by the difference between what the corporations believe is happening and what is actually occurring due to adjustments at the point of execution. Such adjustments are likely to continue, as long as companies train individuals in such a manner that their performance is assumed based primarily on their training. Within the unit, reward is distributed only if the goals of the unit are met, even if the performance required as a result of the training is modified or discarded in order to meet unit goals.

The focus group findings were used to test Hypothesis 3.

Hypothesis 3: Training delivers expected performance.

This hypothesis also had to be rejected as the focus groups and observational data revealed that the production workers do know what to do and choose not to do it.

The data collected suggest that training was only an input to achieving the desired and expected performance. This analysis found that training did not have the impact on performance that was assumed by the corporation. Apparently, employees were altering corporate standards in order to achieve what they perceived as more pressing and immediate company goals. Moreover, research confirmed that employees adjust to a managerial thrust to provide an artificial view of compliance without fixing the situation that

precipitated the establishment of the goal. In meeting the goals, those same individuals would make the ad-hoc decisions necessary to prioritize work, even if it meant breaking some of the organizational standards. The mismatch between operational goals and training goals demands that the employee prioritize daily between the operational on-the-spot adjustments required by local management and the operational corporate goals linked to long term success in the marketplace. The researcher describes and refers to this as a lack of goal alignment between levels of the organization, causing the adjustments at the point of execution.

Results Summary

This chapter delivers the results of the Cause Analysis. The results obtained via quantitative methodologies and combined with qualitative methodologies reveal that employees will strive to meet the goals by which their superiors are assessed, even if it means modifying or discarding what they know to be required from their training, if they perceive it necessary to do so. The findings also indicate that management/supervision condones their employees deviating from trained procedures if this deviation appears to help the employee meet his/her goals at the execution level. The next chapter, suggests that modeling and simulation has been used as an effective tool by organizations to help establish goals across the levels of the organization that are aligned, and hence will help to eliminate situations as described in this chapter.

CHAPTER 7

LITERATURE OVERVIEW (MODELING AND SIMULATION)

The quantitative research revealed that there was significant variability in the production process times, as well as the steps employees actually follow. To assign the variability, a robust design was developed but could not be used to explain the variability. This led to additional research and investigation using qualitative research.

The qualitative research revealed that employees did whatever was necessary to meet the next higher level's performance goals with little regard for adhering to their own individual task standards. This illustrates a misalignment of organizational goals and objectives. The desire to meet the goals of the next level in the organization took deliberate precedence over completing the procedures as trained. This leads to employees not performing as expected. Securing expected performance is a complex problem whose solution requires both qualitative and quantitative analysis.

This chapter builds on the results of the study and surveys the literature of modeling and simulation. This methodology holds promise for aligning organizational goals and objectives. Such alignment is a critical factor in having appropriately trained employees who deliver expected performance.

SIMULATION MODELS

Simulation models have been utilized in many varied fields with demonstrable success; however, it is important to situate simulation in the appropriate context for this work and understand how the term "simulation" is

being used. Simulation as it relates to training and training interventions refers to an individual's opportunity to perform tasks as he or she would in real life in a "re-creation" of the actual environment (Stolovitch and Keeps, 1998). However, from an engineering perspective and for the purpose of this research, simulation and simulation modeling will refer to "the process of designing and creating a computerized model of a real or proposed system for the purpose of conducting numerical experiments to give a better understanding of the behavior of the system for a given set of conditions" (Kelton, Sadowski, and Sadowski, 1998). Schrage (1999) explains that the term "modeling embraces simulation ...[and] is at the highest level of abstraction [for the real world]." Simulations have gained popularity because of their ability to deal with extremely complicated models and systems (Kelton, Sadowski, and Sadowski, 1998). Simulation has been used as a tool to address issues from manufacturing systems to service organization design, for example (Law and Kelton, 1994):

- Designing and analyzing manufacturing systems
- Evaluating hardware and software requirements for a computer system
- Evaluating a new military weapons system or tactic
- Determining ordering policies for an inventory system
- Designing communications systems and message protocols for them
- Designing and operating transportation facilities such as freeways, airports, subways, or ports
- Analyzing financial or economic systems
- Evaluating designs for service organizations such as hospitals, post offices, or fast food restaurants

Simulation has enabled organizations to substitute the model world for the real world. During the conceptualization of simulation models, many assumptions are made in abstracting reality. Each assumption is explicitly specified (Balci,

1998), including the way work is being done and how long it takes people and/or machines to complete the work. However, for the results of simulation models to be valid and useful requires the work force in the real world to consistently perform at the level assumed in the simulation models (Selby-Lucas and Swart, 1999).

Simulation modeling has been used by Burger King to improve operations, planning, and productivity (Donno and Swart, 1981). A restaurant model was developed and viewed as an organizational system with "an operating system made of three interrelated subsystems: The Customer System (where the customers order taken and entered in the system), The Production System (where the order is prepared and inventory replenished), and The Delivery System (where change is given and the order assembled)." This model had to meet the requirements of all of the restaurants in the system, since there were different layouts and designs. The model was built modularly, which allowed modifications to be made according to the configurations and demands of the restaurants. Burger King developed standard times for processing customers.

With continued analysis, the complexity of the system suggested that a full-scale restaurant model be developed. The full-scale restaurant allowed for trade off analyses and projections of the return on investment, relative to possible changes. The use of simulation allowed for (Donno and Swart, 1981):

- Ongoing analysis of the drive-thru
- Operational impact of new products
- Aids in the development of new restaurants
- Accurately projecting number or crew members needed (positioning)

The use of simulation modeling resulted in millions of dollars in savings and revenue. But Swart and Donno (1981) suggest that the "single greatest impact of the simulation models was the establishment of new labor standards," which gave Burger King the ability to quantify work and the ability to measure how quickly an individual was delivering the product to the customer. These standards are more inclusive than typical standards because they specify, for any projected level of sales, how many employees would be required including their tasks.

As an example of the application of the model, Donno and Swart (1981) considered productivity improvements by analyzing Burger King's drive-thru system. They found that the standard set for the drive-thru was 45 seconds from arrival to the window until change was made and food delivered. When analyzed, the 45-second measure was found to limit the number of customers who could be served. The analyses further showed that by improving this time to 30 seconds the volume of customers could be increased by 50 percent, a significant increase in drive-thru capacity and, hence, revenue potential.

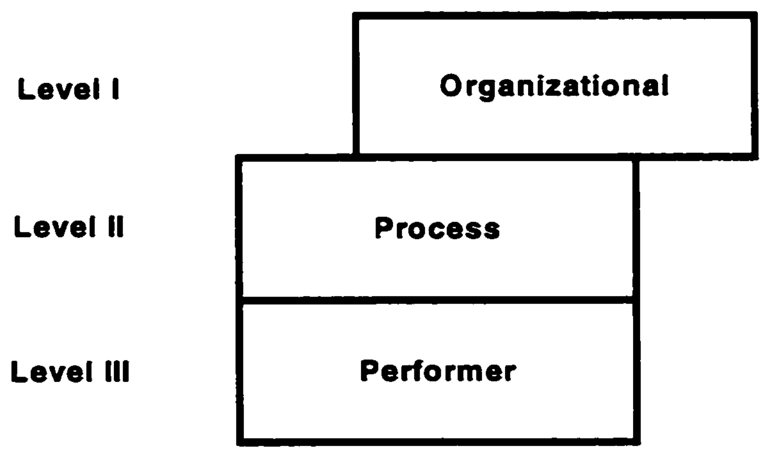
These studies used optimization, statistical models and/or simulation. However, these studies did not continue on to address the impact of the findings on employees when they were asked to deliver the new transaction time. It is one thing to meet the 30-second transaction time, but it is quite another to continue to use the appropriate methods while meeting the new transaction time standard, especially when doing so requires the coordination of cooks, assemblers, and cashiers. The 30-second transaction time delivered the objective of increasing

revenue and productivity at the organizational level. However, it remained undetermined as to whether the new standard would effect the original objective of the organization of "delivering quality food – quickly and courteously" to the customer. These are objectives for the entire unit, which may or may not be met when employees execute their tasks as trained.

Levels of Performance

As discussed in Chapter 2, Rummler and Brache (1988) describe three levels of performance: 1) Organizational, 2) Process, and 3) Performer. Based on the perspective of the researcher when only an objective from one level is determined as the mission of a model it considers only a piece or a slice of the organization, as depicted in Figure 7.1.

Figure 7.1: Levels of Performance



Adapted from Rummler and Brache (1988)

Figure 7.9 represents how models are generally sliced horizontally across levels of an organization. The Donno and Swart (1981) model studied ways of meeting

the corporate objective of increasing the company's profits at the organizational level.

By applying a broader view of simulation and utilizing its iterative capabilities, management could predict the impact that the changing goals and objectives, decided at the higher levels in the organization, would have on the frontline worker or trainee prior to deployment in the actual environment. The focus of this broader view of simulation would be to use models to examine the expected result of the performance. Thus, models and simulation can potentially be used to verify that the goals and objectives of the organization are aligned with the training standards and objectives at all levels of the organization.

SUMMARY

This literature summary is developed to show that simulation models have been used to address organizational performance. However, the models discussed here only focused on the levels or horizontal slices of the organization and did not consider the impact at all levels of the organization, although these models are capable. Therefore, simulation models have the potential of becoming effective tools to align goals from one level of the organization to the next.

CHAPTER 8

GOAL ALIGNMENT VIA MODELING AND SIMULATION

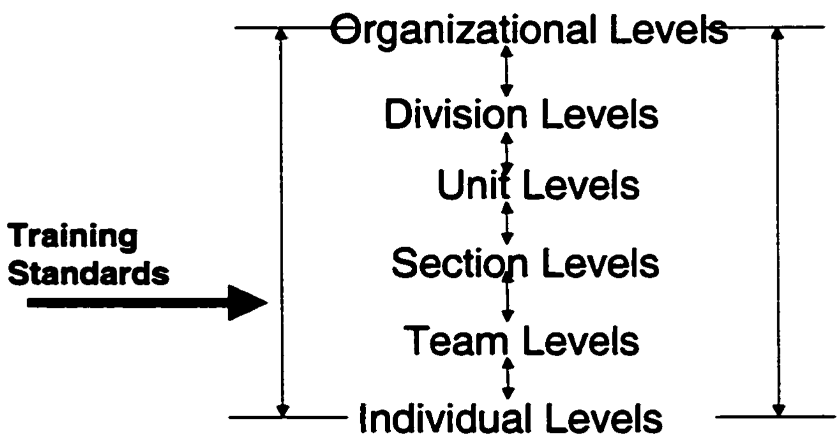
This chapter explains how modeling and simulation can serve as a tool to achieve goal alignment across organizational units. As stated, simulation has been used in the service industry for some time to forecast labor requirements, redesign facility layouts, and examine employee and customer traffic flow, just to name a few examples. Simulation can be used to evaluate the effect of goals established at one level of the organization on the ability to achieve goals at the next level. It can also be used to modify any misaligned goals so that satisfaction of goals at each level would lead to satisfaction of goals at the next level. This presents, for the first time, the opportunity for organizations to better predict whether appropriate training is likely to lead to expected performance.

A key element in linking individual and team performance to organizational performance is the establishment of individual and team time standards for each task. Knowing how long it will take to perform each task helps predict how much labor will be required to meet customer service standards and the resulting labor costs. These time standards must be included in training programs so that each employee or team can follow the established procedures and accomplish them within a given time.

The incorporation of time standards would facilitate linking organizational goals to divisional goals, linking those goals into each unit's goals, and linking those goals into team and individual employee tasks time standards (See Figure

8.1). This alignment can then allow corporations to predict organizational performance as opposed to suffering potential negative effect after the fact.

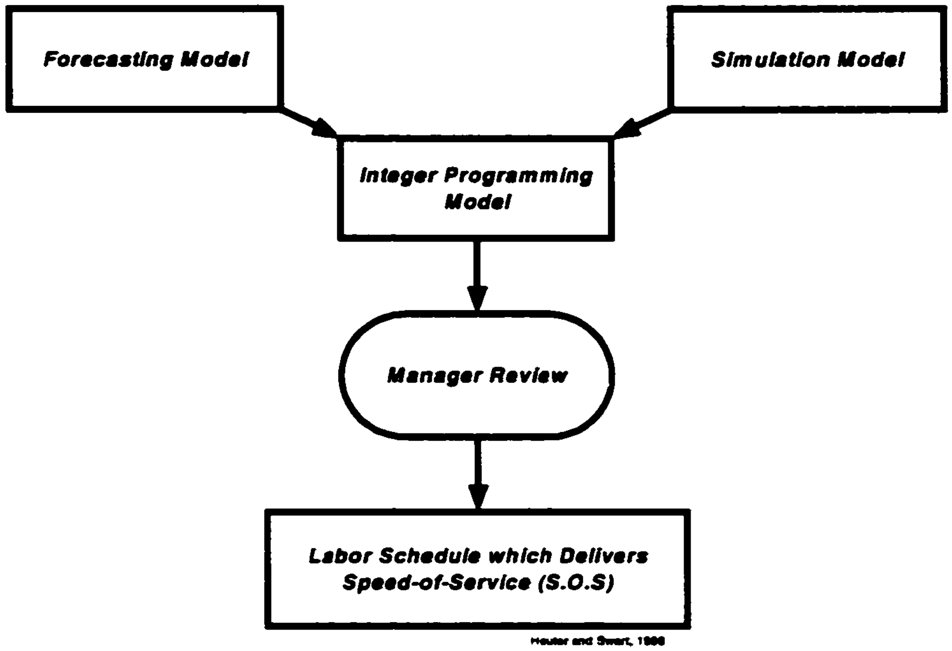
Figure 8.1: Alignment at All Levels



Adapted from Kaufman(1983) Planning Organizational Success

For example, the Labor Management System (LMS) presented by Heuter and Swart (1998) utilized a set of three integrated models. The models were developed to help schedule the labor required for the restaurants. The first was a forecasting model designed to project the number of customers that could be expected at the store at any time of day. The second was a simulation model developed to determine the minimum number of employees needed and assignments in the store to provide the desired levels of service. The third, an optimization model, scheduled employee shifts [Godward and Swart, 1994]. The LMS model is depicted in Figure 8.2.

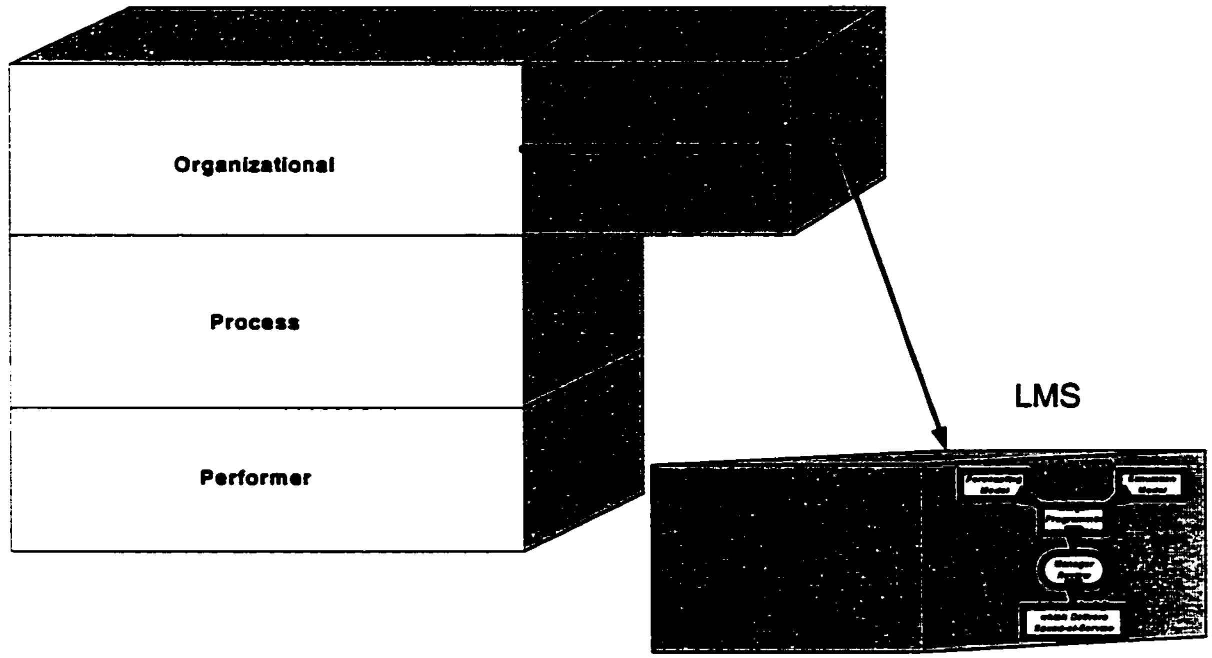
Figure 8.2: Labor Management System (LMS)



Source: Heuter and Swart (1998)

Goranson, Jochem, Nell, Panetto, Partridge, Ripoll, Shorter, Webb, and Zelm (2002) state that the future of the modeling [simulation] discipline lies in the power to evaluate organizations at each level, which allows for tweaking and thereby creates a tool for management to look at decisions both pre- and post-implementation. For example, the development of the Labor Management System was driven at the organizational level to meet the objective of the organization to more efficiently and effectively schedule labor. These models did not consider how the changes would impact the frontline worker, thus leaving out the effect at the process and performer levels (See Figure 8.3).

Figure 8.3. Example of a Horizontal Slice

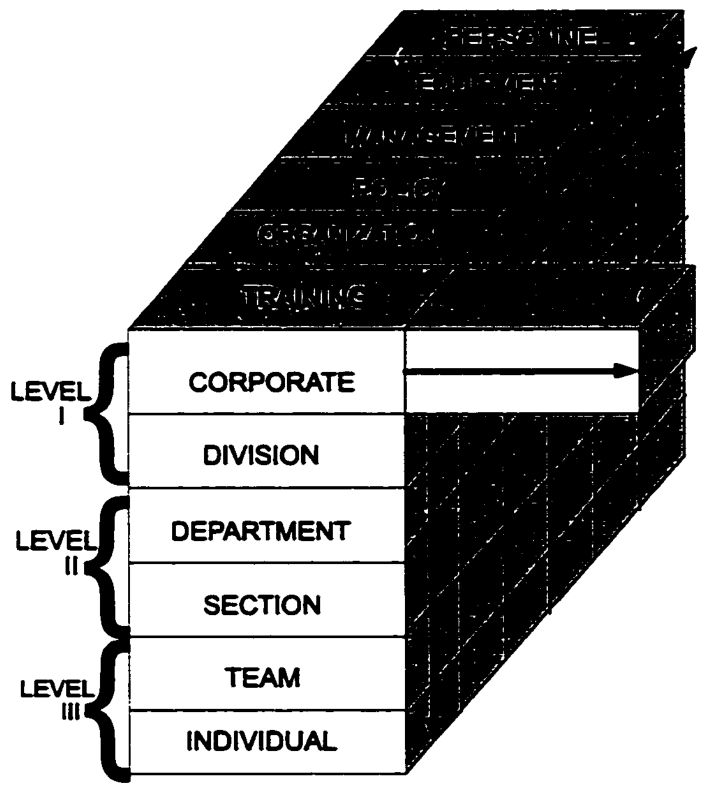


Performance suffers when the organizational or corporate level develops goals and objectives that require managers and production workers to make modifications at the point of execution. This work does not suggest that doing analysis at each individual level of an organization is inappropriate. However, this work does suggest that a horizontal slice can be analyzed taking into account the other levels and vertical components of the organization (vertical impact analysis).

Organizations would benefit from seeing the interrelationships of training, organizational configuration, policy/goals, management/leadership, equipment/ infrastructure, and personnel relative to the attainment of goals (See Figure 8.4). To focus solely on changing training within a corporation (a horizontal slice), for

example, without determining if the changes will lead to expected performance simply will produce undesirable modifications at the point of execution.

Figure 8.4. Horizontal and Vertical Alignment Model



The development of this approach toward organizational goal alignment is a holistic synthesis of the Human Performance Technology and modeling and simulation literature. Currently, there is no theory or perspective that combines HPT and modeling and simulation methodologies in a systematic view for organizational alignment. This chapter lays the foundation for a methodology to fill the gap between HPT and modeling and simulation literature.

FRAMEWORK DEVELOPMENT

The organizational alignment methodology is composed of foundational elements utilized in HPT and modeling and simulation. As stated in the Literature Review, the HPT Model as expressed by ISPI (2001), has four phases: 1) Performance Analysis; 2) Cause Analysis; 3) Intervention Selection and Design; and, 4) Intervention Implementation and Change (See Figure 2.4). As the discipline of HPT matures and changes the following characteristics will continue to hold true:

- *HPT is systematic.* – It is applied methodologically.
- *HPT is systemic.* – It identifies human performance gaps as systems elements.
- *HPT is grounded in scientifically derived theories and the best empirical evidence available.* – It uses scientific research or documents evidence that seeks to achieve expected human performance.
- *HPT is open to all means, methods, and media.* - It seeks to utilize the most effective and efficient resources to obtain performance at the lowest cost.
- *HPT is focused on achievements that human performers and the system value.* – It focuses on the "bottom-line results," i.e.,what should be accomplished.

The maturing of HPT introduced work by Gilbert (1978), Kaufman (1985), Tosti and Jackson (1987), and Rummler and Brache (1988) that moved toward the integration of several levels of interventions and their interrelationships within an organization, as shown in Table 2.3. Each advance in the discipline seeks to improve human performance in the workplace. However, the evaluations incorporated into these advances are done qualitatively during design and implementation, with organizations spending billions of dollars for interventions that may not deliver the desired performance. Stolovitch and Keeps (1999) state that accomplishments that are made after an intervention may not be enough

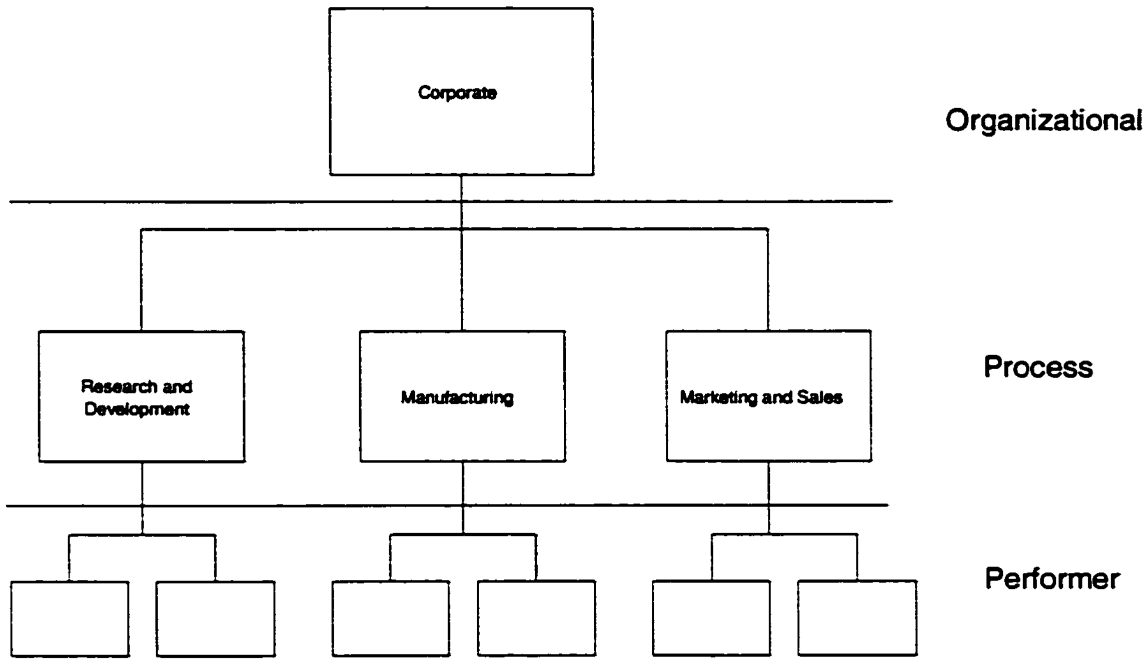
and that these accomplishments must be subject to verification and either accepted "as being aligned with the business requirements or judged as not being so aligned and needing modification." The recognition of the flaw in the model accentuates the gap in the literature. This methodology will enhance the HPT discipline by illustrating how modeling and simulation can allow organizations to predict into the desired outcomes and outputs resulting from organization goal alignment.

Both HPT and Simulation models have been used successfully in the development and growth of organizations. However, HPT concentrated on evaluating human performance qualitatively, while simulation evaluated organizational performance quantitatively. This work proposes combining the two approaches to effectively align organizational goals and objectives with individual goals and objectives at each level of the organization.

Organizational Alignment

Rummler and Brach (1988) summarized the organization into three levels (Figure 8.5): 1) the organizational level – at this level the key variables are organizational strategy and goals; 2) the process level – this level shows the infrastructure of the organization and interrelationships involved in an organization; and, 3) the job/performer level – at the performer level the individuals are responsible for completing the processes in order to deliver the output .

Figure 8.5: Traditional Organization Chart



Adapted from Handbook of Performance Technology (1992)

This view of the organization will assist in the development of the methodology. Rummler and Brache discussed the organizational impact, but only as it related to a horizontal assessment of the organization and in a qualitative fashion. In order to effectively assist in delivering the expected performance, the model must be extended to incorporate quantitative methodologies.

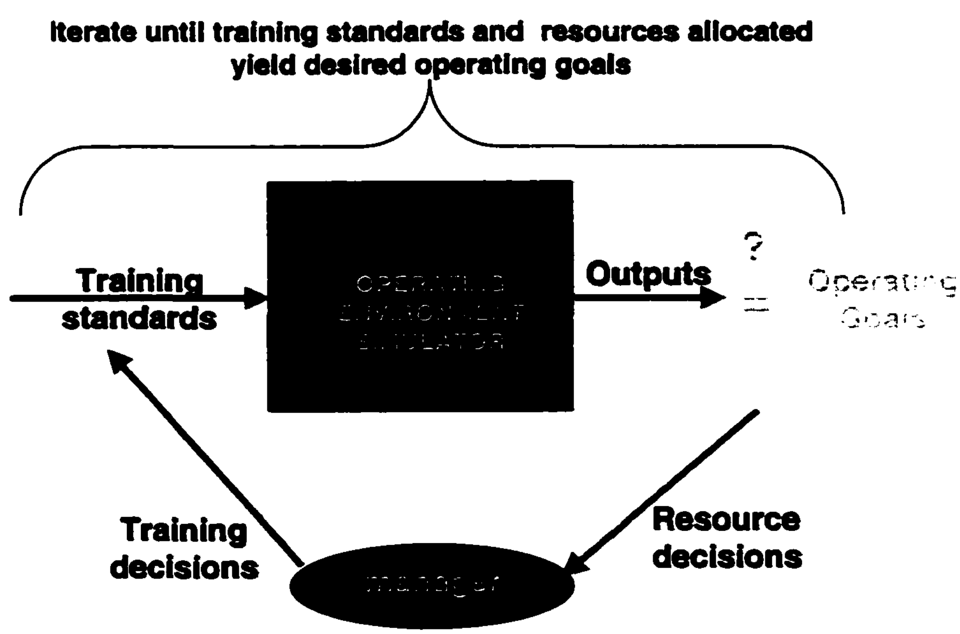
GOAL ALIGNMENT METHODOLOGY

The methodology has 5 basic elements of HPT models with a quantitative methodology component: inputs (training standards); operating environment (simulation); outputs (products); operating goals; and decisions (resource and training).

The operating environment simulator would utilize the input - the training standards - to determine actual service levels and labor costs. The model would then examine these and compare them to the expected operating goals (ideal labor cost and service level). If the comparison results in an unsatisfactory outcome, then adjustments could be made in training standards or operating goals to deliver a desired outcome. Decisions then could be made prior to testing or implementation, resulting in savings of time and resources. This methodology would allow organizations to make educated decisions prior to incorporation into the real world environment.

The development of this methodology is unique in that it uses the iterative nature of simulation until the training standards and resources allocated align with realistic operating goals (See Figure 8.6)..

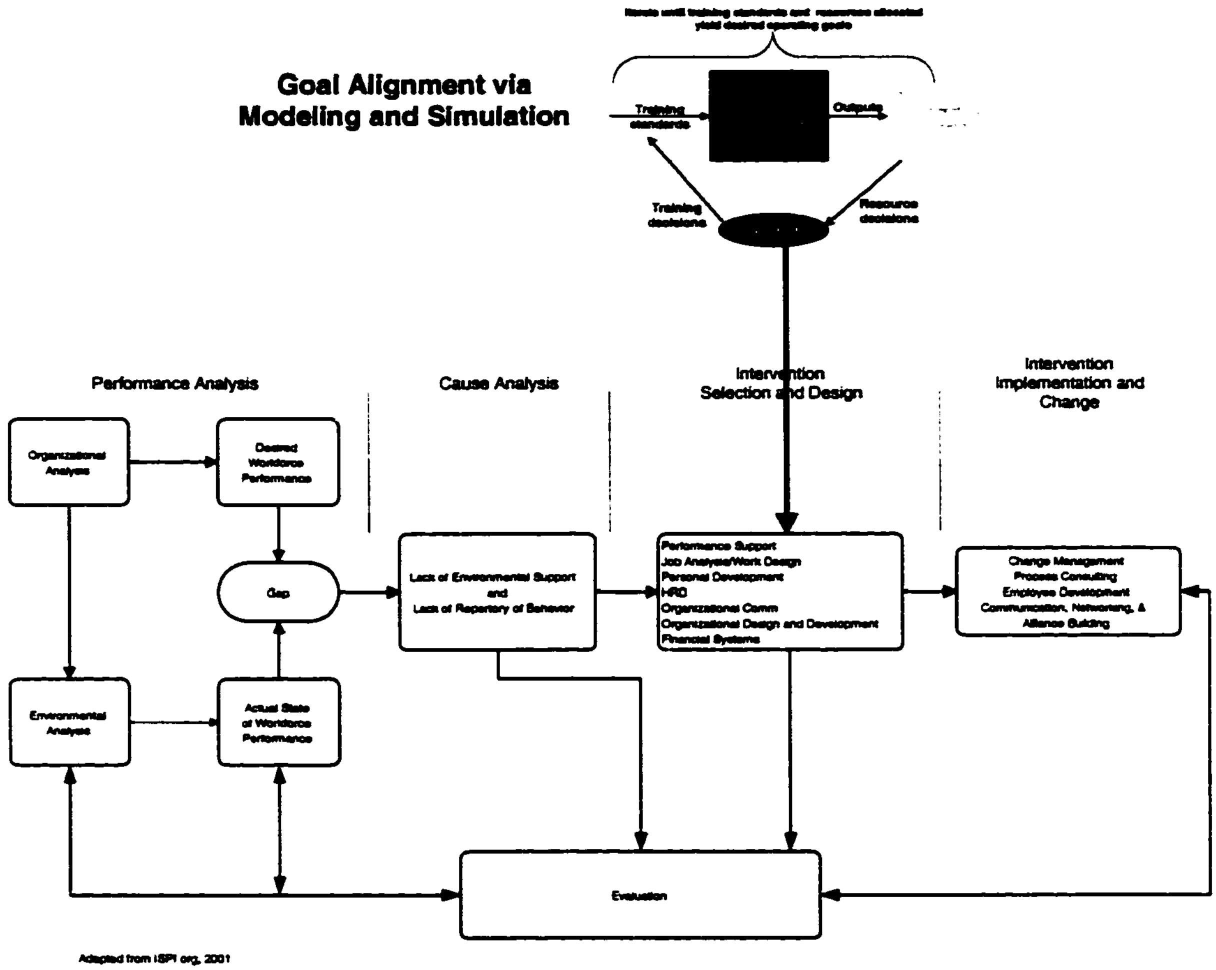
Figure 8.6: Goal Alignment via Simulation



By incorporating the training standards as inputs to the operating environment, simulation allows upper management to begin to make decisions that considers training's impact versus its cost. The engineered standard could be used initially for evaluating the training standards relative to the employee and unit performance and, ultimately, corporate goal attainment. The established goals or standards could then be modified to find the minimum or maximum training standards required for the alignment of operating resource requirements and the associated training decisions. However, there is no simulation to date that can measure productivity increases, compared to training cost because managers currently set achievement goals based on other variables.

The incorporation of the Quantitative Goal Alignment Methodology within the HPT model results in an enhancement to the HPT model and henceforth will be referred to as the HPT^+ Model. The HPT^+ Model utilizes the same fundamental approaches that have been defined by the HPT discipline. This work adds modeling and simulation as a tool to facilitate the Intervention Selection and Design Phase of the model for the alignment of organizational goals and objective at all levels (See Figure 8.7).

Figure 8.7: Enhanced HPT Model (HPT⁺)
(refer to Figures 2.4 and 8.15)



By utilizing simulation technology earlier in the design process, organizations can predict how training interventions might affect performance. Further, the ability to expand the use of simulation in organizations horizontally and vertically would allow the effects of change to be evaluated at each level without spending money unnecessarily for ideas and developments that may not be feasible.

SUMMARY

Many models have been designed and used for improving organizational performance. They do not consider the impact at each level either of the organization, one level up or down. The HPT^{+} model helps to predict the impact of training interventions and allows for expanding the horizontal slice of the organization to include the other levels of the organization and evaluating the impact horizontally and vertically. This will give organizations a new tool to effectively evaluate training interventions and their resulting performance.

CHAPTER 9

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This research has tested hypotheses focusing on the relationship of training and performance within a service chain organization. The results of this research, though surprising, extend and expand the scholarly literature by developing the concept of organizational alignment by synthesizing the literature of two disciplines: HPT and Modeling and Simulation. Organizational training and performance was studied to evaluate aspects of the relationship. This research has demonstrated how to quantify the relationship between training and performance and has determined that time standards must be integrated into training programs. The identification of key factors required to determine if training would lead to expected performance demonstrated that training cannot guarantee performance.

By meshing HPT with modeling and simulation capabilities and expanding the work of Swart, Heuter, and Donno, organizations should be able to create and connect the missing link relative to their current approaches to training.

CONCLUSIONS

This study resulted in the following conclusions:

1. Training does not necessarily guarantee performance.

    This has been one of the major themes throughout the research. Although organizations are investing billions of dollars in training development and deployment for employees, the training may not deliver the desired or expected performance for the organizations.

2. A principal cause of training not leading to performance is the lack of organizational goal alignment between levels of the organization.

   This can be seen from the results of the Performance and Cause analysis phases of this research, which are elements of the HPT model, in the pursuit of human performance improvement.

3. Modeling and simulation is an appropriate method by which to achieve organizational alignment.

   Taking a broader view of simulation and considering its iterative nature for planning and evaluation can allow organizations to proactively align their organizations at all levels.

Recommendations

This research fills a critical gap in the literature and demonstrates an extended use of modeling and simulation. Moreover, this research has created areas for recommendation.

1. Similar quantitative research should be conducted in other industries done to validate that training and performance are not correlated.

   This would allow for validation across industries - not just in service oriented chain organizations.

2. Industries currently using modeling and simulation to study horizontal planes within their organizations could extend their use along the blueprint illustrated and implement the requirements to assess organizational alignment from a vertical analysis.

   This would allow for the evaluation of changes and ideas prior to implementation. Additionally, it would allow organizations to maximize the use of the simulation investment.

3. Industries that have Human Performance Technology departments should include modeling and simulation training, as well as simulationists.

Incorporating the training and expertise into the HPT departments would allow for innovative approaches to evaluating change interventions. This could allow departments to save money on interventions that may not support the organizations goals and objectives.

4. Academic institutions with Human Performance Technology curricula should include modeling and simulation as part of their curricula.

Academic institutions are responsible for producing individuals that are equipped with the tools required to make an impact in industry, government, or academia. The incorporation of modeling and simulation into the curricula can create a competitive advantage for those in the HPT discipline who leverage this broader view of the use of technology to reach the ultimate goal of human performance improvement.

This research study's major contribution is the enhancement of the Human Performance Technology Model, HPT+, and an explanation of how modeling and simulation can support this process. This is a new and innovative perspective for HP technologists and simulationists. The methodology offers corporate managers a blueprint for aligning organizational goals and objectives at all levels of the organization, a tool for trainers to evaluate interventions, and an innovative application for modeling and simulation. These applications extend beyond the current theory and practice available today and have implications that could shape HPT and modeling and simulation thinking well into the future.

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APPENDIX

Using Microsoft Excel Solver

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.96986597
R Square	0.94064001
Adjusted R Square	0.85160002
Standard Error	0.86892414
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9	71.7868	7.976311	10.56424237	0.004784877
Residual	6	4.530175	0.755029		
Total	15	76.316975			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	9.39875	0.217231036	43.26615	1.02039E-08	8.867204415	9.930295585	8.867204415	9.930295585
A	-0.12125	0.217231036	-0.55816	0.596930262	-0.652795585	0.410295585	-0.652795585	0.410295585
B	0.625	0.217231036	2.877121	0.028163536	0.093454415	1.156545585	0.093454415	1.156545585
C	-0.915	0.217231036	-4.21211	0.005610056	-1.446545585	-0.383454415	-1.446545585	-0.383454415
D	1.16625	0.217231036	5.368708	0.001713896	0.634704415	1.697795585	0.634704415	1.697795585
E	0.79625	0.217231036	3.665452	0.010510981	0.264704415	1.327795585	0.264704415	1.327795585
AB	-0.8075	0.217231036	-3.71724	0.009884566	-1.339045585	-0.275954415	-1.339045585	-0.275954415
AC	0.59	0.217231036	2.716002	0.034827199	0.058454415	1.121545585	0.058454415	1.121545585
AD	0.395	0.217231036	1.818341	0.118893344	-0.136545585	0.926545585	-0.136545585	0.926545585
BD	-0.30625	0.217231036	-1.40979	0.208271945	-0.837795585	0.225295585	-0.837795585	0.225295585

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