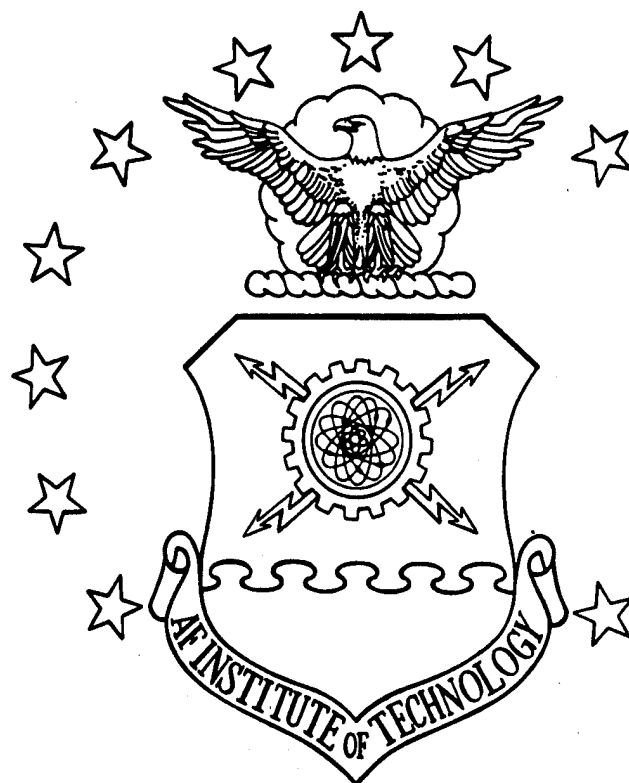
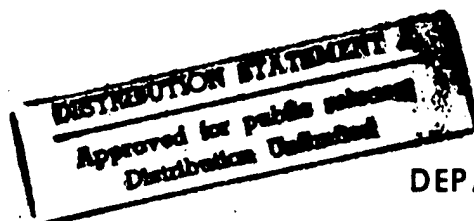


*A PRELIMINARY ANALYSIS OF THE
THEORETICAL PARAMETERS OF
ORGANIZATIONAL LEARNING*

THESIS

Jeffery D. Loyd, B.S.
Captain, USAF

AFTT/GCA/LAR/95S-7



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DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GCA/LAR/95S-7

19951117 020

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A PRELIMINARY ANALYSIS OF THE
THEORETICAL PARAMETERS OF
ORGANIZATIONAL LEARNING

THESIS

Presented to the Faculty of the Graduate School of Logistics
and Acquisition Management of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Cost Analysis

Jeffery D. Loyd, B.S.
Captain, USAF

September 1995

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Acknowledgments

This research project has allowed me to grow more than I could have possibly imagined. This growth process, as with most anything of value, did not come without a price. First, I want to thank my Lord, Jesus Christ, for giving me the desire and ability to accomplish this task, for without him I am nothing.

Next, I want to thank my wife, Kimberly, for all of the sacrifices she has been forced to make so that I could invest the time necessary to complete this research. I also want to thank Joshua, who is too young to understand why his “Dada” must spend so much time upstairs typing when there are rocks to be found and balls to be thrown. I love you both.

I am deeply indebted to Professor Guy Shane who spent considerable time teaching me to speak the language of SAS. I also want to thank Professor Dan Reynolds for sharing his excitement for learning. Thanks also goes out to my classmates, who responded to the “exhaustive” initial questionnaire. I quite literally couldn’t have done it without all your inputs. I must also thank my reader, Professor Robert P. Steel, for his thorough review and quality comments.

Finally, I am truly grateful to Lt Col Wayne Stone for all of his advice and leadership throughout this research project. His enthusiasm for the topic was genuine and contagious, motivating me to press on and do my best. Lt Col Stone had the ability to focus on what was important and helped me to actually learn from the thesis process, what a concept! Thanks again for making all this work worthwhile.

Jeffery D. Loyd

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Abstract

The goal of this research was to develop an instrument capable of measuring the theoretical parameters of organizational learning that could be used as a diagnostic tool to measure an organization's learning potential.

This goal was accomplished by developing a pilot questionnaire based on 27 potential learning parameters. The potential parameters of learning were extracted from the literature. A scale of behavioral statements was developed for each potential parameter.

The pilot questionnaire was completed by 108 Air Force personnel in Air Force Institute of Technology (AFIT) graduate education programs. The results confirmed 85% of the original scales. Ten refined scales were also developed based on the original scales.

Three operational questionnaires were developed. First, a 119 item questionnaire based on a revised version of the initial scales with Cronbach's Alpha values of 0.7725 to 0.9332. Next, two versions of the refined scales questionnaire were developed. A full version containing 118 items with Cronbach's Alpha values ranging from 0.7584 to 0.9463 and a 80 item workshop version with Cronbach's Alpha values ranging from 0.7412 to 0.9066.

A PRELIMINARY ANALYSIS OF THE THEORETICAL PARAMETERS OF ORGANIZATIONAL LEARNING

I. Introduction

Chapter Overview

This chapter will provide the foundation for the thesis. The general issue and its applicability to Air Force organizations will be presented. The problem statement and research objectives identified to solve this problem will be laid out. Finally, an outline of the entire thesis will be provided.

General Issue

The Air Force, as well as numerous other public sector organizations, is committed to improving the quality of work accomplished through continuous improvement. The Quality Air Force Program is evidence of this commitment. Organizational learning is closely linked to Total Quality Management (TQM) principles, it enhances products and services, encourages integrated internal systems and self-managing work teams, and facilitates process improvements (Barrow, 1983:39). A few companies have recognized the importance of organizational learning and have begun to refocus their companies around it (Garvin, 1993:78). An organization that learns is skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights (Garvin, 1993:80). Organizations that can increase their ability to learn will have a sustainable competitive advantage over those that cannot learn (Stata, 1989:63). In

fact, the only competitive advantage the company of the future may have is its members' ability to learn faster than their competition (De Geus, 1988:74).

Private enterprise is not the only arena where the benefits of organizational learning are recognized. In a recent article the U.S. Army was evaluated as a learning organization (Wheatley, 1994). Army Chief of Staff General Gordon R. Sullivan says, "The Army is and must be a learning organization" (Wheatley, 1994:51). "Whereas in the past the Army was either fighting a war or maintaining itself in peace, now it is increasingly called on to intervene in a category of activities labeled operations other than war. These new activities for the Army range from counter-drug actions, to earthquake, riot, hurricane and flood relief, to nation building and peace keeping activities" (Wheatley, 1994:50). The Air Force is facing similar challenges in a period of downsizing and budget reductions. Lt. General Yates, Commander of Air Force Material Command (AFMC), said, "AFMC's work force is smaller now than it was two years ago, and it will get smaller as we continue downsizing. To continue providing our warfighters with superior products, we must continue to revise our processes. We simply have to provide our warfighters a superior product with fewer resources" (Scaggs, 1995:33).

The Air Force acquisition process has become extremely team intensive. The implementation of Process Action Teams (PATs) under the Quality Air Force Movement and most recently Integrated Product Teams (IPTs) have changed the culture of the acquisition organization for the foreseeable future. Micky Blackwell, President of Lockheed Aeronautical Systems, sees the integrated product teams used in the F-22 program as the way of the future. Blackwell says, "The F-22 program is a joint venture between three very large companies - Lockheed, Boeing, and General Dynamics - and we needed to integrate them into a totally team-orientated organization" (Graham, 1995:27). As we find ourselves working in teams, with fewer resources, trying to accomplish more it

only makes sense to work smarter. Organizational learning theory can provide ways to leverage our collective intelligence.

Lt. General Richard Hawley, Principal Deputy to the Air Force Acquisition Executive, said about learning, "You can't learn if you don't have some failure. Because if you don't allow for failure, people will never push hard enough to overcome problems or achieve dramatic results" (Graham, 1995:24). This leadership attitude is a turn toward achieving the type of organizational learning that can contribute to the type of dramatic results top Air Force and Congressional leaders seek. We have to ask what other factors contribute to organizational learning that can be leveraged to improve the overall performance of our teams and the organizations they belong to.

Problem Statement

The purpose of this study is to identify the significant parameters in organizational learning theory and to develop and validate an instrument that is capable of measuring the parameters. The organization's potential for learning can then be objectively measured based on the instrument results. Very little research has been conducted to date to develop a valid methodology to measure organizational learning potential. Work on organizational learning has not led to research based guidelines for increasing the effectiveness of organizational learning (Huber, 1991:108). To apply organizational learning concepts, a methodology must be developed for measuring learning that is more than mere observation of change (Fiol & Lyles, 1985 : 811). This presents a problem for organizations interested in improving their ability to learn. Without a valid measurement instrument, it is very difficult for organizations attempting to develop a learning culture to measure progress objectively. While merely developing the potential for organizational learning does not guarantee that learning will occur, it can drastically increase the odds that it will (Watkins and Marsick, 1993:37).

Research Objectives

The first objective is to identify the theoretical writings related to organizational learning theory.

The second objective is to define the theoretical parameters that impact an organization's learning potential as identified by organizational learning theory.

The third objective is to develop a method to measure organizational learning potential.

The fourth objective is to test the reliability of the scales used to measure the theoretical parameters and refine the concepts associated with organizational learning.

Thesis Outline

The remainder of this thesis is divided into four chapters. Chapter II, Literature Review, will provide the development of organizational learning theory. It begins with an examination of the many different definitions of organizational learning. Different types of learning will then be defined and contrasted. The different theories of organizational learning will be outlined. Finally, the organizational learning parameters identified by each theorist will be categorized and carefully defined.

Chapter III, Method, describes the method used to accomplish each of the objectives identified for this research. It will address the type of instrument selected, the method use to construct the pilot instrument, the plan for administration of the pilot instrument, and finally the methods used to analyze the data gathered.

Chapter IV, Analysis of Data, will contain the results from administration of the pilot study. A statistical analysis of the data collected will be used to develop the operational organizational learning potential instrument.

Chapter V, Summary, Conclusions, and Recommendations, will contain a recommended format for interpreting the results of the instrument and recommendations

for using the instrument results to increase learning within the organization. This chapter will also provide recommendations for future research in the area of organizational learning based on the lessons learned from this research.

Summary

This chapter established the focus of this research effort. The theory of organizational learning was introduced and its strategic importance to all organizations described. This chapter presented the problem statement and outlined the five supporting research objectives. Accomplishment of the five research objectives will provide a feasible solution to the problem statement. Finally, an outline for the presentation of the remainder of this thesis was presented.

II. Literature Review

Chapter Overview

The purpose of this study is to identify the significant parameters in organizational learning theory and to develop and validate an instrument that is capable of measuring the parameters. In order to meet these goals a careful literature review is necessary to define organizational learning, identify the various types of organizational learning, identify the various theories of organizational learning and extract the parameters of learning from the theories.

The literature review is divided into three sections. In Section I: Definition of Organizational Learning, the many existing definitions of organizational learning will be identified and contrasted and the different types of learning will be identified. Section II: Organizational Learning Theories, will identify the various theories of organizational learning that currently exist in the literature. The last section, Section III: Organizational Learning Parameters, will present a framework for categorizing and defining the organizational learning parameters identified in Section II.

Section I: Definition of Organizational Learning

The proliferation of definitions of organizational learning can be very frustrating to the practitioner who merely wishes to understand the concept of organizational learning. This problem has prompted several researchers to spend considerable time analyzing the range of existing definitions (Fiol and Lyles, 1985, Huber, 1991, and Weick, 1991). The following definitions of organizational learning and learning organizations are presented as a sample of the diversity existing in the literature. The definitions will be presented in a chronological order.

Cyert and March define organizational learning in terms of adaptive behavior over time (1963: 123). They assume that organizations change their goals, shift their attention, and revise their procedures for search as a function of their experience (Cyert and March, 1963: 123).

Cangelosi and Dill define organizational learning as a series of interactions between adaptation at the individual level and at the organizational level (1965: 200). "Adaptation occurs as the result of three kinds of stress, one of which stimulates subsystem learning, one total-system learning, and one both subsystem and total-system learning" (Cangelosi and Dill, 1965: 200).

Argyris and Schon identify two types of organizational learning: Single-Loop and Double-Loop. "Organizational learning occurs when members of the organization act as learning agents for the organization, responding to changes in the internal and external environments of the organization by detecting and correcting errors in the organizational theory-in-use, and embedding the results of their inquiry in private images and shared maps of the organization" (Argyris and Schon, 1978: 29). "In single-loop learning individuals respond to error by modifying strategies and assumptions within constant organizational norms while in double-loop learning response to error takes the form of joint inquiry into the organizational norms themselves" (Argyris and Schon, 1978: 29). Argyris and Schon suggest that to increase organizational learning capacity, emphasis must be placed on double-loop learning (Argyris and Schon, 1978: 29).

Duncan and Weiss offer an alternative definition of organizational learning that ties more closely to the properties of the organization than some of the more traditional definitions (Weick, 1991:116). "Organizational learning is the process within the organization by which knowledge about action-outcome relationships and the effect of the environment on these relationships is developed" (Duncan and Weiss, 1979:84).

Mariann Jelinek writes that organizations learn by codifying individual insights, thus making them accessible to others for adoption, true adaptation, change, and generalized application (1979:157).

The research conducted by Fiol and Lyles indicated that researchers use the terms "learning," "adaptation," and "change" inconsistently (1985: 811). Fiol and Lyles offer definitions for both organizational learning and adaptation. "Learning is defined as the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions while adaptation is the ability to make incremental adjustments as a result of environmental changes, goal structure changes, and other changes" (Fiol and Lyles, 1985: 811).

Levitt and March define organizational learning in terms of encoding inferences from history into routines that guide behavior (Levitt and March, 1988:320). These routines are transmitted through socialization, education, imitation, professionalization, personnel movement, mergers and acquisitions (Levitt and March, 1988:320). The routines are recorded in a collective memory and changed as a result of experience (Levitt and March, 1988:320).

Peter Senge defines a learning organizations as an organization that is continually expanding its capacity to create its future (Senge, 1990:14). Senge identifies two types of learning necessary for organizational learning to take place: adaptive learning and generative learning. Adaptive learning occurs when we make changes based on past experience. Senge defines generative learning as learning that enhances our capacity to create (Senge, 1990:14).

George Huber proposed that an organization learns if any of its units acquire knowledge that it recognizes as potentially useful to the organization (Huber, 1991:89). He also points out that organizational learning occurs without observable changes in

behavior. This occurs when cognitive maps are changed to reflect additional learning, but no action is taken (Huber, 1991:89).

Herbert Simon warns against too strict a definition of organizational learning. He writes that all learning takes place inside individual human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have (Simon, 1991:125).

Garvin says that while the topic of organizational learning is gaining popularity it remains murky, confused, and difficult to penetrate (1993: 78). He blames much of this on the inability of scholars to provide practical applications for practitioners. He says, "A learning organization is an organization skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights" (Garvin, 1993: 8).

Watkins and Marsick define the learning organization as an organization that learns continuously and transforms itself (1993:8). "Learning takes place in individuals, teams, the organization, and even the communities with which the organization interacts. Learning is a continuous, strategically used process - integrated with, and running parallel to, work. Learning results in changes in knowledge, beliefs, and behaviors. Learning also enhances organizational capacity for innovation and growth. The learning organization has embedded systems to capture and share learning" (Watkins and Marsick, 1993 8-9).

Daniel Kim conducted research in an attempt to link 'individual learning' to 'organizational learning'. He defined individual learning as increasing one's capacity to take effective action (Kim, 1993:38) "Although the meaning of the term "learning" remains essentially the same as in the individual case, the learning process is fundamentally different at the organizational level" (Kim, 1993:40). "Organizational learning is dependent on individuals improving their mental models and making those mental models explicit is crucial to developing new shared mental models. This process allows

organizational learning to be independent of any specific individual” (Kim, 1993: 44).

Kim defines individual and shared mental models as the organization’s active memory that defines what an organization pays attention to, how it chooses to act, and what it chooses to remember from its experiences (1993: 44). Kim defines organizational learning as increasing an organization’s capacity to take effective action (1993:43).

“Unfortunately, there still exists confusion regarding what is learning and how to distinguish it from unreflective change” (Fiol and Lyles, 1985:808). Fiol and Lyles reviewed 15 works on organizational learning and adaptation in an attempt to illustrate the problem, many of which I have referenced above. Their results are summarized in Table 2-1.

Table 2-1. A Review of Organizational Learning (Fiol and Lyles, 1985:809).

Author	Label	Meaning
Argyris & Schon (1978)	Learning	Lower-level cognition
	Single-loop	Higher-level cognition
	Double-loop	
Cangelosi & Dill (1965)	Learning	Behavioral development
	Interaction between individual & group adaptation	Cognitive development
Chakravarthy (1982)	Adaptation	Cognitive Development
Cyert & March (1963)	Learning	Behavioral development
	Adaptation of goals, attention rules and search rules	
Daft & Weick (1984)	Learning	Behavioral development
	Action after interpretation	

Duncan (1974)	Learning Behavioral level Strategy level	Behavioral development Cognitive development
Duncan & Weiss (1978)	Learning Action-outcomes relationship	Cognitive development
Hedberg (1981)	Learning Habit-forming Discovery	Behavioral development Cognitive development
Jelinek (1979)	Learning OST-belief sharing	Cognitive development
March & Olsen (1975)	Learning Rational adaptation Interpretation	Cognitive development
Meyer (1982)	Adaptation Deviation-reducing Deviation-amplifying	Lower-level cognition Higher-level cognition
Miles (1982)	Learning Diversification outcomes Planning formalization	Behavioral development Cognitive development
Miles & Randolph (1980)	Learning Proactive learning Reactive learning	Behavioral development Cognitive development
Miller & Friesen (1980)	Adaptation Actions	Behavioral development
Shrivastava & Mitroff (1982)	Learning (Systems) Evolutionary Designed	Behavioral development Cognitive development

To determine what the researchers actually meant by learning or adaptation, Fiol and Lyles placed each definition in the category of cognitive development, behavioral development or both. Cognitive development is an adjustment process affecting primarily an organization's interpretation of events (Daft and Weick, 1984:286), the development of shared understanding and conceptual schemes among members of the organization (Hedberg, 1981:9). Behavioral development refers to the new responses or actions that are based on the interpretation of events (Daft and Weick, 1984:286).

Several different levels and types of learning are discussed in the literature. Fiol and Lyles present categories of lower-level and higher-level learning as defined below (1985). Isaacs presents a definition of an even higher level of learning than that defined by Fiol and Lyles (Isaacs, 1994:46). I have chosen to label it highest-level learning and add it to the categories identified by Fiol and Lyles.

Lower-level Learning: Focused learning that may be mere repetition of past behaviors--usually short term, surface, temporary, but with associations being formed. Captures only a certain element--adjustments in part of what the organization does. Single-loop. Routine level.

Higher-level Learning: The development of complex rules and associations regarding new actions. Development of an understanding of causation. Learning that affects the entire organization. Double-loop learning. Central norms, frames of reference, and assumptions changed.
(Fiol and Lyles, 1985:810)

Highest-level Learning: Learning that permits insight into the nature of the central norms, frames of reference, and assumptions. Inquiry into underlying "why's." Why learn this way? Why these goals? Triple-loop learning. Learning about the context of learning itself.

(Isaacs, 1994:46; Bateson, 1972)

The three levels of learning presented above provide a good summation of the various levels and types of learning presented in the literature.

Section II: Organizational Learning Theories

To identify the significant parameters of organizational learning, it will first be necessary to review the existing theories of organizational learning. In this section I will identify and review theories of organizational learning from the literature. Models of organizational adaptation will also be reviewed as they are closely related to the organizational learning process. As potential organizational learning parameters are identified, they will be noted. The literature will be presented in a chronological order.

Cyert and March offer a model of organizational learning based primarily on adaptation. They assume that organizations learn as they change their goals, shift their attention, and revise their procedures for search as a function of their experiences (Cyert and March, 1963: 123). They developed a linear function to express the adaptation of an organization with respect to its goals. This function is outlined below:

$$G_t = a_1G(t-1) + a_2E(t-1) + a_3C(t-1)$$

Where G is the organizational goal, E is the experience of the organization, C is a summary of the experience of comparable organizations, and where $a_1 + a_2 + a_3 = 1$. The parameters in this goal adaptation function are important attributes of the organization. a_3 reflects the organization's sensitivity to the performance of competitors or other comparable organizations. a_1 and a_2 reflect the speed at which the organization revises goals in the face of experience. (Cyert and March, 1963:123)

Cyert and March discuss learning in terms of adaptation in attention rules and adaptation to search rules in addition to goals. Adaptation in attention rules means that organizations will tend to pay closer attention to criteria by which they are measured

while ignoring others (Cyert and March, 1963:124). Adaptation in search rules occurs when an organization discovers a solution to a problem by searching in a particular way. When a similar problem occurs in the future, the organization is likely to search in the same way. The reverse is also true. If a particular search rule was not successful, it is not likely to be used as quickly again. "Thus, the order in which various alternatives solutions to a problem are considered will change as the organization experiences success or failure with alternatives" (Cyert and March, 1963:124).

This model falls into the behavioral development category. Its primary focus is on lower level learning as we have defined it in Section I. Cyert and March do identify two parameters critical to learning as defined by their model: the organization's sensitivity to the performance of competitors or other comparable organizations and the speed at which the organization revises goals in the face of experience.

Cangelosi and Dill present a model of organizational learning based primarily on a series of interactions between adaptation at the individual or subgroup level and at the organizational level. See Figure 2-1.

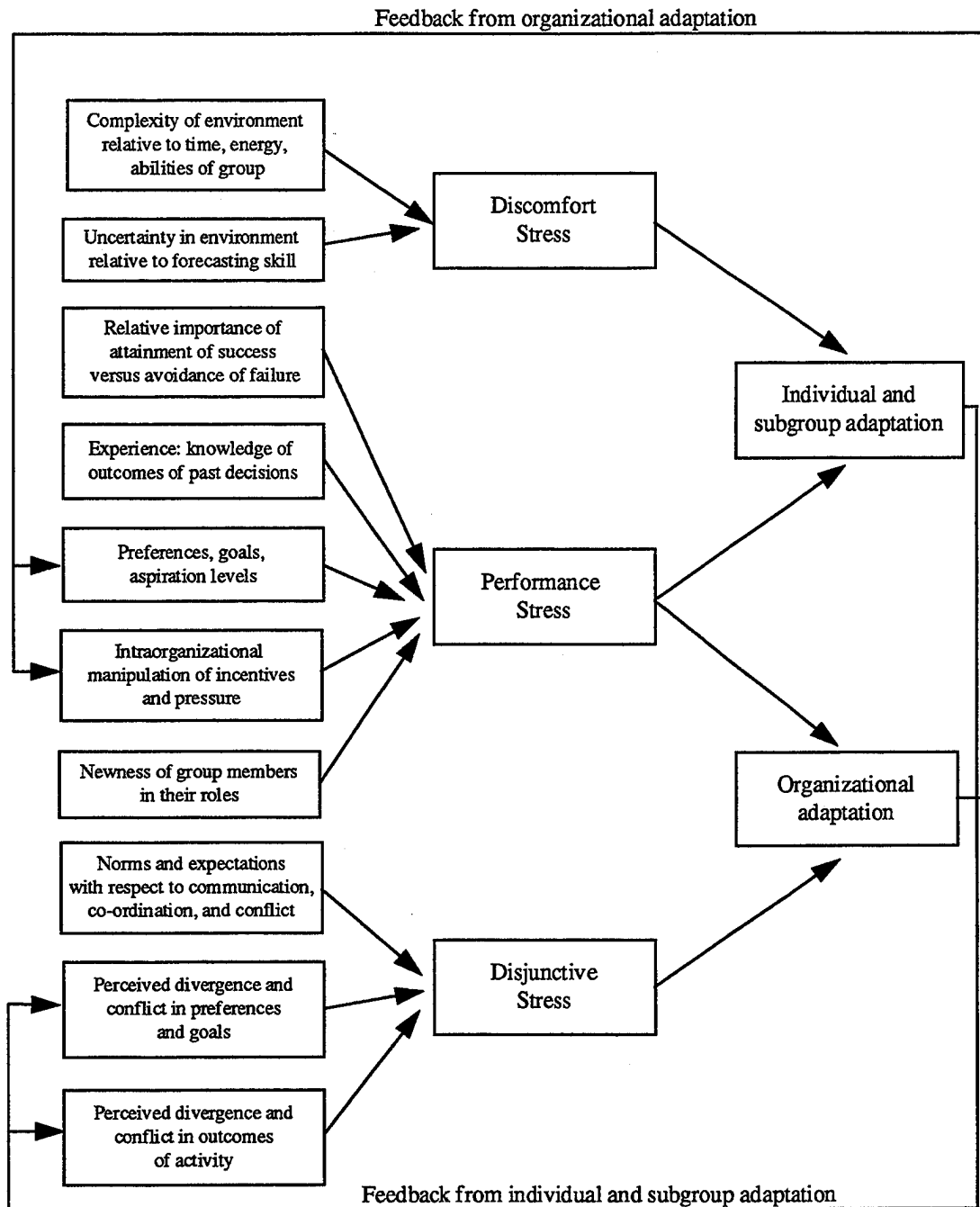


Figure 2-1. Revised Model of Organizational Learning
(Cangelosi and Dill, 1965:201)

Adaptation in the model is driven by one of three types of stress: discomfort stress, performance stress, and disjunctive stress. "Discomfort stress is the pressure felt as a

result of the complexity of the environment relative to the time, energy, and the ability that groups can expend understanding it and of the uncertainty in the environment relative to the groups ability to forecast the future” (Cangelosi and Dill, 1965: 200). Performance stress addresses the degree to which the organization may be highly sensitized to either success or failure (Cangelosi and Dill, 1965: 200). The stress that occurs as the result of increasing degrees of divergence and conflict in the ways in which individuals and subgroups behave is called disjunctive stress (Cangelosi and Dill, 1965: 201). Total systems learning occurs in the model when individual and subgroup adaptation produce divergence and conflict beyond what the organization can tolerate. I chose to include this organizational learning model in my literature review for completeness.

Argyris and Schon describe a fundamental learning loop in which individuals act from an organizational theory-in-use. This leads to a match or mismatch of expectations with outcomes, and it either confirms or disconfirms the organizational theory-in-use (1978:18). “Members of the organization respond to changes in the internal and external environments of the organization by detecting errors which they then correct so as to maintain the central features of the organizational theory-in-use. In the case of disconfirmation, individuals move from error detection to error correction” (Argyris and Schon, 1978:18). This is called single-loop learning. Double-loop learning occurs when the images and maps which are embedded in the organizational theory-in-use are changed (Argyris and Schon, 1978:22). The potential organizational learning parameter surfaced by Argyris and Schon is the organizational theory-in-use.

Duncan and Weiss identify three main factors that impact an organization’s ability to acquire knowledge. The first is a shared paradigm that is “a set of beliefs, a way of seeing or organizing the principles governing perception” (Duncan and Weiss, 1979:91; Masterman, 1970; Kuhn 1970). According to Duncan and Weiss, these paradigms are necessary for learning to occur.

“New knowledge is not likely to be accepted if it conflicts greatly with the paradigm held by the organization’s members” (Dunacan and Weiss, 1979:95). This touches on the political processes within the organization. Duncan and Weiss (1979:95) go on to say, “New knowledge will not be likely to be accepted if it conflicts with the knowledge held by powerful individuals within the organization.” The last factor critical to learning is a high level of communication. “Given that no organizational learning occurs until knowledge is accepted by others in the organization, it must first be communicated” (Duncan and Weiss, 1979:96). The three potential parameters contributed by Duncan and Weiss are organizational paradigms, politically acceptable knowledge, and communication.

Daft and Weick (1984) present a model of Organizations as Interpretation Systems. The model is organized into three stages that constitute the overall learning process (see Figure 2-2).

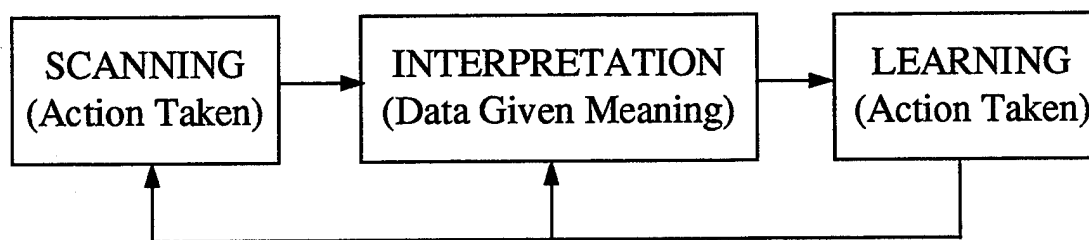


Figure 2-2. Relationship Among Organizational Scanning, Interpretation, and Learning (Daft and Weick, 1984:286)

The first stage is scanning. Scanning is the process of monitoring the environment and providing environmental data to managers (Daft and Weick, 1984:286). In this stage data is collected through formal systems and informal personal contacts. Interpretation is the second stage of the model where the data are given meaning. “Organizational

interpretation is formally defined as the process of translating events and developing shared understanding and conceptual schemes among members of upper management” (Daft and Weick, 1984:286). The final stage of the model is learning. Daft and Weick distinguish this phase from interpretation by the concept of action (1984: 286). Learning is defined as the process of putting cognitive theories into action (Argyris and Schon, 1978; Daft and Weick, 1984; Hedberg, 1981). The model also contains a feedback loop from the learning process (action taken) to the interpretation and scanning processes. “Feedback from organizational actions may provide new collective insights for coalition members” (Daft and Weick, 1984:286).

Daft and Weick further break the interpretation process down describing four types of interpretation: undirected viewing, conditioned viewing, enacting, and discovering. The different types are described in Figure 2-3.

ENVIRONMENTAL ASSUMPTIONS	Unanalyzable	UNDIRECTED VIEWING Constrained interpretations. Nonroutine, informal data. Hunch, rumor, chance opportunities.	ENACTING Experimentation, testing, coercion, invent environment. Learn by doing.
	Analyzable	CONDITIONED VIEWING Interprets within traditional boundaries. Passive detection. Routine, formal data.	DISCOVERING Formal search. Questioning, surveys, data gathering. Active detection.
		Passive	Active
ORGANIZATIONAL INTRUSIVENESS			

Figure 2-3. Model of Organizational Interpretation Modes
 (Daft and Weick, 1984:289)

The two axes define the organization's beliefs about the world and where the organization fits in. Assumptions about the environment that will drive an organization's strategy are on the vertical axis. If the organization views the environment as analyzable, it will behave differently than if it views the environment as unanalyzable. The horizontal axis evaluates the extent to which the organization actively intrudes into the environment. Some organizations actively search the environment for answers while others are passive, accepting whatever information the environment gives them (Daft and Weick, 1984:288). This model falls into the behavioral development school requiring action be taken to signify that learning has occurred within the organization.

Daft and Weick's model identified two parameters critical to organizational learning. The first parameter is scanning, or data collection, and the second is interpretation, or giving meaning to data.

In his article, "Planning as Learning," Arie P. De Geus identifies three areas critical to organizational learning. The first is scenarios, De Geus says that scenarios can be used to "trigger institutional learning" (De Geus, 1988:71; Schnaars, 1987; Wack, 1985). The second area is managerial microworlds, a computer model of the organization's common mental models. As managers learn more about reality in relation to their computer model, the model is changed to reflect reality. By "playing" with a dynamic model, people discover that in a complex system cause and effect is separated in time and place. Managers can also discover what constitutes relevant information (De Geus, 1988:74).

De Geus identifies the process of language development as the most important aspect of institutional learning (De Geus, 1988:74). It is only as the knowledge of each learner can be communicated to the group that it can become a building block of the institutional mental model (De Geus, 1988:74). The rate at which the institutional model changes will be a factor of the individual's ability to communicate with others within the group. The three factors identified by De Geus will be added to the list of potential

organizational learning parameters. The factors are scenarios, managerial microworlds, and language development.

Ray Stata, Chairman of Analog Devices, outlined eight management tools and methods he implemented to increase learning within the organization. "First, organizational learning occurs through shared insights, knowledge, and mental models. Second, learning builds on past knowledge and experience or memory. Organizational memory depends on institutional mechanisms used to retain knowledge" (Stata, 1989:64).

Like Senge, Stata identifies systems thinking as a powerful tool to facilitate both individual and organizational learning. Stata illustrates why systems thinking is so important is his discussion of delayed feedback. "One basic characterization of a system is the delay time between cause and effect" (Stata, 1989:65). This delay can cause managers to misjudge what is actually happening in the system and make costly mistakes. "Using system dynamics to simulate organizational behavior, you find that often one of the highest leverage points for improving performance is the minimization of these system delays" (Stata, 1989:65).

Teamwork, openness, and objectivity were identified as behaviors favorable to learning at Analog Devices. To make teamwork effective small teams were used with the power and resources to enact change (Stata, 1989:70). "Openness is described as a willingness to eliminate hidden agendas, make motives, feelings and biases known, and invite other opinions and points of view" (Stata, 1989:70). "Objectivity is searching for the best answers based on a reasoned position and objective criteria, as opposed to political influence and parochial interests" (Stata, 1989:70). Stata, identifies poor communications between people and between organizations as a major stumbling block to learning and quality improvement (Stata, 1989:70).

A final factor identified by Stata is organizational rewards. By organizational rewards he means that pay and promotion must be tied to the intangible factors you are

trying to promote. He says that the organization will know you are serious and begin to modify its behavior when the proper messages are sent (Stata, 1989:70). If organizations really expect long-term change, they have to provide the proper incentives. The following potential parameters were identified by Stata: shared insights, knowledge, and mental models, organizational memory, systems thinking, teamwork, openness, objectivity, communications, and organizational rewards.

Peter Senge presents five disciplines that he feels are critical to the development of a learning organization in his book *The Fifth Discipline*. They are personal mastery, mental models, shared vision, team learning, and systems thinking (Senge, 1990: 5-11). “Personal Mastery is the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of seeing reality objectively” (Senge, 1990:7). Senge uses this discipline to link personal learning to organizational learning.

“Mental models are deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action” (Senge, 1990:8). “The practice of shared vision involves the skills of unearthing shared “pictures of the future” that foster genuine commitment and enrollment rather than compliance” (Senge, 1990:9). This practice stands in contrast with those that would attempt to dictate a vision. Senge promotes the practice of dialogue which involves learning how to “think together” and recognize and counteract patterns that undermine learning (Senge, 1990:10).

The fifth discipline is critical to Senge’s model of the learning organization. Systems thinking is the fifth discipline that integrates the other disciplines, fusing them into a coherent body of theory and practice (Senge, 1990:12). Systems theory is described as a shift in mindset from seeing interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots (Senge, 1990:73). “Systems thinking is

the discipline for seeing the 'structures' that underlie complex situations and for discerning high from low leverage change" (Senge, 1990:69).

Huber did an exhaustive review of the literature on organizational learning in which he identified "four constructs integrally linked to organizational learning". The constructs identified are: knowledge acquisition, information distribution, information interpretation, and organizational memory" (1991:88). See Figure 2-4 for a detailed breakout of the constructs and related subconstructs and subprocesses.

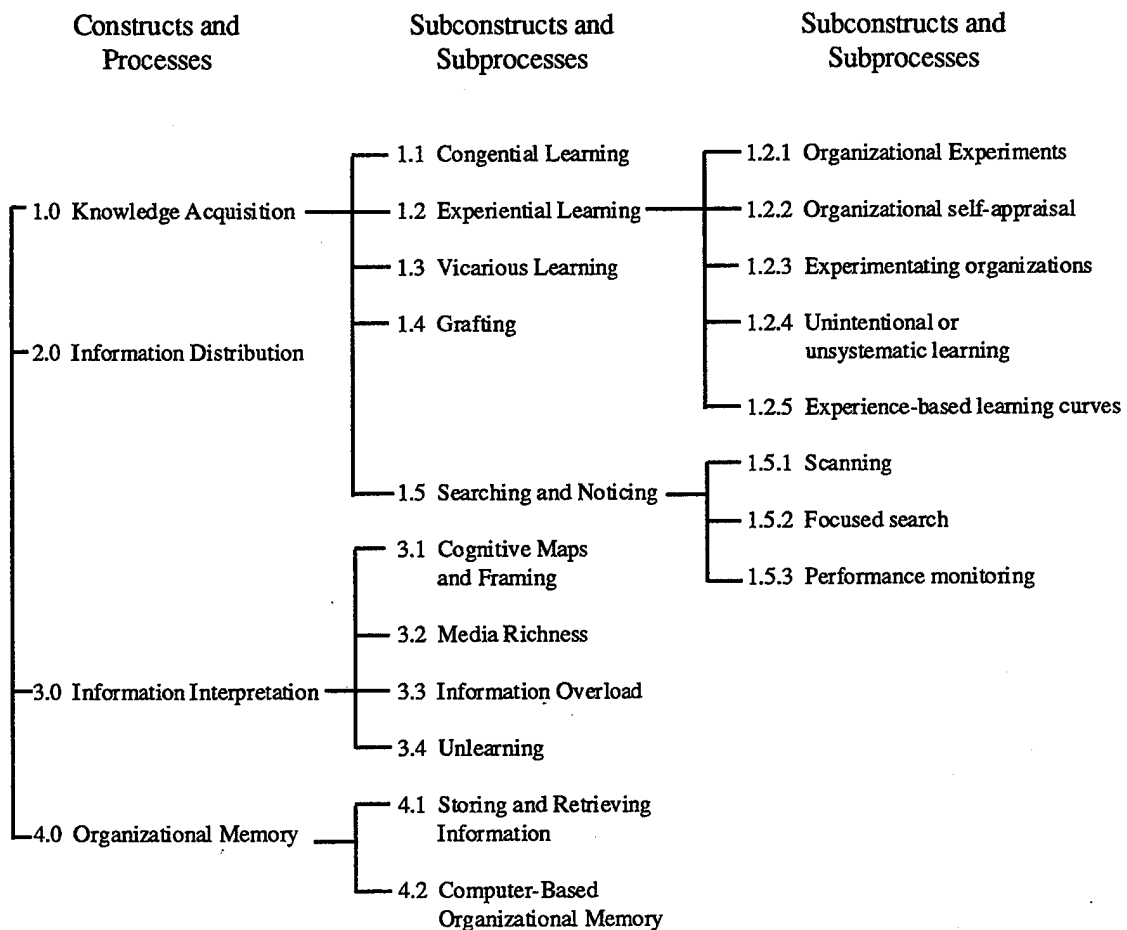


Figure 2-4. Constructs and Processes Associated with Organizational Learning
(Huber, 1991:90)

The first construct identified by Huber is knowledge acquisition. Huber defines knowledge acquisition as the many formal organizational activities as well as the informal behaviors directed toward obtaining information or knowledge (1991:91). He discusses five processes through which organizations acquire information or knowledge: (1) congenital learning, (2) experiential learning, (3) vicarious learning, (4) grafting, and (5) searching. Congenital knowledge is defined as the combination of the knowledge inherited by an organization at its conception and the additional knowledge acquired prior to its birth. Huber cites research that indicates the nature of an organization is greatly influenced by the nature of its founders (Huber 1991:91).

Huber breaks experimental learning down into five subheadings to include: (1) organizational experiments, (2) organizational self-appraisal, (3) experimenting organizations, (4) unintentional or unsystematic learning, and (5) experience-based learning curves. Organizational experiments attempt to increase the accuracy of feedback about cause and effect relationships between the organization and its environment and ensure the collection and analysis of feedback (Huber, 1991:91). Huber defines organizational self-appraisal in terms of action research. "Action research includes gathering information about problems, concerns, and needed changes from organizational members, organizing this information, sharing it with the members, and involving the members in choosing, planning, and implementing actions to correct problems identified" (Huber, 1991:92).

Experimenting organizations are discussed in terms of adaptability. "Organizational experiments and self-appraisals are generally directed toward enhancing adaptation, while maintaining organizational experiments is generally directed toward enhancing adaptability" (Huber, 1991:93). Huber discusses different philosophies in the literature that both criticize and promote experimenting organizations.

The results of research conducted in the late 1950's and early 1960's indicated that organizational learning is often haphazard and multi-faceted (Huber, 1991:94; Cangelosi and Dill 1965). Huber refers to this as unintentional or unsystematic learning. The final type of experimental learning Huber reviews is experience-based learning curves. He references an extensive literature that documents the positive effect of experience on performance in manufacturing organizations (Huber, 1991:94).

Vicarious learning is the next subconstruct under knowledge acquisition. Vicarious learning is defined as "corporate intelligence," the idea of searching for information about what corporate competitors are doing and how they do it (Huber, 1991:96).

The grafting subconstruct refers to an organization's attempt to increase its store of knowledge by hiring or "grafting" on new members who possess knowledge desired by the organization (Huber, 1991:97). The search subconstruct under knowledge acquisition is further subdivided by Huber into three forms: (1) scanning, (2) focused search, and (3) performance monitoring. Scanning is the organization's attempt to monitor their environment for information about change (Huber, 1991:97). Huber briefly touches on focused search. The main point being that a focused search is normally not initiated without a definite need (Huber, 1991:98). Performance monitoring occurs when organizations formally and routinely assess how well they are meeting both their own standards and the expectations of external constituencies (Huber, 1991:99).

The second construct Huber identifies as integral to organizational learning is information distribution. Information distribution influences both the occurrence and breadth of learning. Information distribution fosters learning to occur when organizational components commonly develop "new" information by piecing together items of information that they obtain from other organizational units (Huber, 1991:100). "With respect to the idea that information distribution leads to more broadly based organizational

learning, consider the fact that organizations often do not know what they know” (Huber, 1991:100). The wider information is distributed in the organization the more likely it is to be retrieved and used for learning (Huber, 1991:100).

The third construct presented by Huber is information interpretation. He references the definition of interpretation presented by Daft and Weick (1984) that I reviewed earlier in terms of their model. Huber identifies five factors that affect the shared interpretation of new information to include: (1) the uniformity of prior cognitive maps, (2) the uniformity of the framing of the information as it is communicated, (3) the richness of the media used to convey the information, (4) the information load on the interpreting units, and (5) the amount of unlearning that might be necessary before a new interpretation could be generated (Huber, 1991:102).

Huber combines his discussion of cognitive maps and framing. Considerable research has been done to establish the facts that individual’s cognitive maps will shape their interpretation of data, and that these may vary across organizational units (Huber, 1991:102). “Similarly, it is well established that how information is framed or labeled affects its interpretation” (Huber, 1991:102). Media richness is defined as “the communication medium’s capacity to change mental representations within a specific time interval” (Huber, 1991:103). Information overload occurs when the information to be interpreted exceeds the units’ capacity to process the information (Huber, 1991:103).

The effects of unlearning on learning is a significant subconstruct addressed by Huber. Unlearning is defined as a process through which learners discard obsolete and misleading knowledge (Huber, 1991:104; Hedberg, 1981). Huber explores how unlearning may stimulate additional learning to occur and suggests that unlearning may be analogous to Kurt Lewin’s idea that organizational learning can be best implemented if a felt need for change, an “unfreezing”, occurs (Huber, 1991:105).

The fourth organizational learning construct identified by Huber is organizational memory. He acknowledges that the problem of poor organizational memory is much more complex than the mere aggregation of poor individual memories (Huber, 1991:105). He identifies four variables that are likely to influence long-term organization memory to include: (1) membership attrition, (2) information distribution and organizational interpretation of information, (3) the norms and methods of storing information, and (4) the methods for locating and retrieving stored information. Huber does not discuss membership attrition, feeling its effects on memory are obvious. Information distribution and organizational interpretation have already been addressed in detail. Organizations store both "hard" and "soft" information. Hard information normally takes the form of standard operating procedures, routines, and scripts (Huber, 1991:105). Soft information is routinely acquired by managers and stored mentally (Huber, 1991:105). Huber questions how much nonroutine information is deliberately stored to be used in future decision making and cites the need for additional research.

Huber explores the role of computer-based expert systems in learning. These systems are developed to capture some of the "soft" expertise held by experts in a particular discipline and make it available to the layman (Huber, 1991:106). Some advantages of such systems are accessibility, reliability, and own-ability (Huber, 1991:106). Huber feels that both the demonstrability and usability of learning depend on the effectiveness of the organization's memory (Huber, 1991:106).

I will choose to adopt most of Huber's constructs as organizational learning parameters in Section III. The construct breakdown structure he developed will also be adopted and built on to help identify and classify all the organizational learning parameters.

In his article, "The Knowledge-Creating Company," Ikujiro Nonaka identifies three factors necessary for a company to create knowledge (1991). The first factor is

personal commitment, “the employee’s sense of identity with the enterprise and its mission” (Nonaka, 1991:97). The second factor is self-knowledge, “a shared understanding of what the company stands for, where it is going, what kind of world it wants to live in, and, most importantly, how to make that world a reality” (Nonaka, 1991:97). Nonaka says, “The essence of innovation is to re-create the world according to a particular vision or ideal” (1991:97).

The third factor, unique to Nonaka, is redundancy. Redundancy is an important factor in creating knowledge because it encourages frequent dialogue and communications (Nonaka, 1991:102). Three different examples of redundancy are provided. The first is in Japanese product development where different functional divisions work together in a shared division of labor (Nonaka, 1991:102). Different teams are formed that compete internally to develop different approaches to the same problem. This parallel development allows the team to eventually develop a common understanding of the “best” approach (Nonaka, 1991:102). A second form of redundancy is to use strategic rotation between functions such as R&D and marketing. The rotation helps employees understand the business from different perspectives allowing organizational knowledge to become more “fluid” and easier to put into practice (Nonaka, 1991:102). Finally, “free access to company information also helps to build redundancy” (Nonaka, 1991:102). “When information differentials exist, members of an organization can no longer interact on equal terms, which hinders the search for different interpretations of new knowledge” (Nonaka, 1991:102).

David Garvin identifies five main activities that learning organizations should be skilled at. The activities are systematic problem-solving, experimentation with new approaches, learning from organization’s experiences and past history, learning from the experience and past history of others, and transferring knowledge quickly and efficiently throughout the organization (Garvin, 1993:81).

Systematic problem-solving is accomplished with methods developed by the quality movement according to Garvin. Methods he identifies include what Deming calls the "Plan, Do, Check, Act" cycle, data based decision making versus assumption based, and using statistical tools to organize data and draw inferences (Garvin, 1983:81). Systematic problem-solving will be a potential parameter.

Experimentation should be a systematic searching for and testing of new knowledge (Garvin, 1993:82). Garvin identifies two forms of experimentation, one that is ongoing and another that is one-of-a-kind type projects. Successful ongoing experimentation requires a steady flow of new ideas, incentive systems that favor taking risk, and managers and employees who are properly trained to conduct and evaluate the experiments (Garvin, 1993:83). Experimentation is identified as a potential parameter.

Learning from past experience is identified as a critical practice. Successes and failures must be reviewed, systematically assessed, and the lessons learned recorded in a form that is accessible to employees (Garvin, 1993:85). Garvin cites research that indicates after the study of more than 150 new products, "the knowledge gained from failure is often instrumental in achieving subsequent successes....In the simplest terms, failure is the ultimate teacher." (Garvin, 1993:85, Modesto 1985). Lessons learned is identified as a potential parameter.

Learning from others is another activity identified by Garvin to boost organizational learning. He reviews two sources of relevant outside knowledge: industry best practices and customers. The review and application of industry best practices is called benchmarking. Garvin describes it as "a disciplined process that begins with a thorough search to identify best-practices organizations, continues with careful study of one's own practices and performance, progresses through systematic site visits and interviews, and concludes with an analysis of results, development of recommendations, and implementation" (Garvin, 1993:86). Garvin identifies customers as an excellent

source of up-to-date product information, competitive comparisons, insight into changing preferences, and immediate feedback about service and patterns of use (Garvin, 1993:86). He also suggests observing customers to gather information the customer may not be able to convey verbally. Benchmarking and customer opinion are identified as potential parameters.

The final activity identified by Garvin was transferring knowledge. He points out that for learning to be widespread, knowledge must be dispersed quickly and efficiently throughout the organization. He identifies a variety of mechanisms to accomplish this task including: written, oral, and visual reports, site visits and tours, personnel rotation programs, education and training programs, and standardization programs (Garvin, 1993:87). Transferring knowledge will be the last potential learning parameter identified by Garvin.

Research conducted by Kim links individual learning to organizational learning through mental models. He presents models for both individual and organizational learning. Since the model of organizational learning builds on his individual learning model, I will review both. Kim's Simple Model of Individual Learning combines mental models with an individual learning cycle (see Figure 2-5).

Kim defines the observe - assess - design - implement (OADI) cycle as critical to individual learning (Kim, 1993: 38). In this cycle people experience events, assess their experiences by reflecting on their observation, and then form an abstract concept that is an appropriate response to the assessment. The newly created abstract concepts are then tested in the concrete world which leads to new experiences and another OADI cycle (Kim, 1993: 39).

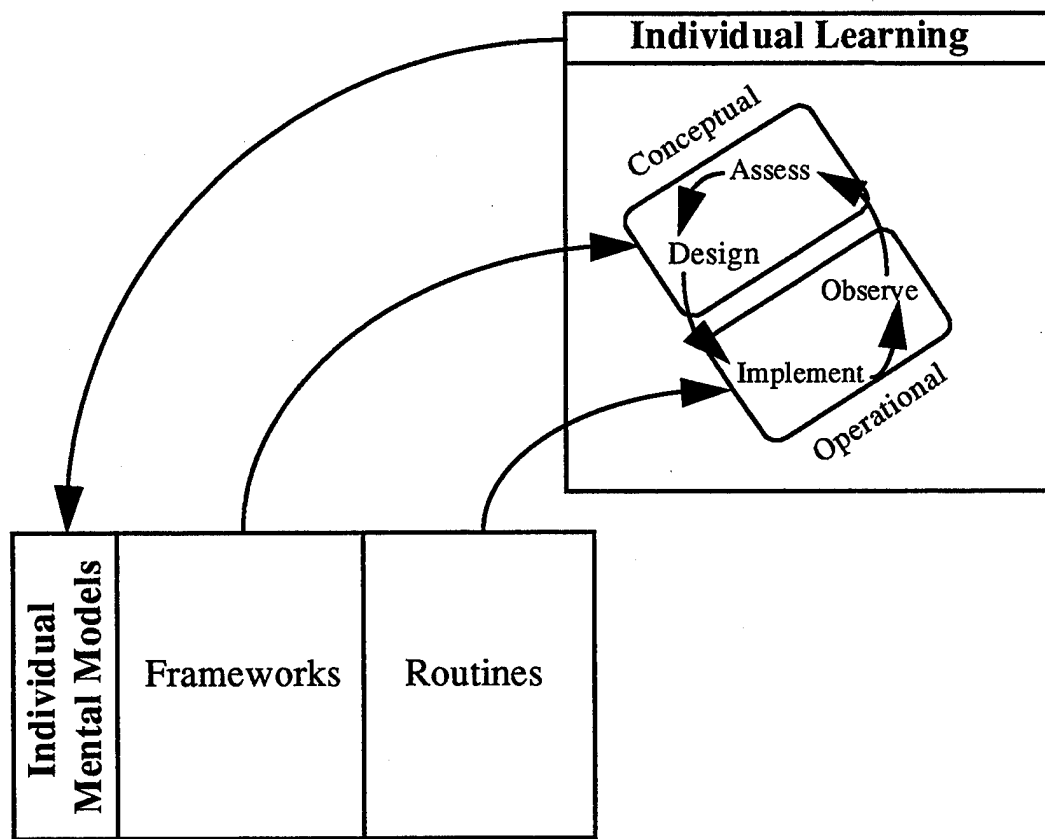


Figure 2-5. Simple Model of Individual Learning: OADI-Individual Mental Models (IMM) Cycle (Kim, 1993:44)

The OADI cycle is incomplete without addressing the role of memory. Kim brings memory into his model with the concept of mental models. Mental models are deeply held internal images of how the world works, which have a powerful influence on what we do because they also affect what we see (Senge, 1990:8). While we tend to view memory as static storage, mental models play an active role in what an individual sees and does (Kim, 1993: 39). Kim relates two levels of learning, conceptual and operational, to two parts of mental models, frameworks and routines. Operational learning is concerned with routine type behavior. "Not only does operational learning accumulate and change routines, but routines affect the operational learning process as well" (Kim, 1993:40).

Conceptual learning occurs at a higher level than operational learning, it questions the way things are done in the first place and sometimes challenges the very nature or existence of prevailing conditions, procedures, or conceptions and leads to new frameworks in the mental model (Kim, 1993:40).

Kim developed the observe, assess, design, implement - shared mental models (OADI-SMM) model to integrate individual learning into organizational learning. Learning is transferred from individuals to the organization through shared mental models (Kim, 1993:43). See Figure 2-6.

Kim defines organizational learning as increasing an organization's capacity to take effective action (1993:43). Organizational memory includes everything that is contained in an organization that is somehow retrievable (1993:43). The active memory of the organization in the model is the individual and shared mental models. The reason the model places so much emphasis on the mental models in the individuals' heads is because that is where a majority of the organization's knowledge exists (Kim, 1993:44). Kim describes two scenarios to illustrate this point. In the first all of the physical records of an organization are destroyed. In the second the records remain intact, but all of the workers have been replaced. Which organization will be easier to rebuild as it was? The one that retains all of the original people.

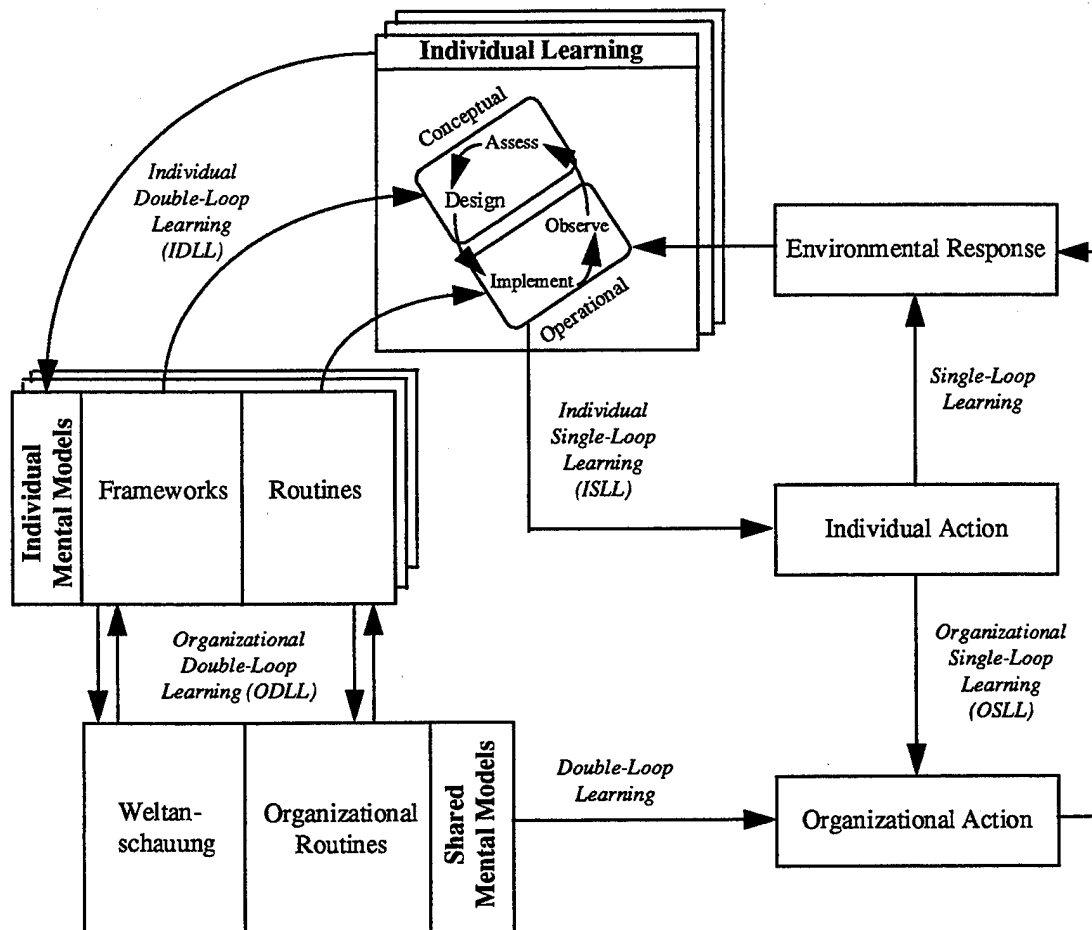


Figure 2-6. An Integrated Model of Organizational Learning: OADI-Shared Mental Models (SMM) Cycle (Kim, 1993:44)

The OADI-SMM model introduces several new terms that must be defined to understand the model. In the model, shared mental models are made up of weltanschauung and organizational routines. The organization's standard operating procedures, or organization's routines, tend to evolve from individual routines that are proved to be sound over time allowing the organization to respond to routine needs in predictable ways (Kim, 1993:45). Weltanschauung is an organization's worldview. This

view evolves to encompass the current thinking of the individuals that make up the organization (Kim, 1993:45).

Kim incorporates the concept of single-loop and double-loop learning developed by Argyris and Schon at both the individual and organizational level in the model. Double-loop learning was briefly discussed in Section I. Kim uses the term organizational double-loop learning in his model to describe the process whereby individual mental models become incorporated into the organization through shared mental models. The shared mental models can then impact organizational action (Kim, 1993:45). The key parameter identified by Kim is shared mental models that serve as the organization's active memory.

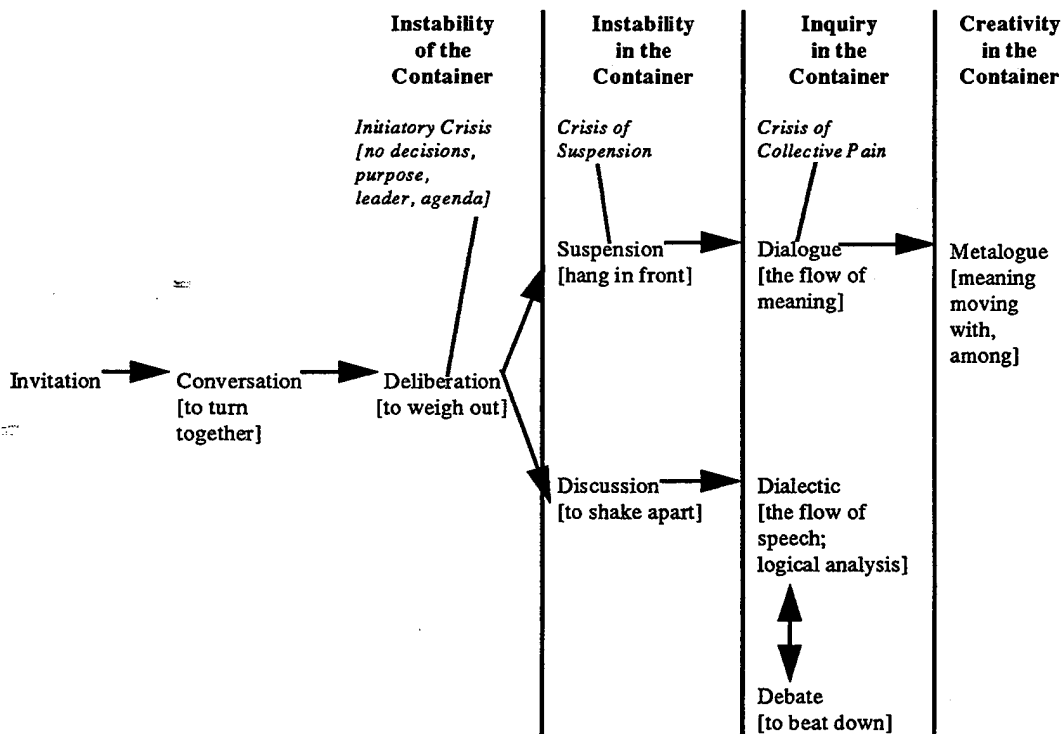


Figure 2-7. Evolution of Dialogue (Isaacs, 1994:50)

The perceived importance of group communication to effective organizational learning has already been demonstrated in this research. Work by Isaacs and Schein identifies the dialogue process as central to organizational learning because it promotes collective thinking and communications (Isaacs, 1994:44; Schein, 1994:67). Isaacs defines dialogue as a sustained collective inquiry into the processes, assumptions, and certainties that compose everyday experience (Isaacs, 1994:41). See Figure 2-7. Dialogue can lead to a higher level of learning called "triple-loop learning." (Bateson, 1972:34). While double-loop learning as defined by Argyris encourages considering which paradigm is superior, triple-loop learning permits insight into the nature of the paradigm itself (Isaacs, 1994:46). Dialogue is a potential learning parameter.

Section III: Theorized Organizational Learning Parameters

The theories that have been outlined above contained fifty potential organizational learning parameters. In this section I will organize the parameters into general categories building on the framework developed by Huber. The individual parameters will be defined and the researcher(s) who proposed the parameter will be identified.

These parameters represent the theoretical processes and activities hypothesized to be necessary for learning to occur. The fact that all are present in an organization will not ensure that the organization is actually learning, but a greater potential for learning may exist if the parameters are present. Watkins and Marsick present a model that illustrates this point (see Figure 2-8).

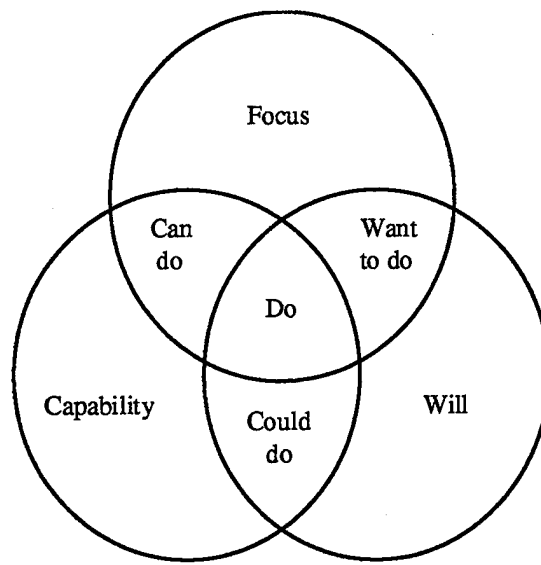


Figure 2-8. The Learning Model (Watkins and Marsick, 1993:37)

“Learning can be described in terms of three components: the focus, capability, and will. The focus is a knowledge or understanding of the learning opportunity. The capability includes the skills and resources that allow an organization to learn. The will is the feelings or motivation that carry learning forward” (Watkins and Marsick, 1993:37). All three factors must be present for learning to actually occur.

Category A - Knowledge Acquisition

Knowledge acquisition is the formal organizational activities as well as the informal behaviors directed toward obtaining information or knowledge (Huber, 1991:91). This category will contain all parameter pertaining to knowledge acquisition. Potential organizational learning parameters in this category are:

Congenital Learning: the combination of the knowledge inherited by an organization at its conception and the additional knowledge acquired prior to its birth (Huber 1991:91).

Organizational Experiments: attempts to increase the accuracy of feedback about cause and effect relationships between the organization and its environment and ensure the collection and analysis of feedback (Huber, 1991:91).

Organizational Self-Appraisal: gathering information about problems, concerns, and needed changes from organizational members, organizing this information, sharing it with the members, and involving the members in choosing, planning, and implementing actions to correct problems identified (Huber, 1991:92).

Experimenting Organizations: organizational experiments and self-appraisals are generally directed toward enhancing adaptation, while maintaining organizational experiments is generally directed toward enhancing adaptability (Huber, 1991:93).

Vicarious learning: searching for information about what corporate competitors are doing and how they do it (Huber, 1991:96).

Scanning: the process of monitoring the environment and providing environmental data to managers (Daft and Weick, 1984:286).

Benchmarking: a disciplined process that begins with a thorough search to identify best-practices organizations, continues with careful study of one's own practices and performance, progresses through systematic site visits and interviews, and concludes with an analysis of results, development of recommendations, and implementation" (Garvin, 1993:86).

Customer Opinion: use customers as an excellent source of up-to-date product information, competitive comparisons, insight into changing preferences, and immediate feedback about service and patterns of use (Garvin, 1993:86).

Grafting: attempts to increase knowledge by hiring or “grafting” on new members who possess knowledge desired by the organization (Huber, 1991:97).

Performance Monitoring: occurs when organizations formally and routinely assess how well they are meeting both their own standards and the expectations of external constituencies (Huber, 1991:99).

Competitor’s Performance: the organizations sensitivity to the performance of competitors or other comparable organizations (Cyert and March, 1963:123).

Performance Stress: degree to which the organization may be highly sensitized to either success or failure (Cangelosi and Dill, 1965:200).

Experimentation With New Approaches: systematic searching for and testing of new knowledge (Garvin, 1993:82). Two forms of experimentation, one that is ongoing, and another that is one-of-a-kind type projects.

Category B - Information Distribution

Information distribution fosters learning to occur when organizational components commonly develop “new” information by piecing together items of information that they obtain from other organizational units (Huber, 1991:100).

Potential organizational learning parameters in this category are:

Language Development: the knowledge of each learner must be cemented to the group so that it can become a building block of the institutional mental model (De Geus, 1988:74). The rate at which the institutional model changes will be a factor of the individual’s ability to communicate with others within the group.

Lessons Learned: Successes and failures must be reviewed, systematically assessed, and the lessons learned recorded in a form that is accessible to employees (Garvin, 1993:85).

Transferring Knowledge: knowledge must be dispersed quickly and efficiently throughout the organization. Mechanisms to accomplish this task include: written, oral, and visual reports, site visits and tours, personnel rotation programs, education and training programs, and standardization programs (Garvin, 1993:87).

Dialogue: a sustained collective inquiry into the processes, assumptions, and certainties that compose everyday experience (Isaacs, 1994:41; Schein, 1994:67).

Redundancy is an important factor in creating knowledge because it encourages frequent dialogue and communications (Nonaka, 1991:102).

Three different examples of redundancy are:

Parallel Product Development: different teams are formed that compete internally to develop different approaches to the same problem. This parallel development allows the team to eventually develop a common understanding of the “best” approach (Nonaka, 1991:102).

Strategic Rotation: rotation between functions such as R&D and marketing. The rotation helps employees understand the business from different perspectives allowing organizational knowledge to become more “fluid” and easier to put into practice (Nonaka, 1991:102).

Free Information Access: When information differentials exist, members of an organization can no longer interact on equal terms. This hinders the search for different interpretations of new knowledge (Nonaka, 1991:102).

Openness: a willingness to eliminate hidden agendas, make motives, feelings and biases known, and invite other opinions and points of view (Stata, 1989:70).

Communications: Poor communications between people and between organizations is a major stumbling block to learning and quality improvement (Stata, 1989:70). No organizational learning occurs until knowledge is accepted by others in the organization, it must first be communicated” (Duncan and Weiss, 1979:96).

Team learning: the dynamics of group communication with emphasis on the practice of dialogue which involves learning how to “think together” and recognize and counteract patterns that undermine learning (Senge, 1990:10).

Category C - Information Interpretation

Interpretation is the process of translating events and developing shared understanding and conceptual schemes among members of upper management” (Daft and Weick, 1984:286).

Potential organizational learning parameters in this category are:

Cognitive Maps: individual’s cognitive maps will shape their interpretation of data, and that these may vary across organizational units (Huber, 1991:102).

Organizational Theory-In-Use: learning occurs when the images and maps which are embedded in the organizational theory-in-use are changed (Argyris and Schon, 1978:22).

Mental Models: deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action (Senge, 1990:8).

Shared Paradigm: set of beliefs, a way of seeing or organizing the principles governing perception (Duncan and Weiss, 1979:91).

Framing: how information is framed or labeled affects its interpretation (Huber, 1991:102).

Media Richness: the communication medium's capacity to change mental representations within a specific time interval (Huber, 1991:103).

Information Load: information overload occurs when the information to be interpreted exceeds the unit's capacity to process the information (Huber, 1991:103).

Unlearning Necessary: a process through which learners discard obsolete and misleading knowledge (Huber, 1991:104; Hedberg, 1981).

Knowledge Acceptability: "New knowledge is not likely to be accepted if it conflicts greatly with the paradigm held by the organization's members" (Duncan and Weiss, 1979:95).

Scenarios: scenarios can be used to "trigger institutional learning" (De Geus, 1988:71; Schnaars, 1987; Wack, 1985).

Systematic Problem Solving: accomplished with methods developed by the quality movement to include what Deming calls the "Plan, Do, Check, Act" cycle, data based decision making versus assumption based, and using statistical tools to organize data and draw inferences (Garvin, 1983:81).

Goal Revision Speed: the speed at which the organization revises goals in the face of experience (Cyert and March, 1963:123).

Discomfort Stress: the pressure felt as a result of the complexity of the environment relative to the time, energy, and the ability that groups can expend understanding it and of

the uncertainty in the environment relative to the groups ability to forecast the future (Cangelosi and Dill, 1965:200).

Disjunctive Stress: occurs as the result of increasing degrees of divergence and conflict in the ways in which individuals and subgroups behave (Cangelosi and Dill, 1965:201).

Systems thinking: a shift in mindset from seeing interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots (Senge, 1990:73).

Objectivity: searching for the best answers based on a reasoned positions and objective criteria, as opposed to political influence and parochial interests (Stata, 1989:70).

Category D - Organizational Memory

This category will capture all parameters in the area of organizational memory. According to Huber, the demonstrability and usability of learning depend on the effectiveness of the organization's memory (Huber, 1991:106; Stata, 1989:64).

Potential organizational learning parameters in this category are:

Membership Attrition: As members of the organization leave, the knowledge of that member not stored in the organization's memory will be lost (Huber, 1991:106).

Hard Information Storage: Organizations store both "hard" and "soft" information. Hard information normally takes the form of standard operating procedures, routines, and scripts (Huber, 1991:105).

Soft Information Storage: Routinely acquired by managers and stored mentally (Huber, 1991:105; Mintzberg 1975).

Organizational Mental Models: Organizational memory includes everything that is contained in an organization that is somehow retrievable (1993:43). The active memory of the organization in the model is the individual and shared mental models. The reason the model places so much emphasis on the mental models in the individual's heads is because that is where a majority of the organization's knowledge exists (Kim, 1993:44; Stata, 1989).

Information Retrieval: the role of computer-based expert systems developed using the knowledge of individuals as a way of capturing some of their "soft" expertise (Huber, 1991:106). Advantages of such systems include accessibility, reliability, and own-ability (Huber, 1991:106).

Managerial Microworld: computer model of the organization common mental models. (De Geus, 1988:74).

Category E - Organizational Culture

This category will capture parameters that deal with the feeling and motivations within an organization at both the individual and organizational level that will carry learning forward. This category evolved from the organizational will element presented in the learning model by Watkins and Marsick (1993:37). Potential organizational learning parameters in this category are:

Personal Commitment: the individuals sense of identification with the enterprise and its mission (Nonaka, 1991:97).

Self-knowledge: a shared understanding of what the organization stands for, where it is going, what kind of world it wants to live in, and, most importantly, how to make that world a reality (Nonaka, 1991:97).

Personal Mastery: the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of seeing reality objectively (Senge, 1990:7).

Shared Vision: skill of unearthing shared “pictures of the future” that foster genuine commitment and enrollment rather than compliance (Senge, 1990:9).

Organizational Rewards: pay and promotion must be tied to the intangible factors you are trying to promote (Stata, 1989:70).

The following tables summarize the potential organizational learning parameters identified in the literature by category.

Table 2-2. Organizational Learning Parameters in the Knowledge Acquisition Category

Knowledge Acquisition	
Parameter	Primary Source
Congenital learning	Huber, 1991
Organizational experiments	Huber, 1991
Organizational self-appraisal	Huber, 1991
Experimenting organizations	Huber, 1991
Vicarious learning	Huber, 1991
Scanning	Daft and Weick, 1984
Benchmarking	Garvin, 1993
Customer Opinion	Garvin, 1993
Grafting	Huber, 1991
Performance Monitoring	Huber, 1991
Competitors Performance	Cyert and March, 1963
Performance Stress	Cangelosi and Dill, 1965
Experimentation with new approaches	Garvin, 1993

Table 2-3. Organizational Learning Parameters in the Information Distribution Category

Knowledge Acquisition	
Parameter	Primary Source
Language Development	Huber, 1991
Lessons Learned	Garvin, 1993
Transferring Knowledge	Garvin, 1993
Dialogue	Isaacs, 1994
Parallel Product Development	Nonaka, 1991
Strategic Rotation	Nonaka, 1991
Free Information Access	Nonaka, 1991
Openness	Stata, 1989
Communications	Duncan and Weiss, 1979
Team Learning	Senge, 1990

Table 2-4. Organizational Learning Parameters in the Information Interpretation Category

Information Interpretation	
Parameter	Primary Source
Cognitive Maps	Huber, 1991
Organizational Theory-In-Use	Agyris and Schon, 1978
Mental Models	Senge, 1990
Shared Paradigm	Duncan and Weiss, 1979
Framing	Huber, 1991
Media Richness	Huber, 1991
Information Load	Huber, 1991
Unlearning Necessary	Huber, 1991
Knowledge Acceptability	Duncan and Weiss, 1979
Scenarios	De Geus, 1988
Systematic Problem Solving	Garvin, 1983
Goal Revision Speed	Cyert and March, 1963
Discomfort Stress	Cangelosi and Dill, 1965
Disjunctive Stress	Cangelosi and Dill, 1965
Systems Thinking	Senge, 1990
Objectivity	Stata, 1989

Table 2-5. Organizational Learning Parameters in the Organizational Memory Category

Organizational Memory	
Parameter	Primary Source
Membership Attrition	Huber, 1991
Hard Info Storage	Huber, 1991
Soft Info Storage	Huber, 1991
Organizational Mental Models	Kim, 1993
Information Retrieval	Huber, 1991
Managerial Microworld	De Geus, 1988

Table 2-6. Organizational Learning Parameters in the Organizational Culture Category

Organizational Change	
Parameter	Primary Source
Personal Commitment	Nonaka, 1991
Self-Knowledge	Nonaka, 1991
Personal Mastery	Senge, 1990
Shared Vision	Senge, 1990
Organizational Rewards	Stata, 1989

Summary

This chapter provided background information needed to understand the importance and relevance of this research. The many definitions of organizational learning

were examined in detail. A review of several theories of organizational learning was presented. Finally, potential organizational learning parameters identified in the various theories were categorized and defined. The remainder of this research will attempt to develop a method to measure the learning potential of an organization using the organizational learning parameters identified in the literature.

III. Method

Chapter Overview

The purpose of this research as outlined in chapter one is to identify the significant parameters in organizational learning theory and to develop and validate an instrument that is capable of measuring the parameters. This chapter will describe and explain the methods used to accomplish that purpose. The chapter will address each of the individual research objectives in terms of its method.

Research Objective Three: Develop a method to measure organizational learning potential.

A method was required to measure the learning potential of an organization. The author chose to develop an Organizational Learning Instrument to measure the significance of each potential parameter in an organization as perceived by members of that organization.

Questionnaire Development. The theorized organizational learning parameters were divided into five general categories: knowledge acquisition, information distribution, information interpretation, organizational memory, and organizational culture. The 50 parameters identified in Chapter II were carefully reviewed and combined into 27 parameters to be measured by the instrument. The number of parameters was reduced by combining obvious duplicates and those parameters that had similar definitions. The following items were developed to describe the expected behavior under the respective parameter. The items were synthesized from the Literature Review.

A. Knowledge Acquisition

Experimentation. Experimentation is a theoretical organizational learning parameter that measures the organization's ability to collect and analyze feedback about cause and effect relationships between the organization and its environment (Garvin, 1993; Huber, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. Testing new ideas/concepts is encouraged in this organization.
2. Testing new products/services is encouraged in this organization.
3. We are encouraged to search for new knowledge in this organization.
4. We are encouraged to test new knowledge in this organization.
5. We are encouraged to look for feedback from the environment about the new ideas/concepts/products/processes we are trying out.
6. We are encouraged to look for feedback from the environment about the new products/processes we are trying out.
7. There is a formal process for testing conducted by the organization.
8. We are encouraged to try new ways of doing things.
9. We are trained to perform and evaluate the "experiments" we do.
10. We are trained to use statistical methods to evaluate data.
11. We are trained to use "creativity" techniques to come up with new ideas/concepts/products/processes.

Self-Appraisal. Self-appraisal is a theoretical organizational learning parameter that measures the organization's ability to collect information about problems, concerns, and needed changes from its members and then to organize this information, share it with the members, and involve the members in choosing, planning, and

implementing actions to correct problems identified (Huber, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization actively solicits information about problems from its members.
2. Organization members receive information on problems identified by other members.
3. The organization takes action to correct problems identified by its members.
4. The organization involves members in planning actions to correct problems.
5. The organization involves members in implementing actions to correct identified problems.

Vicarious Learning. Vicarious learning is a theoretical organizational learning parameter that measures the organizations ability to collect information about what corporate competitors are doing and how they do it (Huber, 1991). Benchmarking, environmental scanning, and monitoring competitor's performance all fall under this parameter (Cyert and March, 1963; Daft and Weick, 1984). Behavioral statements proposed to measure this theoretical parameter are:

1. We monitor the performance of comparable organizations.
2. We search for information about what our competitors are doing.
3. We search for information about what processes our competitors are using.
4. We attempt to identify processes used by others that could be adapted for use within our organization.
5. When organizations similar to ours experience failures, we analyze these failures to improve our organization.
6. We have adopted processes from other organizations.
7. The organization provides trade journals and publications for use by its members.
8. We are given time to read trade journals and publications.

Customer Opinion. Customer opinion is a theoretical organizational learning parameter that measures the organization's use of its customers as a source of up-to-date product information, competitive comparisons, insight into changing preferences, and immediate feedback about service and patterns of use (Garvin, 1993). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization has clearly identified who its customers are.
2. The organization continuously solicits feedback from its customers.
3. The organization uses customer feedback to improve its products/services.
4. The organization's goals are tied to customer satisfaction.
5. Individual/team goals in the organization are tied to customer satisfaction.
6. I can see how my job relates to customer satisfaction.
7. We proactively seek information from customers even when there doesn't appear to be a problem.
8. We ask our customers how we rate in comparison to similar organizations.
9. We ask customers how we can change our products/services to better meet their needs.
10. We ask customers about creative uses for our products/services.
11. We include customers in new product/process design efforts.

Grafting. Grafting is a theoretical organizational learning parameter that measures the organization's attempts to increase its knowledge by hiring or "grafting" on new members who possess knowledge desired by the organization (Huber, 1991).

Behavioral statements proposed to measure this theoretical parameter are:

1. New organization members are skilled in areas that complement the organization's mission.
2. Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.

3. We look outside the organization for needed expertise.
4. Management brings in outside experts to help us solve problems.
5. We have used outside consultants to help us solve problems.

Performance Monitoring. Performance monitoring is a theoretical organizational learning parameter that measures the organization's attempt to formally and routinely assess how well they are meeting both their own standards and the expectations of external constituencies (Huber, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization has established internal performance standards.
2. Performance standards are communicated to all organization members.
3. The organization continuously assesses its performance against internal standards.
4. The organization continuously assesses its performance against industry standards.
5. The organization's performance against the standards is communicated to all organization members.
6. We have identified those organizations or people who have a stake in our success.
7. We have identified those things about our performance that are important to external stakeholders.

Performance Stress. Performance stress is a theoretical organizational learning parameter that measures the organization's sensitivity to either success or failure (Cangelosi and Dill, 1965). Behavioral statements proposed to measure this theoretical parameter are:

1. Severe consequences exist if the organization or its members fail.
2. Significant rewards exist if the organization or its members succeed.
3. Organization members are under pressure to perform.

4. Failure is never acceptable in our organization.
5. We are encouraged to learn from our mistakes.
6. I believe that I have experienced a stress-related illness.
7. Others in our organization have experienced stress-related illnesses.
8. Stress-related illnesses are common in our organization.
9. Our organization sponsors stress reduction activities.

B. Information Distribution

Communication. Communication is a theoretical organizational learning parameter that measures the organization's ability to disperse knowledge quickly and efficiently throughout the organization (Duncan and Weiss, 1979; Garvin, 1993; Stata, 1989). Behavioral statements proposed to measure this theoretical parameter are:

1. Our organization disperses knowledge quickly.
2. Our organization disperses knowledge efficiently.
3. Written reports are used to disperse knowledge throughout the organization.
4. Oral reports are used to disperse knowledge throughout the organization.
5. Conversations "around the water cooler" are encouraged.
6. We use electronic media (E-mail, bulletin boards, etc.) to disperse knowledge.
7. Mentoring is encouraged in the organization.
8. Communication skills are taught within the organization.
9. Organization members socialize together at lunchtime and breaks.
10. Organization members communicate with those in different functions, departments, and projects.
11. We hold meetings when it is necessary to "get the word out" quickly.
12. I feel that I get the information that I need to do my job when I need it.

Dialogue. Dialogue is a theoretical organizational learning parameter that measures the organization's ability to collectively examine the processes, assumptions, and certainties that compose its everyday experience. (Isaacs, 1994; Schein, 1994; Senge, 1990; Stata, 1989). Behavioral statements proposed to measure this theoretical parameter are:

1. Organization members are willing to eliminate hidden agendas.
2. Organization members try to understand the motives and reasoning of others without passing judgment.
3. Organization members feel free to express their true opinions without fear of reprisal.
4. Organization members feel that it is all right to disagree with the boss.
5. Negative feedback is valued as a positive contribution to the organization.
6. Honest opinions are valued more than noncontroversial opinions.
7. Organizational members can share ideas in an environment of openness and trust.
8. We regularly analyze the assumptions which underlie our decisions.

Lessons Learned. Lessons learned is a theoretical organizational learning parameter that measures the organization's ability to review and systematically assess its successes and failures and record the lessons learned in a form that is accessible to employees (Garvin, 1993). Behavioral statements proposed to measure this theoretical parameter are:

1. We actively analyze successes within the organization.
2. We actively analyze failures within the organization.
3. Lessons learned from organizational success are accessible to members.
4. Lessons learned from organizational failures are accessible to members.
5. The organization values the contribution failures can make to its lessons learned.
6. Organization members apply lessons learned to new projects.

7. We have a system for keeping track of our successes and failures.

Personnel Rotation. Personnel rotation is a theoretical organizational learning parameter that measures the organization's process for increasing understanding of the organization from different perspectives (Nonaka, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization encourages members to master different functions.
2. The organization requires members to rotate to other functions to gain experience.
3. A total organization perspective is favored over a functional perspective.
4. Broad-based organizational experience is valued over strictly functional experience in the organization.
5. A regular rotation plan is part of each individual's career development plan.
6. We use cross-functional teams to help solve problems.

Information Access. Information access is a theoretical organizational learning parameter that measures the organization's commitment to the free flow of information to all members (Nonaka, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. Organization members have broad access to all organization information except personnel records.
2. Information is not restricted within the organization.
3. Information is easy to obtain within the organization.
4. Members are sometimes denied information that they need to know.
5. The organization treats information as power.
6. The organization withholds information for no clear reason.
7. Information is readily shared between organizational units.

8. Easy and assessable methods exist for all organization members to transfer information within the organization.

C. Information Interpretation

Mental Models. Mental models is a theoretical organizational learning parameter that measures the influence of deeply ingrained assumptions, generalizations, and pictures or images on the way the organization takes action (Duncan and Weiss, 1979; Huber, 1991; Senge, 1990). Behavioral statements proposed to measure this theoretical parameter are:

1. Commonly held assumptions about the organization govern day to day decisions.
2. Underlying assumptions about the organization's environment can be constructively challenged.
3. Underlying assumptions that govern the organization's actions can be changed.
4. Underlying assumptions are changed when they are challenged and proven wrong.
5. When making decisions, the organization analyses the assumptions underlying the alternative decisions.
6. We know our "place" among organizations similar to ours.
7. We have commonly held beliefs about the way the organization should "behave."

Information Load. Information load is a theoretical organizational learning parameter that measures the organization's capacity to interpret information based on the amount of information that must be processed (Huber, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. The amount of information that must be reviewed to make decisions is overwhelming.
2. I often have too much information when making decisions.
3. Our problem isn't too little information, it is too much information.

4. I am on too many teams to be effective.
5. I regularly feel overwhelmed by all the things going on in our organization.
6. I sometimes feel “bombarded” with information which confuses the issues.

Unlearning. Unlearning is a theoretical organizational learning parameter that measures the amount of obsolete and misleading knowledge that must be discarded for learning to occur (Duncan and Weiss, 1979; Hedberg, 1981; Huber, 1991).

Behavioral statements proposed to measure this theoretical parameter are:

1. The organization is very slow to accept new ideas.
2. The organization is very slow to change old ways when better ways are identified.
3. The organization has very strong opinions about the way things are done that cannot be easily changed.
4. Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
5. A lot of negative information must be received before we change the ways we do things.
6. The organization tends to hold on to old ideas even when we know that they are wrong.

Scenarios. Scenarios is a theoretical organizational learning parameter that measures the organization’s attempts to use hypothetical situations to prepare plans for the future (De Geus, 1988; Schnaars, 1987; Wack, 1985). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization evaluates how changes in the environment may impact it’s future.
2. The organization considers how specific sets of changes in the environment could change the way the organization operates.

3. The organization tries to anticipate environmental changes and react to them before being forced to change.
4. The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
5. We try to visualize the future in order to build contingency plans.
6. We encourage development of alternative views of where we are going.
7. We use alternative future possibilities to test the quality of our decisions.

Systematic Problem Solving. Systematic problem solving is a theoretical organizational learning parameter that measures the organization's commitment to making data based decisions (Garvin, 1983). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization uses the scientific method to diagnose problems.
2. The organization uses data to support decision making.
3. Statistical tools are used to organize data and draw inferences.
4. We construct and test hypotheses when trying to solve a problem.
5. We use a step-by-step process for identifying, analyzing, and solving problems.

Discomfort Stress. Discomfort stress is a theoretical organizational learning parameter that measures the pressure the organization feels as a result of the complexity of the environment with respect to time, energy, and the ability that groups can expand understanding it and the uncertainty in the environment relative to the group's ability to forecast the future (Cangelosi and Dill, 1965). Behavioral statements proposed to measure this theoretical parameter are:

1. The environment members work in is too complex to understand.
2. Our future organizational environment looks stable.
3. The organization is confident that it can predict its future environment.
4. The number of external organizations we must deal with seems to be increasing.
5. The speed with which our working environment is changing seems to be increasing.

Systems Thinking. Systems thinking is a theoretical organizational learning parameter that measures the organization's commitment to thinking in terms of interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots (Senge, 1990; Stata, 1989). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization always looks for the long term solution rather than a quick fix.
2. The organization is careful to fix the problem not just the symptoms.
3. When solving problems, the highest impact solution is sought out.
4. The organization considers the whole process rather than static "snap-shots" when problem-solving.
5. Organization members view the organization as a system.
6. When solving problems, the total-organization and its interrelationships are considered.
7. When solving a problem, we consider the impact of the solution on all parts of the organization.
8. We perform "deep" problem analysis to ensure effective problem solutions.
9. We believe that a change in one part of our organization affects all parts.

D. Organizational Memory

Membership Attrition. Membership attrition is a theoretical organizational learning parameter that measures the amount of knowledge lost by the organization when

members leave the organization (Huber, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization experiences a high turnover of members.
2. The organization experiences a high turnover of members in key positions.
3. People are constantly joining and leaving our teams.
4. Our turnover seems higher than other organizations' turnover.
5. The knowledge lost from members leaving the organization is greater than the knowledge gained from the fresh ideas of people entering the organization.
6. It is better to hire new people with fresh ideas than to retain experienced people with organizational knowledge.

Hard Information Storage. Hard information storage is a theoretical organizational learning parameter that measures the influence of information stored in the form of written standard operating procedures, routines, and scripts (Huber, 1991).

Behavioral statements proposed to measure this theoretical parameter are:

1. Standard operating procedures for the organization are written down.
2. Important processes in the organization are documented.
3. Standard operating procedures document how the procedures are actually accomplished.
4. Documentation is updated to reflect changes in the procedures and processes.
5. The organization maintains an archive of all documentation and records.
6. Our rules and regulations constrain us more than they guide us.
7. Our rules and regulations help us make consistent decisions when we are faced with new situations.

Soft Information Storage. Soft information storage is a theoretical organizational learning parameter that measures the influence of information routinely acquired by managers and stored mentally (Huber, 1991). Behavioral statements proposed to measure this theoretical parameter are:

1. Many procedures are not written down, but everyone knows what they are.
2. The organization has standard ways of thinking about things that are not written down.
3. The organization has lots of unwritten rules.
4. The way we say we do things and the way that things actually get done are completely different.
5. We would operate just as effectively without our written rules and regulations.

Computer Models. Computer models is a theoretical organizational learning parameter that measures the organization's use of computer-based expert systems and models (De Geus, 1988; Huber, 1991, Senge, 1990). Behavioral statements proposed to measure this theoretical parameter are:

1. The organization uses computer-based expert systems.
2. The organization uses computer models to capture organizational knowledge.
3. The organization uses computer models to test new strategies.
4. The knowledge of experts from within the organization is captured on computer.
5. The organizational expertise captured on computer is easily accessible to organizational members.
6. Our computers are important to our decision processes.
7. We use computer models to see how our decisions will affect the organization.
8. Our computers are used more for administrative tasks than problem-solving tasks.

E. Organizational Culture

Organizational Commitment to Learning. Organizational commitment to learning is a theoretical organizational learning parameter that measures the commitment of the organization's leadership to its members and to the idea of continuous learning (Nonaka, 1991; Senge, 1990; Stata, 1989). Behavioral statements proposed to measure this theoretical parameter are:

1. Continuous learning is a recognized way of life in the organization.
2. The organization's leaders are committed to organizational learning.
3. The organization's leaders work to provide a better environment for learning.
4. Creativity is encouraged in the organization.
5. The organization is concerned about me as an individual.
6. The organization is committed to my personal development.
7. The organization is committed to my professional development.
8. The organization has helped me develop a plan for my professional growth.
9. My manager solicits my opinions, values, solutions, and ideas.

Personal Commitment to Learning. Personal commitment to learning is a theoretical organizational learning parameter that measures the commitment of the organization's members to the organization and to the idea of continuous learning (Nonaka, 1991; Senge, 1990). Behavioral statements proposed to measure this theoretical parameter are:

1. I value my involvement with the organization.
2. I will go out of my way to make the organization a success.
3. I am personally committed to learning and growing.
4. I care about the organization and what it is doing.
5. When the organization is successful I feel successful.

6. I take the initiative to learn about new technologies and processes associated with my job.
7. I try to know as much about the organization and its processes as possible.

Shared Vision. Shared vision is a theoretical organizational learning parameter that measures the organization's ability to develop a shared picture of the future that fosters the genuine commitment of the organization's members (Nonaka, 1991; Senge, 1990). Behavioral statements proposed to measure this theoretical parameter are:

1. I know the organization's vision for the future.
2. I know and share the values of the organization.
3. I feel that my personal goals align with the goals of the organization.
4. Members of the organization know where they fit into the organization's overall vision.
5. Managers take positive action to transmit the organization's vision to all members.
6. I feel a personal commitment to helping the organization make its vision a reality.

Organizational Rewards. Organizational rewards is a theoretical organizational learning parameter that measures how well the organization has tied its pay and promotion system to organizational learning (Stata, 1989). Behavioral statements proposed to measure this theoretical parameter are:

1. The organizational reward system promotes my learning efforts.
2. Organizational rewards are tied to things the organization is trying to promote such as teamwork, quality improvement, and learning.
3. Promotions and compensation are tied to the intangible factors the organization is trying to promote such as teamwork or quality improvement.
4. The organization rewards risk taking.
5. The organization rewards personal development.

6. When organizational groups discover better ways of doing business, the organization adequately recognizes their efforts.
7. The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.

Demographic Questions. The questionnaire contained seven demographic questions in addition to the behavioral statements identified above. The demographic questions were designed to provide helpful information about different groupings of individuals within the organization. The groupings were based on time in the organization, level in the organization, sex, age, rank/grade, and education level. See Table 3-1 below.

Response Scale

Questionnaire participants were asked to read each behavioral statement and respond on a Likert scale based upon their agreement or disagreement with the statement. The Likert scale provided was broken into seven possible responses: 1) Decidedly Disagree, 2) Moderately Disagree, 3) Slightly Disagree, 4) Borderline, 5) Slightly Agree, 6) Moderately Agree, 7) Decidedly Agree.

Two versions of the questionnaire were administered to eliminate a potential bias due to respondent fatigue. Both versions begin with the seven demographic questions. Version A follows the demographic questions with 193 behavioral statements in the order presented previously in this chapter. Version B contains the same behavioral statements as Version A in reverse order by parameter.

Table 3-1. Demographic Questions

1. About how long have you been assigned to the organization?
 1. Less than 6 months
 2. 7-12 months
 3. 13-18 months
 4. 19-23 months
 5. 2-3 years
 6. 4-5 years
 7. 6 years or more
2. Which category best describes your level in the organization?
 1. Operational (non-supervisory)
 2. Supervisory
 3. Middle-management
 4. Staff / Non-managerial
 5. Executive management
3. What sex are you?
 1. Male
 2. Female
4. What was your age on your last birthday?
 1. Less than 20 years
 2. 20 - less than 30 years
 3. 30 - less than 40 years
 4. 40 - less than 50 years
 5. 50 - less than 60 years
 6. More than 60 years
5. If you are in the military what is your rank? (Leave blank if not applicable)
 1. O1
 2. O2
 3. O3
 4. O4
 5. O5
 6. O6 or above
 7. other
6. If you are a civilian what is your grade? (Leave blank if not applicable)
 1. GS 5 - GS 6
 2. GS 7 - GS 8
 3. GS 9 - GS 10
 4. GS 11 - GS 12
 5. GM 13 - GM 15
 6. other
7. What is the highest education level you have completed?
 1. Grade school
 2. High school
 3. Technical/associate degree
 4. College degree
 5. Masters degree
 6. Masters degree plus

The responses to Version B were sorted by computer prior to analysis to match the order of Version A. Appendix A contains Version A of the pilot questionnaire.

Questionnaire respondents were also prompted to provide written feedback about the potential for learning in their organization and on the questionnaire itself.

Research Objective Four: Test the reliability of the scales used to measure the theoretical parameters and refine the concepts associated with organizational learning.

To test the reliability of the 27 parameters identified in the Literature Review the corresponding scales, 193 behavioral statements, were statistically analyzed using Cronbach's alpha analysis, confirmatory factor analysis, and exploratory factor analysis. Each form of analysis will be described in this section.

Sample Size. To provide results from a wide cross section of Air Force Organizations, the Pilot Organizational Learning Questionnaire was administered to Air Force Institute of Technology (AFIT) graduate students in the school of Acquisition and Logistics. Questionnaires were administered to 88 students from the 1995 Graduate Programs and 72 students from the 1996 Graduate Programs. The students were told to answer all of the questions with reference to the organizations they were members of before arriving at AFIT. A total of 160 questionnaires were administered to obtain data needed to assess the reliability of the scales in the pilot organizational learning questionnaire.

A larger sample size would normally be appropriate for the type of analysis I will be using. Due to the preliminary nature of this research and the requirements of administering a larger number of surveys, I decided that the smaller sample size would

have to be used. More extensive research, with a larger sample size, will be required using the reduced size operational questionnaire I will develop with this research.

Cronbach's Alpha. Initial analysis of the items, grouped by learning parameter, was conducted using Cronbach's Alpha. Cronbach's coefficient of reliability (α) is a measure of internal consistency used to evaluate the reliability of the questionnaire (SAS Procedures Guide, 1988:129). It determines which of the behavioral statements do not contribute to the overall reliability of the scale and should be dropped. The value of the Cronbach Alpha indicates the level of correlation the scale would have if the particular variable being examined was removed from the scale. Larger values of Cronbach's Alpha indicate that either a particular behavioral statement does not contribute to measurement of the respective parameter or that it measures the same aspect of the parameter as another statement. Behavioral items with substantially higher alpha coefficients than the group alpha coefficient were dropped from the analysis beginning with the highest alpha factor (Comrey, 1992:407).

Factor Analysis. Factor Analysis describes a variety of statistical techniques used to represent a set of variables in terms of a smaller number of hypothetical variables or factors (Kim, 1978:9). This technique will be used to either confirm or deny the existence of the theorized organizational learning parameters. The 193 behavioral statements (the variables) identified in this research will be used to confirm the 26 theorized organizational learning parameters (the factors). Two major types of factor analysis will be performed: confirmatory and exploratory. Confirmatory factor analysis is used when a hypothesized number of factors exists. The analysis is used to confirm this expectation (Kim, 1978:9). Exploratory factor analysis is used when the researcher does

not know how many factors exist. It is used to ascertain the minimum number of hypothetical factors and to explore the data for possible reductions (Kim, 1978:9).

Five steps are normally followed to perform factor analysis: 1) selection of the variables, 2) completion of the matrix of correlation among the behavioral statements, 3) extraction of the unrotated factors, 4) rotation of the factors, and 5) interpretation of the rotated factor matrix (Comrey, 1992:5). The individual steps will be discussed below:

Selection of the Variables. The 197 behavioral statements that make up the questionnaire are the variables that were selected for factor analysis. These variables represent the 25 theorized organizational learning parameters. The five demographic questions that were included in the questionnaire will not be included in the factor analysis because they do not represent a potential parameter. The number of variables to be used in factor analysis was decreased slightly by the analysis of Cronbach's alpha. Behavioral statements that were redundant or did not contribute towards the measurement of learning were not included in the factor analysis.

Completion of the Correlation Matrix. SAS generated a correlation matrix of all the variables identified for factor analysis based upon the data collected from the questionnaire respondents. This matrix contains the correlation between all variables to be analyzed. The value of the correlation coefficients ranges from -1 to 1. Correlation coefficient values close to zero indicate a weak linear relationship between the variables. Values that are close to 1 or -1 indicate a strong linear relationship between the variables (Comrey, 1992:5).

Extraction of Unrotated Factors. SAS factor analysis produced a table of eigenvalues for each variable, communality values for each variable, unrotated factor patterns, and rotated factor patterns.

The communality values provide an indication of the degree of overlap between the variables and the factors they measure (Comrey, 1992:8). A communality value of 1 for a variable would indicate that it totally overlaps with all of the factors it measures. A communality value of 0 would indicate that the variable does not overlap at all with the factors identified.

The unrotated and rotated factor patterns contain a row for each variable included in the factor analysis and a column for each factor. These numbers represent the factor loadings for each variable on a factor. A larger factor loading value indicates a stronger relationship between the variable and its corresponding factor.

The principal factor method was used to extract factors from the data. This method is most commonly used today, replacing the centroid method of factor extraction (Comrey, 1992:52). The centroid method was done manually with a desk calculator and is used primarily for teaching purposes today. The centroid method was actually an approximation of the principal factor method which was not practical due to the number of calculations required before computers became more readily accessible (Comrey, 1992:78).

Rotation of the Factors. The data provided by unrotated factor extraction values is extremely difficult to interpret. These values indicate the strength or weakness of a behavioral statement to each of the extracted factors without regard to that factor's individual characteristics (Comrey, 1992:9). As a result, the factor loadings can appear to be similar for several variables. Rotating the factor matrix produces a new matrix mathematically equivalent to the original unrotated matrix. However, when the factors are rotated it becomes clear which variables are related to a particular factor. The factor loadings will tend to reveal a small number of variables with higher loadings that appear to relate to the factor and a number of variables with smaller values that do not appear to relate to the factor in consideration (Comrey, 1992:11).

Rotation Methods. The rotation method used in this research was the Varimax method. The Varimax method is the most popular rotation method in use today (Comrey, 1992:186). The Varimax method is so popular because it is based on the premise that the most interpretable factor has many high and low loading values with very few in the middle (Comrey, 1992:189). This facilitates interpretation of the data by cutting down on the number of variables with loading values in the middle range.

Factor Loadings. Table 3-1, Factor Loadings, provides general guidelines for determining the strength of the relationship between a variable and a factor (Comrey, 1992:243). This table was used to help determine which variables, behavioral statements, should be considered related to a factor and which should be dropped from the analysis.

Table 3-2. Factor Loadings

Factor Loading	Rating
.71	Excellent
.63	Very Good
.55	Good
.45	Fair
.32	Poor

Interpretation of the Rotated Factor Matrix. Interpretation of the rotated factor matrix is a subjective process that must be confirmed by evidence outside of the factor analysis (Comrey, 1992:11). When doing confirmatory factor analysis, I was looking for high loadings on factors from behavioral statements that I suspected belonged to that factor. This analysis would tend to either confirm or deny the parameters identified

previously in this chapter. Exploratory factor analysis was conducted by allowing SAS to identify as many factors as possible. The statements that loaded heavily under the factor identified were then analyzed to see if previously unidentified parameters might emerge.

Method Limitations

There are a number of limitations inherent in this method. They are:

Selection of Behavioral Statements. The behavioral statements selected to support each identified organizational learning parameter may not capture the intent of its creator. Where possible these statements were derived from the creator's text. However, many parameters were not well defined in the literature forcing me to rely on personal interpretation to develop descriptive behavioral statements.

Limited Pilot Sample Size. The sample size for the pilot study is not as large as I would have wanted. A larger sample may have increased the effectiveness of the overall factor analysis. The sample population is primarily composed of military officers who are all graduate students. A broader population may produce different results.

Factor Analysis. The factor analysis technique itself offers so many different variables that given the same set of data several analysts would probably each come up with a unique solution (Comrey, 1992:11). For example, SAS offers seven different factor rotation methods combined with nine different factor extraction methods (SAS User's Guide: Statistics, 1985:342,345).

Summary

This chapter outlined the method used to develop, administer, and interpret the results of a questionnaire that measures an organization's potential to learn. The method for each objective of this research was presented. The method itself is based on the organizational learning literature and statistical factor analysis. The inherent limitations of this methodology were also addressed.

IV. Analysis of Data

Chapter Overview

The purpose of this chapter is to present the finding of this research effort as described in Chapter III: Method. This chapter will provide the reader a step by step report of the data collected and subsequent analysis. The first section will address administrative data collected to include the response rates to the pilot questionnaire and a frequency analysis of the demographic data collected. Variable names are then assigned to all potential learning scales and individual scale items. Next, the Cronbach's coefficient of reliability (α) analysis for the 27 scales identified in the Chapter II: Literature Review is presented. Cronbach's coefficient of reliability (α) analysis is then presented for a set of scales that have been refined based on the initial Cronbach's Alpha analysis. Following this section the factors identified through the confirmatory factor analysis performed on the refined scales will be presented. Composite scales are then defined and used in exploratory factor analysis. The results of the exploratory factor analysis is presented identifying five composite factors and ten refined factors. Finally, the ten statistically significant refined factors are presented in a complete and a shortened workshop version.

Questionnaire Administration Statistics

This section of the analysis will review the response rate to the pilot organizational learning questionnaire and a statistical analysis of responses to the demographic questions. The information has been presented in tables wherever possible to facilitate interpretation.

Response Rate. The overall response rate to the pilot organizational learning questionnaire is presented in Table 4-1, Pilot Questionnaire Response Rates. The total number returned is defined as the total number of surveys returned that were correctly filled out and could be used for analysis purposes. The 88 surveys that were distributed to

the 1995 Class were placed in students mailboxes with instructions to return completed questionnaires to my mailbox in three weeks. Approximately 42% of the students returned acceptably completed questionnaires (see Table 4-1).

Table 4-1. Pilot Questionnaire Response Rates

Group	Sent Out	Returned	%	Cum %
AFIT Graduate Students, 1995 Class	88	37	42.0	23.1
AFIT Graduate Students, 1996 Class	72	71	98.6	44.4
Totals	160	108		67.5

Questionnaires were administered to the 1996 Class as a group during their school inprocessing. The questionnaires were passed out in a classroom and students were given as much time as required to complete the questionnaire. The students were not required to participate, but highly encouraged, with 98.6% of the students returning acceptably completed questionnaires. The group administration method generated a much more favorable response rate. However, the quality of responses may have been unfavorably impacted by the perception that this was a “mandatory” survey. As indicated above, the overall response rate of 67.5% for both classes resulted in 108 properly completed questionnaires.

Table 4-2, Test Version, shows the breakout of test versions for the 108 completed questionnaires. The breakout is fairly even, 47.2% of the returned questionnaires were Version A and 52.8% of the questionnaires were Version B. The first step of the statistical analysis was to sort the data in Version B to match Version A so that all of the items would be in the same order.

Table 4-2. Test Version

Test Version	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	51	47.2	51	47.2
B	57	52.8	108	100.0

Analysis of Demographic Data. This section contains analysis of the seven demographic questions included in the questionnaire. A frequency distribution of the responses will be presented for each of the demographic questions.

Table 4-3, Time in Organization, contains the frequency distribution for the first demographic question. About how long have you been assigned to the organization? Given the fact that my sample population is primarily military officers, it is not surprising that the most frequent response was 2 to 3 years.

Table 4-3. Time in Organization

Time in Organization	Frequency	Percent	Cumulative Frequency	Cumulative Percent
< 6 months	4	3.7	4	3.7
7-12 months	16	14.8	20	18.5
13-18 months	15	13.9	35	32.4
19-23 months	16	14.8	51	47.2
2-3 years	49	45.4	100	92.6
4-5 years	6	5.6	106	98.1
6 years or >	2	1.9	108	100.0

Table 4-4, Organizational Level, presents the frequency distribution for demographic question number two. Which category best describes your level in the organization? The most frequent response by a significant margin was middle-management.

Table 4-4. Organizational Level

Organizational Level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Operational	25	23.1	25	23.1
Supervisory	16	14.8	41	38.0
Middle-Mgt	45	41.7	86	79.6
Staff/Non-Mgt	16	14.8	102	94.4
Executive Mgt	6	5.6	108	100.0

Table 4-5, Sex of Respondents, presents the frequency distribution for demographic question number three. What sex are you? A majority of the respondents were male with one respondent miscoding the question.

Table 4-5. Sex of Respondents

Sex	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Male	86	79.6	86	79.6
Female	21	19.4	107	99.1
Miscode	1	0.9	108	100.0

Table 4-6, Age of Respondents, presents the frequency distribution for demographic question number four. What was your age on your last birthday? The majority of respondents fell between the ages of 20 and 40 years old.

Table 4-6. Age of Respondents

Age	Frequency	Percent	Cumulative Frequency	Cumulative Percent
< 20 yrs	1	0.9	1	0.9
20 - < 30 yrs	53	49.1	54	50.0
30 - < 40 yrs	46	42.6	100	92.6
40 - < 50 yrs	8	7.4	108	100.0
50 - < 60 yrs	0	0	108	100.0
60 yrs or >	0	0	108	100.0

Table 4-7, Military Rank, presents the frequency distribution for demographic question number five. If you are a military member what is your rank? The question prompts the respondent to leave the question blank if it is not applicable. A majority of the respondents, 86.7%, were either first lieutenants or captains.

Table 4-7. Military Rank

Military Rank	Frequency	Percent	Cumulative Frequency	Cumulative Percent
O1	2	1.9	2	1.9
O2	28	26.7	30	28.6
O3	63	60.0	93	88.6
O4	9	8.6	102	97.1
O5	1	1.0	103	98.1
O6 or above	0	0.0	103	98.1
other	2	1.9	105	100.0

Table 4-8, Civilian Grade, presents the frequency distribution for demographic question number six. If you are a civilian what is your grade? The question prompts the respondent to leave the question blank if it is not applicable. Twelve of the questionnaire

respondents coded civilian grades as indicated below with a total of fourteen responses. Given that questions five and six are mutually exclusive, their combined responses should total 108. The number of responses to both questions sums to 119. This indicates that at least 11 respondents miscoded their responses. These questions need to be more carefully worded to accurately capture the Military/Civilian breakout of survey respondents.

Table 4-8. Civilian Grade

Civilian Grade	Frequency	Percent	Cumulative Frequency	Cumulative Percent
GS 5 - GS 6	0	0.0	0	0.0
GS 7 - GS 8	0	0.0	0	0.0
GS 9 - GS 10	1	7.1	1	7.1
GS 11 - GS 12	4	28.6	5	35.7
GM 13 - GM 15	7	50.0	12	85.7
other	2	14.3	14	100.0

Table 4-9, Education Level, presents the frequency distribution for demographic question number seven. What is the highest education level you have completed? The results indicate that a majority of the respondents, 81.5%, have a college degree or higher. Given that all respondents have been accepted into graduate programs at AFIT, this result is to be expected.

Table 4-9. Education Level

Education Level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Grade School	0	0	0	0
High School	0	0	0	0
Tech/Associate Degree	0	0	0	0
College Degree	88	81.5	88	81.5
Masters Degree	17	15.7	105	97.2
Master Degree Plus	2	1.9	107	99.1
Miscode	1	0.9	108	100.0

Initial Variable Assignments. To facilitate analysis of the data, it was necessary to assign a variable name, or code, to each item. The coding scheme assigns a two letter code to each of the 26 individual scales (see Table 4-10). The first letter represents one of the five hypothesized general categories of learning parameters or scales. The second letter identifies the actual hypothesized learning parameter, hereafter referred to as a scale.

Table 4-10. Learning Category and Scale Name Codes

A = Knowledge Acquisition
AA = Experimentation
AB = Self-Appraisal
AC = Vicarious Learning
AD = Customer Opinion
AE = Grafting
AF = Performance Monitoring
AG = Performance Stress
D = Information Distribution
DA = Communication
DB = Dialogue
DC = Lessons Learned
DD = Personnel Rotation
DE = Information Access
I = Information Interpretation
IA = Mental Models
IB = Information Load
IC = Unlearning
ID = Scenarios
IE = Systematic Problem Solving
IF = Discomfort Stress
IG = Systems Thinking
M = Organizational Memory
MA = Membership Attrition
MB = Hard Information Storage
MC = Soft Information Storage
MD = Computer Models
C = Organizational Culture
CA = Organizational Commitment to Learning
CB = Personal Commitment to Learning
CC = Shared Vision
CD = Organizational Rewards

Tables 4-11 through 4-37 identify the variable code names assigned to each of the items, also referred to as behavioral statements, that make up the 27 scales categorized in Table 4-10. A unique three letter code has been assigned to each item that identifies the item, the scale it belongs to and the general category that the scale has been placed under. An "R" following the three letter code indicates an item that will be reverse scored.

Table 4-11. Item Codes for the Experimentation Scale

Experimentation Statements	
AAA	Testing new ideas/concepts is encouraged in this organization.
AAB	Testing new products/services is encouraged in this organization.
AAC	We are encouraged to search for new knowledge in this organization.
AAD	We are encouraged to test new knowledge in this organization.
AAE	We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.
AAF	There is a formal process for testing conducted by the organization.
AAG	We are encouraged to try new ways of doing things.
AAH	We are trained to perform and evaluate the "experiments" we do.
AAI	We are trained to use statistical methods to evaluate data.
AAJ	We are trained to use "creativity" techniques to come up with new ideas/concepts/products/processes.

Table 4-12. Item Codes for the Self-Appraisal Scale

Self-Appraisal Statements	
ABA	The organization actively solicits information about problems from its members.
ABB	Organization members receive information on problems identified by other members.
ABC	The organization takes action to correct problems identified by its members.
ABD	The organization involves members in planning actions to correct problems.
ABE	The organization involves members in implementing actions to correct identified problems.

Table 4-13. Item Codes for the Vicarious Learning Scale

Vicarious Learning Statements	
ACA	We monitor the performance of comparable organizations.
ACB	We search for information about what our competitors are doing.
ACC	We attempt to identify processes used by others that could be adapted for use within our organization.
ACD	When organizations similar to ours experience failures, we analyze these failures to improve our organization.
ACE	We have adopted processes from other organizations.
ACF	The organization provides trade journals and publications for use by its members.
ACG	We are given time to read trade journals and publications.

Table 4-14. Item Codes for the Customer Opinion Scale

Customer Opinion Statements	
ADA	The organization has clearly identified who its customers are.
ADB	The organization continuously solicits feedback from its customers.
ADC	The organization uses customer feedback to improve its products/services.
ADD	The organization's goals are tied to customer satisfaction.
ADE	Individual/team goals in the organization are tied to customer satisfaction.
ADF	I can see how my job relates to customer satisfaction.
ADG	We proactively seek information from customers even when there doesn't appear to be a problem.
ADH	We ask our customers how we rate in comparison to similar organizations.
ADI	We ask customers how we can change our products/services to better meet their needs.
ADJ	We ask customers about creative uses for our products/services.
ADK	We include customers in new product/process design efforts.

Table 4-15. Item Codes for the Grafting Scale

Grafting Statements	
AEA	New organization members are skilled in areas that complement the organization's mission.
AEB	Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
AEC	We look outside the organization for needed expertise.
AED	Management brings in outside experts to help us solve problems.
AEE	We have used outside consultants to help us solve problems.

Table 4-16. Item Codes for the Performance Monitoring Scale

Performance Monitoring Statements	
AFA	The organization has established internal performance standards.
AFB	Performance standards are communicated to all organization members.
AFC	The organization continuously assesses its performance against internal standards.
AFD	The organization continuously assesses its performance against industry standards.
AFE	The organization's performance against the standards is communicated to all organization members.
AFF	We have identified those organizations or people who have a stake in our success.
AFG	We have identified those things about our performance that are important to external stakeholders.

Table 4-17. Item Codes for the Performance Stress Scale

Performance Stress Statements	
AGA R	Severe consequences exist if the organization or its members fail.
AGB	Significant rewards exist if the organization or its members succeed.
AGC	Organization members are under pressure to perform.
AGD R	Failure is never acceptable in our organization.
AGE	We are encouraged to learn from our mistakes.
AGF R	I believe that I have experienced a stress-related illness.
AGG R	Others in our organization have experienced stress-related illnesses.
AGH R	Stress-related illnesses are common in our organization.
AGI	Our organization sponsors stress reduction activities.

Table 4-18. Item Codes for the Communication Scale

Communication Statements	
DAA	Our organization disperses knowledge quickly.
DAB	Our organization disperses knowledge efficiently.
DAC	Written reports are used to disperse knowledge throughout the organization.
DAD	Oral reports are used to disperse knowledge throughout the organization.
DAE	Conversations “around the water cooler” are encouraged.
DAF	We use electronic media (E-mail, bulletin boards, etc.) to disperse knowledge.
DAG	Mentoring is encouraged in the organization.
DAH	Communication skills are taught within the organization.
DAI	Organization members socialize together at lunchtime and breaks.
DAJ	Organization members communicate with those in different functions, departments, and projects.
DAK	We hold meetings when it is necessary to “get the word out” quickly.
DAL	I feel that I get the information that I need to do my job when I need it.

Table 4-19. Item Codes for the Dialogue Scale

Dialogue Statements	
DBA	Organization members are willing to eliminate hidden agendas.
DBB	Organization members try to understand the motives and reasoning of others without passing judgment.
DBC	Organization members feel free to express their true opinions without fear of reprisal.
DBD	Organizations members feel that it is all right to disagree with the boss.
DBE	Negative feedback is valued as a positive contribution to the organization.
DBF	Honest opinions are valued more than noncontroversial opinions.
DBG	Organizational members can share ideas in an environment of openness and trust.
DBH	We regularly analyze the assumptions which underlie our decisions.

Table 4-20. Item Codes for the Lessons Learned Scale

Lessons Learned Statements	
DCA	We actively analyze successes within the organization.
DCB	We actively analyze failures within the organization.
DCC	Lessons learned from organizational success are accessible to members.
DCD	Lessons learned from organizational failures are accessible to members.
DCE	The organization values the contribution failures can make to its lessons learned.
DCF	Organization members apply lessons learned to new projects.
DCG	We have a system for keeping track of our successes and failures.

Table 4-21. Item Codes for the Personnel Rotation Scale

Personnel Rotation Statements	
DDA	The organization encourages members to master different functions.
DDB	The organization requires members to rotate to other functions to gain experience.
DDC	A total organization perspective is favored over a functional perspective.
DDD	Broad-based organizational experience is valued over strictly functional experience in the organization.
DDE	A regular rotation plan is part of each individuals career development plan.
DDF	We use cross-functional teams to help solve problems.

Table 4-22. Item Codes for the Information Access Scale

Information Access Statements	
DEA	Organization members have broad access to all organization information except personnel records.
DEB	Information is not restricted within the organization.
DEC	Information is easy to obtain within the organization.
DED R	Members are sometimes denied information that they need to know.
DEE R	The organization treats information as power.
DEF R	The organization withholds information for no clear reason.
DEG	Information is readily shared between organizational units.
DEH	Easy and assessable methods exist for all organization members to transfer information within the organization.

Table 4-23. Item Codes for the Mental Models Scale

Mental Models Statements	
IAA	Commonly held assumptions about the organization govern day to day decisions.
IAB	Underlying assumptions about the organization's environment can be constructively challenged.
IAC	Underlying assumptions that govern the organization's actions can be changed.
IAD	Underlying assumptions are changed when they are challenged and proven wrong.
IAE	When making decisions the organization analyses the assumptions underlying the alternative decisions.
IAF	We have commonly held beliefs about the way the organization should "behave."

Table 4-24. Item Codes for the Information Load Scale

Information Load Statements	
IBA R	The amount of information that must be reviewed to make decisions is overwhelming.
IBB R	I often have too much information when making decisions.
IBC R	Our problem isn't too little information, it is too much information.
IBD R	I am on too many teams to be effective.
IBE R	I regularly feel overwhelmed by all the things going on in our organization.
IBF R	I sometimes feel "bombarded" with information which confuses the issues.

Table 4-25. Item Codes for the Unlearning Scale

Unlearning Statements	
ICA R	The organization is very slow to accept new ideas.
ICB R	The organization is very slow to change old ways when better ways are identified.
ICC R	The organization has very strong opinions about the way things are done that cannot be easily changed.
ICD R	Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
ICE R	A lot of negative information must be received before we change the ways we do things.
ICF R	The organization tends to hold on to old ideas even when we know that they are wrong.

Table 4-26. Item Codes for the Scenarios Scale

Scenarios Statements	
IDA	The organization evaluates how changes in the environment may impact it's future.
IDB	The organization considers how specific sets of changes in the environment could change the way the organization operates.
IDC	The organization tries to anticipate environmental changes and react to them before being forced to change.
IDD	The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
IDE	We try to visualize the future in order to build contingency plans.
IDF	We encourage development of alternative views of where we are going.
IDG	We use alternative future possibilities to test the quality of our decisions.

Table 4-27. Item Codes for the Systematic Problem Solving Scale

Systematic Problem Solving Statements	
IEA	The organization uses the scientific method to diagnose problems.
IEB	The organization uses data to support decision making.
IEC	Statistical tools are used to organize data and draw inferences.
IED	We construct and test hypotheses when trying to solve a problem.
IEE	We use a step-by-step process for identifying, analyzing, and solving problems.

Table 4-28. Item Codes for the Discomfort Stress Scale

Discomfort Stress Statements	
IFA R	The environment members work in is too complex to understand.
IFB	Our future organizational environment looks stable.
IFC	The organization is confident that it can predict its future environment.
IFD R	The number of external organizations we must deal with seems to be increasing.
IFE R	The speed with which our working environment is changing seems to be increasing.

Table 4-29. Item Codes for the Systems Thinking Scale

Systems Thinking Statements	
IGA	The organization always looks for the long term solution rather than a quick fix.
IGB	The organization is careful to fix the problem not just the symptoms.
IGC	When solving problems the highest impact solution is sought out.
IGD	The organization considers the whole process rather than static “snap-shots” when I problem solving.
IGE	Organization members view the organization as a system.
IGF	When solving problems the total-organization and its interrelationships are considered.
IGG	When solving a problem we consider the impact of the solution on all parts of the organization.
IGH	We perform “deep” problem analysis to ensure effective problem solutions.
IGI	We believe that a change in one part of our organization affects all parts.

Table 4-30. Item Codes for the Membership Attrition Scale

Membership Attrition Statements	
MAA R	The organization experiences a high turnover of members.
MAB R	The organization experiences a high turnover of members in key positions.
MAC R	People are constantly joining and leaving our teams.
MAD R	Our turnover seems higher than other organizations’ turnover.
MAE R	The knowledge lost from members leaving the organization is greater than the knowledge gained from the fresh ideas of people entering the organization.
MAF	It is better to hire new people with fresh ideas than to retain experienced people with organizational knowledge.

Table 4-31. Item Codes for the Hard Information Storage Scale

Hard Information Storage Statements	
MBA	Standard operating procedures for the organization are written down.
MBB	Important processes in the organization are documented.
MBC	Standard operating procedures document how the procedures are actually accomplished.
MBD	Documentation is updated to reflect changes in the procedures and processes.
MBE	The organization maintains an archive of all documentation and records.
MBF R	Our rules and regulations constrain us more than they guide us.
MBG	Our rules and regulations help us make consistent decisions when we are faced with new situations.

Table 4-32. Item Codes for the Soft Information Storage Scale

Soft Information Storage Statements	
MCA	Many procedures are not written down, but everyone knows what they are.
MCB	The organization has standard ways of thinking about things that are not written down.
MCC	The organization has lots of unwritten rules.
MCD R	The way we say we do things and the way that things actually get done are completely different.
MCE	We would operate just as effectively without our written rules and regulations.

Table 4-33. Item Codes for the Computer Models Scale

Computer Models Statements	
MDA	The organization uses computer-based expert systems.
MDB	The organization uses computer models to capture organizational knowledge.
MDC	The organization uses computer models to test new strategies.
MDD	The knowledge of experts from within the organization is captured on computer.
MDE	The organizational expertise captured on computer is easily assessable to organization members.
MDF	Our computers are important to our decision processes.
MDG	We use computer models to see how our decisions will affect the organization.
MDH R	Our computers are used more for administrative tasks than problem-solving tasks.

Table 4-34. Item Codes for the Organizational Commitment to Learning Scale

Organizational Commitment to Learning Statements	
CAA	Continuous learning is a recognized way of life in the organization.
CAB	The organization's leaders are committed to organizational learning.
CAC	The organization's leaders work to provide a better environment for learning.
CAD	Creativity is encouraged in the organization.
CAE	The organization is concerned about me as an individual.
CAF	The organization is committed to my professional development.
CAG	The organization has helped me develop a plan for my professional growth.
CAH	My manager solicits my opinions, values, solutions, and ideas.

Table 4-35. Item Codes for the Personal Commitment to Learning Scale

Personal Commitment to Learning Statements	
CBA	I value my involvement with the organization.
CBB	I will go out of my way to make the organization a success.
CBC	I personally committed to learning and growing.
CBD	I care about the organization and what it is doing.
CBE	When the organization is successful I feel successful.
CBF	I take the initiative to learn about new technologies and processes associated with my job.
CBG	I try to know as much about the organization and it's processes as possible.

Table 4-36. Item Codes for the Personal Shared Vision Scale

Shared Vision Statements	
CCA	I know the organization's vision for the future.
CCB	I know and share the values of the organization.
CCC	I feel that my personal goals align with the goals of the organization.
CCD	Members of the organization know where they fit into the organization's overall vision.
CCE	Managers take positive action to transmit the organization's vision to all members.
CCF	I feel a personal commitment to helping the organization make it's vision a reality.

Table 4-37. Item Codes for the Organizational Rewards Scale

Organizational Rewards Statements	
CDA	The organizational reward system promotes my learning efforts.
CDB	Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
CDC	Promotions and compensation are tied to the intangible factors the organizations is trying to promote such as teamwork or quality improvement.
CDD	The organization rewards risk taking.
CDE	The organization rewards personal development.
CDF	When organizational groups discover better ways of doing business, the organization adequately recognizes their efforts.
CDG	The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.

Initial Scale Reliability Analysis. In this section the reliability for each scale will be measured. This was accomplished by using Cronbach's coefficient of reliability (α) analysis on the 27 scales. In order to boost the overall scale reliability, scale items with particularly low correlation or items that appeared to duplicate a concept, were eliminated to come up with a revised set of scales and items. In some cases entire scales were eliminated due to exceptionally poor correlation between items. The resulting revised scales provide the best measure of the theorized learning parameters to be used in factor analysis. The initial and revised Cronbach's coefficient of reliability (α) analysis is presented below by individual scale.

Two main criteria were used in deciding which items to exclude from the scales. First, items with the weakest correlation were eliminated to increase the overall reliability of the scales. Secondly, items that appeared to measure the same behavior were eliminated to reduce any unnecessary duplication. In a few cases items were eliminated due to a subjective assessment. These items may have had a high correlation with the other items in the scale but just did not seem to add value to the scale. In the following tables items that were eliminated from the scale are noted with an asterisk.

Experimentation Scale.

Table 4-38. Cronbach's Alpha Statistics for the Initial Experimentation Scale

Raw Scale Alpha = .9250		
Scale Items	Correlation with total	α if item deleted
AAA Testing new ideas/concepts is encouraged in this organization.*	0.8178	0.9120
AAB Testing new products/services is encouraged in this organization.	0.7747	0.9143
AAC We are encouraged to search for new knowledge in this organization.	0.7769	0.9140
AAD We are encouraged to test new knowledge in this organization.	0.8417	0.9103
AAE We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.	0.7953	0.9133
AAF There is a formal process for testing conducted by the organization.*	0.6433	0.9219
AAG We are encouraged to try new ways of doing things.	0.6714	0.9196
AAH We are trained to perform and evaluate the "experiments" we do.*	0.6822	0.9190
AAI We are trained to use statistical methods to evaluate data.*	0.5336	0.9286
AAJ We are trained to use "creativity" techniques to come up with new ideas/concepts/products/processes.*	0.6635	0.9201

The initial Experimentation Scale had an alpha of 0.9250 with ten items (see Table 4-38). Item AAA was eliminated due to duplication, Items AAF, AAH, AAI and AAJ due to low correlation. The revised Experimentation Scale alpha increased by 0.0002 to 0.9252 with five items remaining in the scale (see Table 4-39).

Table 4-39. Cronbach's Alpha Statistics for the Revised Experimentation Scale

Raw Scale Alpha = .9252		
Scale Items	Correlation with total	α if item deleted
AAB Testing new products/services is encouraged in this organization.	0.7862	0.9117
AAC We are encouraged to search for new knowledge in this organization.	0.8603	0.8969
AAD We are encouraged to test new knowledge in this organization.	0.8555	0.8979
AAE We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.	0.8089	0.9073
AAG We are encouraged to try new ways of doing things.	0.7129	0.9251

Self-Appraisal Scale.

Table 4-40. Cronbach's Alpha Statistics for the Initial Self-Appraisal Scale

Raw Scale Alpha = .8364		
Scale Items	Correlation with total	α if item deleted
ABA The organization actively solicits information about problems from its members.	0.6285	0.8066
ABB Organization members receive information on problems identified by other members.	0.5958	0.8153
ABC The organization takes action to correct problems identified by its members.	0.6477	0.8023
ABD The organization involves members in planning actions to correct problems.	0.6797	0.7915
ABE The organization involves members in implementing actions to correct identified problems.	0.6448	0.8014

The initial Self-Appraisal Scale had an alpha of 0.8364 with five items (see Table 4-40). No changes were made to this scale.

Vicarious Learning Scale.

Table 4-41. Cronbach's Alpha Statistics for the Initial Vicarious Learning Scale

Raw Scale Alpha = 0.8500		
Scale Items	Correlation with total	α if item deleted
ACA We monitor the performance of comparable organizations.	0.6650	0.8210
ACB We search for information about what our competitors are doing.	0.7017	0.8147
ACC We attempt to identify processes used by others that could be adapted for use within our organization.	0.6738	0.8214
ACD When organizations similar to ours experience failures, we analyze these failures to improve our organization.	0.6827	0.8180
ACE We have adopted processes from other organizations.*	0.6402	0.8266
ACF The organization provides trade journals and publications for use by its members.*	0.5126	0.8450
ACG We are given time to read trade journals and publications.*	0.4345	0.8554

The initial Vicarious Learning Scale had seven items (see Table 4-41). Items ACE, ACF and ACG were eliminated due to low correlation with the other items. The revised Learning Scale alpha improved by 0.0103 to 0.8603 with four remaining items (see Table 4-42).

Table 4-42. Cronbach's Alpha Statistics for the Revised Vicarious Learning Scale

Raw Scale Alpha = 0.8603		
Scale Items	Correlation with total	α if item deleted
ACA We monitor the performance of comparable organizations.	0.7321	0.8112
ACB We search for information about what our competitors are doing.	0.7424	0.8072
ACC We attempt to identify processes used by others that could be adapted for use within our organization.	0.6747	0.8362
ACD When organizations similar to ours experience failures, we analyze these failures to improve our organization.	0.6850	0.8311

Customer Opinion Scale.**Table 4-43.** Cronbach's Alpha Statistics for the Initial Customer Opinion Scale

Raw Scale Alpha = 0.9378		
Scale Items	Correlation with total	α if item deleted
ADA The organization has clearly identified who its customers are.*	0.6279	0.9365
ADB The organization continuously solicits feedback from its customers.	0.8242	0.9282
ADC The organization uses customer feedback to improve its products/services.	0.8645	0.9265
ADD The organization's goals are tied to customer satisfaction.	0.8482	0.9273
ADE Individual/team goals in the organization are tied to customer satisfaction.	0.7424	0.9317
ADF I can see how my job relates to customer satisfaction.*	0.6578	0.9351
ADG We proactively seek information from customers even when there doesn't appear to be a problem.	0.7725	0.9304
ADH We ask our customers how we rate in comparison to similar organizations.*	0.7166	0.9328
ADI We ask customers how we can change our products/services to better meet their needs.	0.7930	0.9297
ADJ We ask customers about creative uses for our products/services.*	0.6046	0.9372
ADK We include customers in new product/process design efforts.*	0.6368	0.9360

Items ADA, ADF, ADH, ADJ, ADK were dropped from the Customer Opinion Scale due to low correlation with the other items (see Table 4-43). After elimination of the five items, the Customer Opinion Scale alpha decreased slightly by 0.0046 to 0.9332 (see Table 4-44).

Table 4-44. Cronbach's Alpha Statistics for the Revised Customer Opinion Scale

Raw Scale Alpha = 0.9332		
Scale Items	Correlation with total	α if item deleted
ADB The organization continuously solicits feedback from its customers.	0.8372	0.9163
ADC The organization uses customer feedback to improve its products/services.	0.8629	0.9130
ADD The organization's goals are tied to customer satisfaction.	0.8362	0.9166
ADE Individual/team goals in the organization are tied to customer satisfaction.	0.7401	0.9289
ADG We proactively seek information from customers even when there doesn't appear to be a problem	0.7677	0.9254
ADI We ask customers how we can change our products/services to better meet their needs.	0.7764	0.9242

Grafting Scale.

Table 4-45. Cronbach's Alpha Statistics for the Initial Grafting Scale

Raw Scale Alpha = 0.7732		
Scale Items	Correlation with total	α if item deleted
AEA New organization members are skilled in areas that complement the organization's mission.	0.4843	0.7528
AEB Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.	0.4770	0.7579
AEC We look outside the organization for needed expertise.	0.5856	0.7194
AED Management brings in outside experts to help us solve problems.	0.6604	0.6899
AEE We have used outside consultants to help us solve problems.	0.5463	0.7331

The initial Grafting Scale had an alpha of 0.7732 with five items (see Table 4-45).

No changes were made to this scale.

Performance Monitoring Scale.

Table 4-46. Cronbach's Alpha Statistics for the Initial Performance Monitoring Scale

Raw Scale Alpha = 0.7732		
Scale Items	Correlation with total	α if item deleted
AFA The organization has established internal performance standards.	0.6295	0.8526
AFB Performance standards are communicated to all organization members.*	0.6864	0.8447
AFC The organization continuously assesses its performance against internal standards.	0.7712	0.8325
AFD The organization continuously assesses its performance against industry standards.	0.6204	0.8563
AFE The organization's performance against the standards is communicated to all organization members.	0.7242	0.8390
AFF We have identified those organizations or people who have a stake in our success.*	0.4998	0.8681
AFG We have identified those things about our performance that are important to external stakeholders.	0.5965	0.8572

Two items were dropped from the initial Performance Monitoring Scale. Item AFB was dropped based on a subjective assessment and item AFF due to a very low correlation to the other items (see Table 4-46). After eliminating the two items, the scale alpha increased by 0.0629 to 0.8361 with a total of five items remaining in the scale (see Table 4-47).

Table 4-47. Cronbach's Alpha Statistics for the Revised Performance Monitoring Scale

Raw Scale Alpha = 0.8361		
Scale Items	Correlation with total	α if item deleted
AFA The organization has established internal performance standards.	0.5754	0.8196
AFC The organization continuously assesses its performance against internal standards.	0.7497	0.7707
AFD The organization continuously assesses its performance against industry standards.	0.6321	0.8087
AFE The organization's performance against the standards is communicated to all organization members.	0.7218	0.7782
AFG We have identified those things about our performance that are important to external stakeholders.	0.5306	0.8307

Performance Stress Scale.

Table 4-48. Cronbach's Alpha Statistics for the Initial Performance Stress Scale

Raw Scale Alpha = 0.5215		
Scale Items	Correlation with total	α if item deleted
AGA Severe consequences exist if the organization or its members fail.	0.0376	0.5601
AGB Significant rewards exist if the organization or its members succeed.	0.3264	0.4584
AGC Organization members are under pressure to perform.	0.0053	0.5617
AGD Failure is never acceptable in our organization.	0.1894	0.5056
AGE We are encouraged to learn from our mistakes.	0.3891	0.4436
AGF I believe that I have experienced a stress-related illness.	0.4733	0.3759
AGG Others in our organization have experienced stress-related illnesses.		
AGH Stress-related illnesses are common in our organization.	0.4697	0.3994
AGI Our organization sponsors stress reduction activities.	0.1048	0.5408

The entire Performance Stress Scale was dropped from further analysis due to the extremely low correlation of scale items. The overall alpha of 0.5215 indicated that this scale was not reliable and no items could be eliminated to pull the scale alpha over 0.60 (see Table 4-48).

Communications Scale.

Table 4-49. Cronbach's Alpha Statistics for the Initial Communication Scale

Raw Scale Alpha = 0.8348		
Scale Items	Correlation with total	α if item deleted
DAA Our organization disperses knowledge quickly.	0.7041	0.8056
DAB Our organization disperses knowledge efficiently.	0.7223	0.8042
DAC Written reports are used to disperse knowledge throughout the organization.	0.5023	0.8218
DAD Oral reports are used to disperse knowledge throughout the organization.*	0.5388	0.8197
DAE Conversations "around the water cooler" are encouraged.*	0.3423	0.8329
DAF We use electronic media (E-mail, bulletin boards, etc.) to disperse knowledge.*	0.3359	0.8458
DAG Mentoring is encouraged in the organization.*	0.6496	0.8093
DAH Communication skills are taught within the organization.*	0.4671	0.8247
DAI Organization members socialize together at lunchtime and breaks.*	0.4500	0.8257
DAJ Organization members communicate with those in different functions, departments, and projects.	0.4597	0.8250
DAK We hold meetings when it is necessary to "get the word out" quickly.*	0.3919	0.8296
DAL I feel that I get the information that I need to do my job when I need it.	0.5147	0.8216

Seven items were eliminated from the Communications Scale. Items DAD and DAG were eliminated due to subjective assessment and items DAE, DAF, DAH, DAI and DAK due to low correlation to the other items (see Table 4-49). After elimination of all

seven items, the Communications Scale alpha decreased by 0.0423 to 0.7925 (see Table 4-50).

Table 4-50. Cronbach's Alpha Statistics for the Revised Communication Scale

Raw Scale Alpha = 0.7925		
Scale Items	Correlation with total	α if item deleted
DAA Our organization disperses knowledge quickly.	0.7429	0.6932
DAB Our organization disperses knowledge efficiently.	0.7741	0.6817
DAC Written reports are used to disperse knowledge throughout the organization.	0.4847	0.7832
DAJ Organization members communicate with those in different functions, departments, and projects.	0.3529	0.8169
DAL I feel that I get the information that I need to do my job when I need it.	0.5363	0.7649

Dialogue Scale.

Table 4-51. Cronbach's Alpha Statistics for the Initial Dialogue Scale

Raw Scale Alpha = 0.9120		
Scale Items	Correlation with total	α if item deleted
DBA Organization members are willing to eliminate hidden agendas.	0.6962	0.9020
DBB Organization members try to understand the motives and reasoning of others without passing judgment.	0.6237	0.9079
DBC Organization members feel free to express their true opinions without fear of reprisal.	0.7469	0.8977
DBD Organizations members feel that it is all right to disagree with the boss.	0.7390	0.8984
DBE Negative feedback is valued as a positive contribution to the organization.*	0.6985	0.9019
DBF Honest opinions are valued more than noncontroversial opinions.*	0.7577	0.8967
DBG Organizational members can share ideas in an environment of openness and trust.	0.8293	0.8905
DBH We regularly analyze the assumptions which underlie our decisions.*	0.6163	0.9086

Three items were eliminated from the Dialogue Scale. Item DBF due to subjective assessment and items DBE and DBH due to low correlation with the other items (see Table 4-51). After removal of the items, the Dialogue Scale alpha decreased by 0.0364 to 0.8756 (see Table 4-52).

Table 4-52. Cronbach's Alpha Statistics for the Revised Dialogue Scale

Raw Scale Alpha = 0.8756		
Scale Items	Correlation with total	α if item deleted
DBA Organization members are willing to eliminate hidden agendas.	0.7258	0.8445
DBB Organization members try to understand the motives and reasoning of others without passing judgment.	0.6345	0.8654
DBC Organization members feel free to express their true opinions without fear of reprisal.	0.7592	0.8357
DBD Organizations members feel that it is all right to disagree with the boss.	0.6454	0.8632
DBG Organizational members can share ideas in an environment of openness and trust.	0.7645	0.8347

Lessons Learned Scale.

Table 4-53. Cronbach's Alpha Statistics for the Initial Lessons Learned Scale

Raw Scale Alpha = 0.9087		
Scale Items	Correlation with total	α if item deleted
DCA We actively analyze successes within the organization.*	0.6685	0.9010
DCB We actively analyze failures within the organization.	0.7178	0.8959
DCC Lessons learned from organizational success are accessible to members.	0.7444	0.8930
DCD Lessons learned from organizational failures are accessible to members.	0.7820	0.8890
DCE The organization values the contribution failures can make to its lessons learned.	0.7221	0.8955
DCF Organization members apply lessons learned to new projects.*	0.7247	0.8957
DCG We have a system for keeping track of our successes and failures.	0.7326	0.8953

The initial Lessons Learned Scale had a alpha of 0.9087 with seven items (see Table 4-53). Item DCA was eliminated due to a low correlation with the other items and DCF due to duplication. After removing the two items, the Lessons Learned Scale alpha decreased by 0.0230 to 0.8857 with five items remaining (see Table 4-54).

Table 4-54. Cronbach's Alpha Statistics for the Revised Lessons Learned Scale

Raw Scale Alpha = 0.8857		
Scale Items	Correlation with total	α if item deleted
DCB We actively analyze failures within the organization.	0.7038	0.8656
DCC Lessons learned from organizational success are accessible to members.	0.7311	0.8595
DCD Lessons learned from organizational failures are accessible to members.	0.8149	0.8409
DCE The organization values the contribution failures can make to its lessons learned.	0.6741	0.8725
DCG We have a system for keeping track of our successes and failures.	0.7087	0.8664

Personnel Rotation Scale.

Table 4-55. Cronbach's Alpha Statistics for the Initial Personnel Rotation Scale

Raw Scale Alpha = 0.8110		
Scale Items	Correlation with total	α if item deleted
DDA The organization encourages members to master different functions.	0.5350	0.7894
DDB The organization requires members to rotate to other functions to gain experience.	0.6154	0.7712
DDC A total organization perspective is favored over a functional perspective.	0.6700	0.7607
DDD Broad-based organizational experience is valued over strictly functional experience in the organization.	0.6126	0.7736
DDE A regular rotation plan is part of each individuals career development plan.*	0.6012	0.7752
DDF We use cross-functional teams to help solve problems.*	0.4221	0.8151

Two items were eliminated from the Personnel Rotation Scale. Item DDE was dropped due to duplication and Item DDF due to a very low correlation with the other items in the scale (see Table 4-55). After removing the two items, the Personnel Rotation Scale alpha decreased by 0.0316 to 0.7794 with a total of four remaining items (see Table 4-56).

Table 4-56. Cronbach's Alpha Statistics for the Revised Personnel Rotation Scale

Raw Scale Alpha = 0.7794		
Scale Items	Correlation with total	α if item deleted
DDA The organization encourages members to master different functions.	0.4964	0.7680
DDB The organization requires members to rotate to other functions to gain experience.	0.5542	0.7465
DDC A total organization perspective is favored over a functional perspective.	0.6635	0.6845
DDD Broad-based organizational experience is valued over strictly functional experience in the organization.	0.6361	0.7003

Information Access Scale.

Table 4-57. Cronbach's Alpha Statistics for the Initial Information Access Scale

Raw Scale Alpha = 0.8888		
Scale Items	Correlation with total	α if item deleted
DEA Organization members have broad access to all organization information except personnel records.	0.6856	0.8725
DEB Information is not restricted within the organization.	0.7163	0.8694
DEC Information is easy to obtain within the organization.	0.8391	0.8566
DED Members are sometimes denied information that they need to know.	0.6922	0.8719
DEE The organization treats information as power.*	0.4632	0.8930
DEF The organization withholds information for no clear reason.*	0.6496	0.8761
DEG Information is readily shared between organizational units.	0.7109	0.8706
DEH Easy and assessable methods exist for all organization members to transfer information within the organization.*	0.5458	0.8862

Three items were removed from the Information Access Scale. Items DEE, DEF, and DEH were eliminated due to low correlation with the other items (see Table 4-57).

The revised Information Access Scale alpha decreased by 0.0002 to 0.8886 with five remaining items (see Table 4-58).

Table 4-58. Cronbach's Alpha Statistics for the Revised Information Access Scale

Raw Scale Alpha = 0.8886		
Scale Items	Correlation with total	α if item deleted
DEA Organization members have broad access to all organization information except personnel records.	0.7265	0.8654
DEB Information is not restricted within the organization.	0.7726	0.8543
DEC Information is easy to obtain within the organization.	0.8427	0.8376
DED Members are sometimes denied information that they need to know.	0.6474	0.8828
DEG Information is readily shared between organizational units.	0.6633	0.8789

Mental Models Scale.

Table 4-59. Cronbach's Alpha Statistics for the Initial Mental Models Scale

Raw Scale Alpha = 0.7654		
Scale Items	Correlation with total	α if item deleted
IAA Commonly held assumptions about the organization govern day to day decisions.*	-0.0709	0.8543
IAB Underlying assumptions about the organization's environment can be constructively challenged.	0.6362	0.6982
IAC Underlying assumptions that govern the organization's actions can be changed.	0.7797	0.6583
IAD Underlying assumptions are changed when they are challenged and proven wrong.*	0.7431	0.6580
IAE When making decisions the organization analyses the assumptions underlying the alternative decisions.	0.6285	0.6968
IAF We have commonly held beliefs about the way the organization should "behave."	0.4245	0.7512

The initial Mental Models Scale had an alpha of 0.7654 with six items. Item IAA was eliminated due to an extremely low correlation with the other items and Item IAD was eliminated due to duplication (see Table 4-59). After removal of these two items, the

Mental Models Scale alpha increased by 0.0296 to 0.7950 with four items remaining (see Table 4-60).

Table 4-60. Cronbach's Alpha Statistics for the Revised Mental Models Scale

Raw Scale Alpha = 0.7950		
Scale Items	Correlation with total	α if item deleted
IAB Underlying assumptions about the organization's environment can be constructively challenged.	0.7079	0.6929
IAC Underlying assumptions that govern the organization's actions can be changed.	0.7779	0.6551
IAE When making decisions the organization analyses the assumptions underlying the alternative decisions.	0.6230	0.7368
IAF We have commonly held beliefs about the way the organization should "behave."	0.3491	0.8551

Information Load Scale.

Table 4-61. Cronbach's Alpha Statistics for the Initial Information Load Scale

Raw Scale Alpha = 0.7895		
Scale Items	Correlation with total	α if item deleted
IBA The amount of information that must be reviewed to make decisions is overwhelming.	0.5097	0.7648
IBB I often have too much information when making decisions.*	0.4738	0.7725
IBC Our problem isn't too little information, it is too much information.	0.5350	0.7592
IBD I am on too many teams to be effective.	0.5410	0.7577
IBE I regularly feel overwhelmed by all the things going on in our organization.	0.5388	0.7593
IBF I sometimes feel "bombarded" with information which confuses the issues.	0.6523	0.7286

Item IBB was eliminated from the Information Load Scale due to a low correlation with the other scale items (see Table 4-61). The Information Load Scale alpha decreased by 0.0170 to 0.7725 for the revised scale with five items remaining (see Table 4-62).

Table 4-62. Cronbach's Alpha Statistics for the Revised Information Load Scale

Raw Scale Alpha = 0.7725		
Scale Items	Correlation with total	α if item deleted
IBA The amount of information that must be reviewed to make decisions is overwhelming.	0.4247	0.7677
IBC Our problem isn't too little information, it is too much information.	0.4675	0.7552
IBD I am on too many teams to be effective.	0.5948	0.7126
IBE I regularly feel overwhelmed by all the things going on in our organization.	0.5809	0.7182
IBF I sometimes feel "bombarded" with information which confuses the issues.	0.6579	0.6892

Unlearning Scale.

Table 4-63. Cronbach's Alpha Statistics for the Initial Unlearning Scale

Raw Scale Alpha = 0.9132		
Scale Items	Correlation with total	α if item deleted
ICA The organization is very slow to accept new ideas.	0.7108	0.9041
ICB The organization is very slow to change old ways when better ways are identified.*	0.7524	0.8982
ICC The organization has very strong opinions about the way things are done that cannot be easily changed.	0.7939	0.8923
ICD Many of the organizations processes never change because of an attitude that embraces the old way of doing things.	0.7762	0.8947
ICE A lot of negative information must be received before we change the ways we do things.	0.7821	0.8944
ICF The organization tends to hold on to old ideas even when we know that they are wrong.	0.7286	0.9017

The initial Unlearning Scale had a alpha of 0.9132 with six items (see Table 4-63). Item ICB was dropped due to duplication. The revised Unlearning Scale has an alpha of 0.8982, a 0.0150 decrease from the original scales alpha, with five items (see Table 4-64).

Table 4-64. Cronbach's Alpha Statistics for the Revised Unlearning Scale

Raw Scale Alpha = 0.8982		
Scale Items	Correlation with total	α if item deleted
ICA The organization is very slow to accept new ideas.	0.6571	0.8960
ICC The organization has very strong opinions about the way things are done that cannot be easily changed.	0.7876	0.8672
ICD Many of the organizations processes never change because of an attitude that embraces the old way of doing things.	0.7935	0.8657
ICE A lot of negative information must be received before we change the ways we do things.	0.7959	0.8662
ICF The organization tends to hold on to old ideas even when we know that they are wrong.	0.7157	0.8835

Scenarios Scale.**Table 4-65. Cronbach's Alpha Statistics for the Initial Scenarios Scale**

Raw Scale Alpha = 0.9030		
Scale Items	Correlation with total	α if item deleted
IDA The organization evaluates how changes in the environment may impact it's future.	0.6314	0.8981
IDB The organization considers how specific sets of changes in the environment could change the way the organization operates.	0.7477	0.8851
IDC The organization tries to anticipate environmental changes and react to them before being forced to change.	0.7561	0.8837
IDD The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.	0.7988	0.8788
IDE We try to visualize the future in order to build contingency plans.	0.7457	0.8849
IDF We encourage development of alternative views of where we are going.	0.7040	0.8896
IDG We use alternative future possibilities to test the quality of our decisions.	0.6145	0.8992

Two items were eliminated from the initial Scenarios Scale. Item IDA because of duplication and Item IDG because of a low correlation with the other items (see Table 4-65). After elimination of the two items, the Scenarios Scale alpha dropped 0.0104 to 0.8926 with five items remaining (see Table 4-66).

Table 4-66. Cronbach's Alpha Statistics for the Revised Scenarios Scale

Raw Scale Alpha = 0.8926		
Scale Items	Correlation with total	α if item deleted
IDB The organization considers how specific sets of changes in the environment could change the way the organization operates.	0.7347	0.8702
IDC The organization tries to anticipate environmental changes and react to them before being forced to change.	0.7671	0.8624
IDD The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.	0.8002	0.8549
IDE We try to visualize the future in order to build contingency plans.	0.7222	0.8738
IDF We encourage development of alternative views of where we are going.	0.6686	0.8840

Systematic Problem Solving Scale.

Table 4-67. Cronbach's Alpha Statistics for the Initial Systematic Problem Solving Scale

Raw Scale Alpha = 0.8614		
Scale Items	Correlation with total	α if item deleted
IEA The organization uses the scientific method to diagnose problems.	0.6833	0.8317
IEB The organization uses data to support decision making.	0.5984	0.8521
IEC Statistical tools are used to organize data and draw inferences.	0.6789	0.8331
IED We construct and test hypotheses when trying to solve a problem.	0.7326	0.8192
IEE We use a step-by-step process for identifying, analyzing, and solving problems.	0.7084	0.8249

Two items were eliminated from the initial Systematic Problem Solving Scale. Item IEA because of a low correlation with the other items and qualitative considerations and Item IEB because of a low correlation with the other items (see Table 4-67). After elimination of the two items, the Systematic Problem Solving Scale alpha dropped 0.0336 to 0.8278 with three items remaining (see Table 4-68).

Table 4-68. Cronbach's Alpha Statistics for the Revised Systematic Problem Solving Scale

Raw Scale Alpha = 0.8278		
Scale Items	Correlation with total	α if item deleted
IEC Statistical tools are used to organize data and draw inferences.	0.6861	0.7628
IED We construct and test hypotheses when trying to solve a problem.	0.7062	0.7437
IEE We use a step-by-step process for identifying, analyzing, and solving problems.	0.6666	0.7805

Discomfort Stress.

Table 4-69. Cronbach's Alpha Statistics for the Initial Discomfort Stress Scale

Raw Scale Alpha = 0.3890		
Scale Items	Correlation with total	α if item deleted
IFA The environment members work in is too complex to understand.	0.2046	0.3329
IFB Our future organizational environment looks stable.	0.2803	0.2639
IFC The organization is confident that it can predict its future environment.	0.2240	0.3131
IFD The number of external organizations we must deal with seems to be increasing.	0.1207	0.4008
IFE The speed with which our working environment is changing seems to be increasing.	0.1574	0.3651

The Discomfort Stress Scale was eliminated from further analysis due to the low correlation between items. This indicates that the scale is not reliable with a alpha value of 0.3890 (see Table 4-69).

Systems Thinking Scale.

Table 4-70. Cronbach's Alpha Statistics for the Initial Systems Thinking Scale

Raw Scale Alpha = 0.9098		
Scale Items	Correlation with total	α if item deleted
IGA The organization always looks for the long term solution rather than a quick fix.*	0.6133	0.9051
IGB The organization is careful to fix the problem not just the symptoms.	0.7405	0.8959
IGC When solving problems the highest impact solution is sought out.*	0.6284	0.9038
IGD The organization considers the whole process rather than static "snap-shots" when I problem solving.	0.7088	0.8983
IGE Organization members view the organization as a system.*	0.6342	0.9035
IGF When solving problems the total-organization and its interrelationships are considered.	0.7170	0.8981
IGG When solving a problem we consider the impact of the solution on all parts of the organization.	0.7527	0.8951
IGH We perform "deep" problem analysis to ensure effective problem solutions.	0.7166	0.8977
IGI We believe that a change in one part of our organization affects all parts.	0.6995	0.8990

Three items were dropped from the initial Systems Thinking Scale due to low correlation with the other items. The items eliminated were IGA, IGC, and IGE (see Table 4-70). The revised Systems Thinking Scale had a alpha of 0.8909, a 0.0189 decrease from the original scale, with six remaining items (see Table 4-71).

Table 4-71. Cronbach's Alpha Statistics for the Revised Systems Thinking Scale

Raw Scale Alpha = 0.8909		
Scale Items	Correlation with total	α if item deleted
IGB The organization is careful to fix the problem not just the symptoms.	0.6825	0.8768
IGD The organization considers the whole process rather than static "snap-shots" when I problem solving.	0.6623	0.8794
IGF When solving problems the total-organization and its interrelationships are considered.	0.7094	0.8726
IGG When solving a problem we consider the impact of the solution on all parts of the organization.	0.7818	0.8603
IGH We perform "deep" problem analysis to ensure effective problem solutions.	0.7120	0.8715
IGI We believe that a change in one part of our organization affects all parts.	0.7168	0.8707

Membership Attrition Scale.

Table 4-72. Cronbach's Alpha Statistics for the Initial Membership Attrition Scale

Raw Scale Alpha = 0.7848		
Scale Items	Correlation with total	α if item deleted
MAA The organization experiences a high turnover of members.	0.7633	0.6880
MAB The organization experiences a high turnover of members in key positions.	0.7403	0.6955
MAC People are constantly joining and leaving our teams.	0.7782	0.6845
MAD Our turnover seems higher than other organizations' turnover.	0.6531	0.7236
MAE The knowledge lost from members leaving the organization is greater than the knowledge gained from the fresh ideas of people entering the organization.*	0.1838	0.8280
MAF It is better to hire new people with fresh ideas than to retain experienced people with organizational knowledge.*	0.1115	0.8301

The initial Membership Attrition Scale had an alpha value of 0.7848 with six items (see Table 4-72). Items MAE and MAF were eliminated due to low correlation with the other variables. The alpha value for the revised Membership Attrition Scale was 0.9050, a 0.1202 increase from the original scale, with a total of four items remaining (see Table 4-73).

Table 4-73. Cronbach's Alpha Statistics for the Revised Membership Attrition Scale

Raw Scale Alpha = 0.9050		
Scale Items	Correlation with total	α if item deleted
MAA The organization experiences a high turnover of members.	0.8457	0.8551
MAB The organization experiences a high turnover of members in key positions.	0.7711	0.8829
MAC People are constantly joining and leaving our teams.	0.8234	0.8635
MAD Our turnover seems higher than other organizations' turnover.	0.7102	0.9033

Hard Information Storage Scale.

Table 4-74. Cronbach's Alpha Statistics for the Initial Hard Information Storage Scale

Raw Scale Alpha = 0.8211		
Scale Items	Correlation with total	α if item deleted
MBA Standard operating procedures for the organization are written down.	0.6771	0.7765
MBB Important processes in the organization are documented.	0.6891	0.7755
MBC Standard operating procedures document how the procedures are actually accomplished.	0.7496	0.7636
MBD Documentation is updated to reflect changes in the procedures and processes.	0.7828	0.7571
MBE The organization maintains an archive of all documentation and records.*	0.4994	0.8092
MBF Our rules and regulations constrain us more than they guide us.*	0.0711	0.8628
MBG Our rules and regulations help us make consistent decisions when we are faced with new situations.*	0.4818	0.8099

The initial alpha value for the Hard Information Storage Scale was 0.8211 with seven variables in the scale (see Table 4-74). Items MBE, MBF, and MBG were eliminated due to low correlation with the other scale items. The revised Hard Information Storage Scale alpha value increased by 0.0637 to 0.8848 after removing the three items (see Table 4-75).

Table 4-75. Cronbach's Alpha Statistics for the Revised Hard Information Storage Scale

Raw Scale Alpha = 0.8848		
Scale Items	Correlation with total	α if item deleted
MBA Standard operating procedures for the organization are written down.	0.7200	0.8633
MBB Important processes in the organization are documented.	0.7671	0.8454
MBC Standard operating procedures document how the procedures are actually accomplished.	0.7672	0.8449
MBD Documentation is updated to reflect changes in the procedures and processes.	0.7420	0.8546

Soft Information Storage Scale.

Table 4-76. Cronbach's Alpha Statistics for the Initial Soft Information Storage Scale

Raw Scale Alpha = 0.3616		
Scale Items	Correlation with total	α if item deleted
MCA Many procedures are not written down, but everyone knows what they are.	0.5585	-0.0802
MCB The organization has standard ways of thinking about things that are not written down.	0.5224	0.0585
MCC The organization has lots of unwritten rules.	0.5467	-0.0956
MCD The way we say we do things and the way that things actually get done are completely different.*	-0.5549	0.7681
MCE We would operate just as effectively without our written rules and regulations.*	0.2510	0.2514

The initial Soft Information Scale had a very low alpha value of 0.3616 with five items in the scale. Two Items, MCD and MCE, were dropped due to low correlation with the other variables in the scale (see Table 4-76). The Soft Information Scale increases significantly by 0.4585 to 0.8201 after removing the two items with low correlation (see Table 4-77).

Table 4-77. Cronbach's Alpha Statistics for the Revised Soft Information Storage Scale

Raw Scale Alpha = 0.8201		
Scale Items	Correlation with total	α if item deleted
MCA Many procedures are not written down, but everyone knows what they are.	0.7333	0.6894
MCB The organization has standard ways of thinking about things that are not written down.	0.6145	0.8197
MCC The organization has lots of unwritten rules.	0.7085	0.7229

Computer Models Scale.

Table 4-78. Cronbach's Alpha Statistics for the Initial Computer Models Scale

Raw Scale Alpha = 0.8830		
Scale Items	Correlation with total	α if item deleted
MDA The organization uses computer-based expert systems.*	0.6477	0.8700
MDB The organization uses computer models to capture organizational knowledge.	0.7766	0.8551
MDC The organization uses computer models to test new strategies.	0.8076	0.8527
MDD The knowledge of experts from within the organization is captured on computer.	0.7540	0.8576
MDE The organizational expertise captured on computer is easily assessable to organization members.	0.7184	0.8612
MDF Our computers are important to our decision processes.*	0.6307	0.8711
MDG We use computer models to see how our decisions will affect the organization.	0.7240	0.8624
MDH Our computers are used more for administrative tasks than problem-solving tasks.*	0.1454	0.9074

Three Items, MDA, MDF and MDH were eliminated from the initial Computer Models Scale (see Table 4-78). The items were removed due to low correlation with the

other items in the scale. The resulting five item scale had a alpha of 0.8976 representing a 0.0146 increase over the initial Computer Models Scale (see Table 4-79).

Table 4-79. Cronbach's Alpha Statistics for the Revised Computer Models Scale

Raw Scale Alpha = 0.8976		
Scale Items	Correlation with total	α if item deleted
MDB The organization uses computer models to capture organizational knowledge.	0.7545	0.8735
MDC The organization uses computer models to test new strategies.	0.8003	0.8634
MDD The knowledge of experts from within the organization is captured on computer.	0.7590	0.8724
MDE The organizational expertise captured on computer is easily assessable to organization members.	0.7293	0.8796
MDG We use computer models to see how our decisions will affect the organization.	0.6981	0.8859

Organizational Commitment to Learning Scale.

Table 4-80. Cronbach's Alpha Statistics for the Initial Organizational Commitment to Learning Scale

Raw Scale Alpha = 0.8995		
Scale Items	Correlation with total	α if item deleted
CAA Continuous learning is a recognized way of life in the organization.*	0.5409	0.8993
CAB The organization's leaders are committed to organizational learning.	0.7292	0.8832
CAC The organization's leaders work to provide a better environment for learning.	0.7930	0.8778
CAD Creativity is encouraged in the organization.*	0.6508	0.8898
CAE The organization is concerned about me as an individual.*	0.7795	0.8778
CAF The organization is committed to my professional development.	0.7977	0.8759
CAG The organization has helped me develop a plan for my professional growth.	0.6575	0.8902
CAH My manager solicits my opinions, values, solutions, and ideas.*	0.5635	0.8984

The alpha value for the original eight items in the Organizational Commitment to Learning Scale was 0.8995 (see Table 4-80). Four items were eliminated from the scale. Items CAA, CAD, and CAH were dropped because of low correlation with the other items. Item CAE was eliminated due to subjective assessment. The revised Organizational Commitment to Learning Scale had an alpha of 0.8572, a 0.0423 decrease from the initial scale, with four items remaining in the scale (see Table 4-81).

Table 4-81. Cronbach's Alpha Statistics for the Revised Organizational Commitment to Learning Scale

Raw Scale Alpha = 0.8572		
Scale Items	Correlation with total	α if item deleted
CAB The organization's leaders are committed to organizational learning.	0.6887	0.8244
CAC The organization's leaders work to provide a better environment for learning.	0.7460	0.8028
CAF The organization is committed to my professional development.	0.7539	0.7952
CAG The organization has helped me develop a plan for my professional growth.	0.6394	0.8508

Personal Commitment to Learning Scale.

Table 4-82. Cronbach's Alpha Statistics for the Initial Personal Commitment to Learning Scale

Raw Scale Alpha = 0.9063		
Scale Items	Correlation with total	α if item deleted
CBA I value my involvement with the organization.	0.7344	0.8940
CBB I will go out of my way to make the organization a success.	0.7328	0.8909
CBC I personally committed to learning and growing.	0.7004	0.8972
CBD I care about the organization and what it is doing.	0.8529	0.8768
CBE When the organization is successful I feel successful.	0.7784	0.8859
CBF I take the initiative to learn about new technologies and processes associated with my job.	0.6299	0.9018
CBG I try to know as much about the organization and it's processes as possible.	0.6777	0.8973

The initial Personal Commitment to Learning Scale had seven items with an alpha of 0.9063 (see Table 4-82). This scale was broken into two separate scales, a revised

Personal Commitment to Learning Scale and a new scale called Personal Commitment to the Organization. The revised Personal Commitment to Learning Scale contains three items: CBC, CBF, and CBG. The alpha for this scale is 0.8290 a 0.0773 decrease from the initial scale alpha (see Table 4-83). The new scale, Personal Commitment to the Organization, contains the remaining four variables from the original scale: CAB, CAC, CAF, and CAG. The alpha for the new scale is 0.9014, a 0.0049 decrease from the original scale (see Table 4-84).

Table 4-83. Cronbach's Alpha Statistics for the Revised Personal Commitment to Learning Scale

Raw Scale Alpha = 0.8290		
Scale Items	Correlation with total	α if item deleted
CBC I personally committed to learning and growing.	0.6894	0.7674
CBF I take the initiative to learn about new technologies and processes associated with my job.	0.6891	0.7622
CBG I try to know as much about the organization and it's processes as possible.	0.6917	0.7608

Table 4-84. Cronbach's Alpha Statistics for the Personal Commitment to the Organization Scale

Raw Scale Alpha = 0.9014		
Scale Items	Correlation with total	α if item deleted
CBA I value my involvement with the organization.	0.7874	0.8732
CBB I will go out of my way to make the organization a success.	0.7575	0.8811
CBD I care about the organization and what it is doing.	0.8016	0.8663
CBE When the organization is successful I feel successful.	0.7865	0.8700

Shared Vision Scale.

Table 4-85. Cronbach's Alpha Statistics for the Initial Shared Vision Scale

Raw Scale Alpha = 0.8978		
Scale Items	Correlation with total	α if item deleted
CCA I know the organization's vision for the future.*	0.6886	0.8864
CCB I know and share the values of the organization.	0.7771	0.8726
CCC I feel that my personal goals align with the goals of the organization.	0.7431	0.8771
CCD Members of the organization know where they fit into the organization's overall vision.	0.7063	0.8824
CCE Managers take positive action to transmit the organization's vision to all members.	0.7142	0.8813
CCF I feel a personal commitment to helping the organization make it's vision a reality.	0.7251	0.8795

The initial Shared Vision Scale had an alpha of 0.8978 with six items (see Table 4-85). Item CCA was deleted due to a low correlation with the other items. The revised Shared Vision Scale with five items has an alpha value of 0.8864, a 0.0114 decrease from the initial alpha value (see Table 4-86).

Table 4-86 Cronbach's Alpha Statistics for the Revised Vision Scale

Raw Scale Alpha = 0.8864		
Scale Items	Correlation with total	α if item deleted
CCB I know and share the values of the organization.	0.7603	0.8545
CCC I feel that my personal goals align with the goals of the organization.	0.7250	0.8619
CCD Members of the organization know where they fit into the organization's overall vision.	0.7099	0.8654
CCE Managers take positive action to transmit the organization's vision to all members.	0.7172	0.8641
CCF I feel a personal commitment to helping the organization make it's vision a reality.	0.7172	0.8636

Organizational Rewards Scale.

Table 4-87. Cronbach's Alpha Statistics for the Initial Organizational Rewards Scale

Raw Scale Alpha = 0.9086		
Scale Items	Correlation with total	α if item deleted
CDA The organizational reward system promotes my learning efforts	0.7647	0.8905
CDB Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.	0.7769	0.8891
CDC Promotions and compensation are tied to the intangible factors the organizations is trying to promote such as teamwork or quality improvement.*	0.6368	0.9046
CDD The organization rewards risk taking.	0.6813	0.8998
CDE The organization rewards personal development.	0.7983	0.8875
CDF When organizational groups discover better ways of doing business, the organization adequately recognizes their efforts.*	0.6886	0.8990
CDG The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.	0.7390	0.8934

The initial Organizational Rewards Scale has seven items and an alpha value of 0.9086 (see Table 4-87). Two items, CDC and CDF, were removed because they were too similar to other items in the scale. The revised Organizational Rewards Scale has an alpha value of 0.8902, a 0.0184 decrease from the original scale, with five items remaining (see Table 4-88).

Table 4-88. Cronbach's Alpha Statistics for the Revised Organizational Rewards Scale

Raw Scale Alpha = 0.8902		
Scale Items	Correlation with total	α if item deleted
CDA The organizational reward system promotes my learning efforts	0.7481	0.8628
CDB Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.	0.7483	0.8627
CDD The organization rewards risk taking.	0.6599	0.8827
CDE The organization rewards personal development.	0.7971	0.8533
CDG The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.	0.7167	0.8702

Revised Scales. The original scales were modified to reflect the revised scales created as a result of the Cronbach's Alpha analysis. Two of the original scales were dropped from further analysis while another scale was broken into two separate revised scales. The net result is one less scale for a new total of 26 scales. The number of total items was also decreased by 74 from 193 to 119 items (see Table 4-89). The Cronbach's Alpha values for the initial scales ranged from 0.9378 to 0.3613. Cronbach's Alpha for the 26 revised scales ranged from 0.9332 to 0.7725. Appendix C, Revised Scales, contains a listing of all the revised scales and assigned item codes to be used in the confirmatory factor analysis. Appendix D, Revised Questionnaire, contains a sample questionnaire using the scales and items revised as a result of the Cronbach's Alpha analysis.

Table 4-89. Summary of Cronbach's Alpha Statistics for Initial and Revised Scales

Scale Name	Initial Scale			Revised Scale		
	Scale #	# Items	α	Scale #	# Items	α
Experimentation	1	10	0.9250	1	5	0.9252
Self-Appraisal	2	5	0.8364	2	5	0.8364
Vicarious Learning	3	7	0.8500	3	4	0.8603
Customer Opinion	4	11	0.9378	4	6	0.9332
Grafting	5	5	0.7732	5	5	0.7732
Performance Monitoring	6	7	0.7732	6	5	0.8361
Performance Stress	7	9	0.5215		0	Drop
Communications	8	12	0.8348	7	5	0.7925
Dialogue	9	8	0.9120	8	5	0.8756
Lessons Learned	10	7	0.9087	9	5	0.8857
Personnel Rotation	11	6	0.8110	10	4	0.7794
Information Access	12	8	0.8888	11	5	0.8886
Mental Models	13	6	0.7654	12	4	0.7950
Information Load	14	6	0.7895	13	5	0.7725
Unlearning	15	6	0.9134	14	5	0.8982
Scenarios	16	7	0.9030	15	5	0.8926
Systematic Problem Solving	17	5	0.8614	16	3	0.8278
Discomfort Stress	18	5	0.3890		0	Drop
Systems Thinking	19	9	0.9098	17	6	0.8909
Membership Attrition	20	6	0.7848	18	4	0.9050
Hard Information Storage	21	7	0.8211	19	4	0.8848
Soft Information Storage	22	5	0.3616	20	3	0.8201
Computer Models	23	8	0.8830	21	5	0.8976
Organ. Commitment to Lrng.	24	8	0.8995	22	4	0.8572
Personal Commitment to Lrng.	25	7	0.9063	23	3	0.8290
Pers. Commitment to the Org.		0	Added	24	4	0.9014
Shared Vision	26	6	0.8978	25	5	0.8864
Organizational Rewards	27	7	0.9086	26	5	0.8902
Totals		193			119	

Confirmatory Factor Analysis. Confirmatory factor analysis was performed using the 119 items identified as reliable after the Cronbach's Alpha analysis. The factor analysis identified 25 factors with eigenvalues greater than one. Three of the factors were eliminated from the analysis because only one item loaded significantly on these factors. In the initial steps of the analysis, the factor that each item loaded most significantly on was identified. The next step was to list the items that loaded most heavily on a particular factor together and drop the insignificant items.

Tables 4-90 through 4-133 summarize the 22 significant factors identified by factor analysis. The factors have been sorted to fit under the five general scale categories identified earlier.

Category A. Knowledge Acquisition. Factor 1 is made up of all five of the Customer Opinion scale items and three of the five Self-Appraisal scale items. This confirms the Customer Opinion scale and that all the items are correctly grouped under the same general category of Knowledge Acquisition. See Table 4-90.

Table 4-90. Factor Loadings on Factor 1

Factor 1 - ZAD		
Factor Eigenvalue = 7.79		
Name	Load	Item
ADE	.783	Individual/team goals in the organization are tied to customer satisfaction.
ADD	.755	The organization's goals are tied to customer satisfaction.
ADB	.749	The organization continuously solicits feedback from its customers.
ADC	.726	The organization uses customer feedback to improve its products/services.
ADG	.709	We proactively seek information from customers even when there doesn't appear to be a problem.
ADI	.655	We ask customers how we can change our products/services to better meet their needs.
ABA	.652	The organization actively solicits information about problems from its members.
ABB	.456	Organization members receive information on problems identified by other members.
ABE	.434	The organization involves members in implementing actions to correct identified problems.

The Cronbach's Alpha for Factor 1 is 0.9326 indicating a strong correlation between the scale items. See Table 4-91.

Table 4-91. Cronbach's Alpha Statistics for the Factor 1 (ZAD) Scale

Raw Scale Alpha = 0.9326		
Scale Items	Correlation with total	α if item deleted
ADA Individual/team goals in the organization are tied to customer satisfaction.	0.7525	0.9247
ADD The organization's goals are tied to customer satisfaction.	0.8366	0.9193
ADB The organization continuously solicits feedback from its customers.	0.8211	0.9202
ADC The organization uses customer feedback to improve its products/services.	0.8714	0.9169
ADG We proactively seek information from customers even when there doesn't appear to be a problem.	0.7641	0.9239
ADI We ask customers how we can change our products/services to better meet their needs.	0.7550	0.9244
ABA The organization actively solicits information about problems from its members.	0.7364	0.9256
ABB Organization members receive information on problems identified by other members.	0.5843	0.9338
ABE The organization involves members in implementing actions to correct identified problems.	0.6096	0.9325

The second strongest factor identified under the Knowledge Acquisition category with a eigenvalue of 4.88 is Factor 2 (see Table 4-92). Factor 2 is made up of the exact same items as the Experimentation Scale. This was considered confirmation of the Experimentation Scale.

Table 4-92. Factor Loadings on Factor 2

Factor 2 - ZAA		
Factor Eigenvalue = 4.88		
Name	Load	Item
AAC	.692	We are encouraged to search for new knowledge in this organization.
AAB	.683	Testing new products/services is encouraged in this organization.
AAD	.653	We are encouraged to test new knowledge in this organization.
AAG	.645	We are encouraged to try new ways of doing things.
AAE	.623	We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.

The Cronbach's Alpha for the Factor 2 Scale is 0.9252, unchanged from the revised Experimentation Scale alpha, indicating a high level of correlation between scale elements (see Table 4-93). This was considered a strong confirmation of the Experimentation Scale.

Table 4-93. Cronbach's Alpha Statistics for the Factor 2 (ZAA) Scale

Raw Scale Alpha = 0.9252		
Scale Items	Correlation with total	α if item deleted
AAC We are encouraged to search for new knowledge in this organization.	0.8603	0.8969
AAB Testing new products/services is encouraged in this organization.	0.7862	0.9117
AAD We are encouraged to test new knowledge in this organization.	0.8555	0.8979
AAG We are encouraged to try new ways of doing things.	0.7129	0.9251
AAE We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.	0.8089	0.9073

Factor 3 is the third strongest factor in the Knowledge Acquisition category with an eigenvalue of 4.65 (see Table 4-94). The factor contains all four items from the Vicarious Learning Scale, three out of five items from the Performance Monitoring Scale,

and one item from the Systems Thinking Scale. Item IGD appears to be out of place coming from the Information Interpretation category. Its load of .347 is relatively weak when compared to other items in Factor 10. This was considered a strong confirmation of the Vicarious Learning Scale and partial confirmation of the Grafting Scale.

Table 4-94. Factor Loadings on Factor 3

Factor 3 - ZAC		
Factor Eigenvalue = 4.65		
Name	Load	Item
AFD	.676	The organization continuously assesses its performance against industry standards.
ACC	.666	We attempt to identify processes used by others that could be adapted for use within our organization.
ACD	.625	When organizations similar to ours experience failures, we analyze these failures to improve our organization.
ACA	.565	We monitor the performance of comparable organizations.
ACB	.455	We search for information about what our competitors are doing.
AFC	.432	The organization continuously assesses its performance against internal standards.
IGD	.347	The organization considers the whole process rather than static "snap-shots" when problem solving.
AFE	.323	The organization's performance against the standards is communicated to all organization members.

The Cronbach's Alpha for Factor 3 is 0.8904 (see Table 4-95). This indicates considerable coordination between the items in the factor.

Table 4-95. Cronbach's Alpha Statistics for the Factor 3 (ZAC) Scale

Raw Scale Alpha = 0.8904		
Scale Items	Correlation with total	α if item deleted
AFD The organization continuously assesses its performance against industry standards.	0.7180	0.8713
ACC We attempt to identify processes used by others that could be adapted for use within our organization.	0.7257	0.8716
ACD When organizations similar to ours experience failures, we analyze these failures to improve our organization.	0.6744	0.8758
ACA We monitor the performance of comparable organizations.	0.7048	0.8727
ACB We search for information about what our competitors are doing.	0.7046	0.8728
AFC The organization continuously assesses its performance against internal standards.	0.6486	0.8782
IGD The organization considers the whole process rather than static "snap-shots" when problem solving.	0.5076	0.8903
AFE The organization's performance against the standards is communicated to all organization members.	0.6404	0.8790

The fourth factor identified in the Knowledge Acquisition category is Factor 4 with an eigenvalue of 3.06 (see Table 4-96). This factor is made up of three out of the five items in the Grafting Scale. All three items deal directly with organizations taking advantage of outside expertise. The items are confirmed as a sub-scale of the revised Grafting Scale.

Table 4-96. Factor Loadings on Factor 4

Factor 4 - ZAE		
Factor Eigenvalue = 3.06		
Name	Load	Item
AED	.746	Management brings in outside experts to help us solve problems.
AEC	.734	We look outside the organization for needed expertise.
AEE	.707	We have used outside consultants to help us solve problems.

Factor 4 has a Cronbach's Alpha of 0.8105 (see Table 4-97). This is a strong indication that the items within the scale are correlated to each other.

Table 4-97. Cronbach's Alpha Statistics for the Factor 4 (ZAE) Scale

Raw Scale Alpha = 0.8105		
Scale Items	Correlation with total	α if item deleted
AED Management brings in outside experts to help us solve problems.	0.7778	0.6167
AEC We look outside the organization for needed expertise.	0.5362	0.8559
AEE We have used outside consultants to help us solve problems.	0.6909	0.7112

Factor 5 is the fifth factor identified from the Knowledge Acquisition category with an eigenvalue of 2.82. Factor 5 contains items from three of the five categories. Two items from the Self-Appraisal Scale loaded significantly on the factor. Item AFG comes from the same category as the Self-Appraisal Scale while the two remaining items are each from a different category (see Table 4-98). The remaining three items from the Self-Appraisal Scale loaded heavily on Factor 1, this suggests two sub-scales in the revised Self-Appraisal Scale.

Table 4-98. Factor Loadings on Factor 5

Factor 5 - ZAB		
Factor Eigenvalue = 2.82		
Name	Load	Item
IAF	.693	We have commonly held beliefs about the way the organization should "behave."
ABC	.561	The organization takes action to correct problems identified by its members.
DAJ	.499	Organization members communicate with those in different functions, departments, and projects.
ABD	.367	The organization involves members in planning actions to correct problems.
AFG	.346	We have identified those things about our performance that are important to external stakeholders.

The Cronbach's Alpha for Factor 5, 0.8127, shows a significant level of correlation between the items in the factor (see Table 4-99). As a whole the factor does not seem to reflect any one of the original scales.

Table 4-99. Cronbach's Alpha Statistics for the Factor 5 (ZAB) Scale

Raw Scale Alpha = 0.8127		
Scale Items	Correlation with total	α if item deleted
IAF We have commonly held beliefs about the way the organization should "behave."	0.5226	0.7984
ABC The organization takes action to correct problems identified by its members.	0.7197	0.7420
DAJ Organization members communicate with those in different functions, departments, and projects.	0.5393	0.7976
ABD The organization involves members in planning actions to correct problems.	0.6185	0.7712
AFG We have identified those things about our performance that are important to external stakeholders.	0.6235	0.7697

The sixth and final factor identified in the Knowledge Acquisition category with an eigenvalue of 2.10 was Factor 6 (see Table 4-100). Factor 6 is made up of two of the five items from the initial Grafting Scale. The other three factors from the Grafting Scale all loaded highly as Factor 4 and were discussed above. This suggests that the revised Grafting Scale breaks out into two sub-scales and indicated by Factors 4 and 6.

Table 4-100. Factor Loadings on Factor 6

Factor 6 - ZAG		
Factor Eigenvalue = 2.10		
Name	Load	Item
AEB	.737	Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
AEA	.613	New organization members are skilled in areas that complement the organization's mission.

Cronbach's Alpha for Factor 6 is 0.7750 (see Table 4-101). This alpha value indicates significant correlation between Items AEB and AEA.

Table 4-101. Cronbach's Alpha Statistics for the Factor 6 (ZAG) Scale

Raw Scale Alpha = 0.7750		
Scale Items	Correlation with total	α if item deleted
AEB Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.	0.6620	N/A
AEA New organization members are skilled in areas that complement the organization's mission.	0.6620	N/A

Category D. Information Distribution.

Factor 7 is the first identified in the Information Distribution category with a eigenvalue of 4.71 (see Table 4-102). The factor contains the entire Lessons Learned Scale and two of the four items from the Personnel Rotation Scale. The items from the Lessons Learned Scale are all loaded the heaviest within the factor confirming the existence of that scale.

Table 4-102. Factor Loadings on Factor 7

Factor 7 - ZDC		
Factor Eigenvalue = 4.71		
Name	Load	Item
DCD	.790	Lessons learned from organizational failures are accessible to members.
DCB	.728	We actively analyze failures within the organization.
DCC	.658	Lessons learned from organizational success are accessible to members.
DCE	.612	The organization values the contribution failures can make to its lessons learned.
DCG	.569	We have a system for keeping track of our successes and failures.
DDB	.406	The organization requires members to rotate to other functions to gain experience.
DDA	.321	The organization encourages members to master different functions.

The Cronbach's Alpha for Factor 7 is 0.8829 (see Table 4-103). This indicates a strong level of correlation between the items in the factor.

Table 4-103. Cronbach's Alpha Statistics for the Factor 7 (ZDC) Scale

Raw Scale Alpha = 0.8829		
Scale Items	Correlation with total	α if item deleted
DCD Lessons learned from organizational failures are accessible to members.	0.8050	0.8497
DCB We actively analyze failures within the organization.	0.6908	0.8636
DCC Lessons learned from organizational success are accessible to members.	0.7143	0.8607
DCE The organization values the contribution failures can make to its lessons learned.	0.6998	0.8622
DCG We have a system for keeping track of our successes and failures.	0.6961	0.8630
DDB The organization requires members to rotate to other functions to gain experience.	0.5249	0.8857
DDA The organization encourages members to master different functions.	0.5924	0.8752

Factor 8 is the second factor identified in the Information Distribution category. Factor 8 has an eigenvalue of 4.64 (see Table 4-104). The factor contains the five items

making up the Information Access Scale. This factor confirms the Information Access Scale.

Table 4-104. Factor Loadings on Factor 8

Factor 8 - ZDE		
Factor Eigenvalue = 4.64		
Name	Load	Item
DEB	.765	Information is not restricted within the organization.
DEC	.726	Information is easy to obtain within the organization.
DED	.716	Members are sometimes denied information that they need to know.
DEA	.646	Organization members have broad access to all organization information except personnel records.
DEG	.578	Information is readily shared between organizational units.

The Cronbach's Alpha for Factor 8, 0.8886, is the same as for the revised Information Access Scale (see Table 4-105).

Table 4-105. Cronbach's Alpha Statistics for the Factor 8 (ZDE) Scale

Raw Scale Alpha = 0.8886		
Scale Items	Correlation with total	α if item deleted
DEB Information is not restricted within the organization.	0.7726	0.8543
DEC Information is easy to obtain within the organization.	0.8427	0.8376
DED Members are sometimes denied information that they need to know.	0.6474	0.8828
DEA Organization members have broad access to all organization information except personnel records.	0.7265	0.8654
DEG Information is readily shared between organizational units.	0.6633	0.8789

The third factor identified in the Information Distribution category is Factor 9. Factor 9 contains all five elements of the Dialogue Scale with an eigenvalue of 4.44 (see Table 4-106). This factor serves as confirmation of the revised Dialogue Scale.

Table 4-106. Factor Loadings on Factor 9

Factor 9 - ZDB		
Factor Eigenvalue = 4.44		
Name	Load	Item
DBC	.693	Organization members feel free to express their true opinions without fear of reprisal.
DBA	.692	Organization members are willing to eliminate hidden agendas.
DBB	.593	Organization members try to understand the motives and reasoning of others without passing judgment.
DBG	.524	Organizational members can share ideas in an environment of openness and trust.
DBD	.478	Organizations members feel that it is all right to disagree with the boss.

Factor 9 contains the same items as the Dialogue Scale with a Cronbach's Alpha of 0.8756 (see Table 4-107). This high alpha value indicates significant correlation between the scale items as confirmed by the factor analysis.

Table 4-107. Cronbach's Alpha Statistics for the Factor 9 (ZDB) Scale

Raw Scale Alpha = 0.8756		
Scale Items	Correlation with total	α if item deleted
DBC Organization members feel free to express their true opinions without fear of reprisal.	0.7592	0.8357
DBA Organization members are willing to eliminate hidden agendas.	0.7258	0.8445
DBB Organization members try to understand the motives and reasoning of others without passing judgment.	0.6345	0.8654
DBG Organizational members can share ideas in an environment of openness and trust.	0.7645	0.8347
DBD Organizations members feel that it is all right to disagree with the boss.	0.6454	0.8632

Factor 10 is the fourth factor identified by factor analysis is the Information Distribution category with an eigenvalue of 2.54 (see Table 4-108). The factor contains two of the four items in the Personnel Rotation Scale. This confirms a sub-scale existing within the Personnel Rotation Scale.

Table 4-108. Factor Loadings on Factor 10

Factor 10 - ZDD		
Factor Eigenvalue = 2.54		
Name	Load	Item
DDC	.715	A total organization perspective is favored over a functional perspective.
DDD	.654	Broad-based organizational experience is valued over strictly functional experience in the organization.

Cronbach's Alpha for Factor 10 is 0.8203 indicating a significant correlation between the items (see Table 4-109).

Table 4-109. Cronbach's Alpha Statistics for the Factor 10 (ZDD) Scale

Raw Scale Alpha = 0.8203		
Scale Items	Correlation with total	α if item deleted
DDC A total organization perspective is favored over a functional perspective.	0.6956	N/A
DDD Broad-based organizational experience is valued over strictly functional experience in the organization.	0.6956	N/A

The fifth factor identified in the Information Distribution category is Factor 11. This factor contains three out of five items from the Communication Scale. The eigenvalue for the factor is 1.88 (see Table 4-110). This item confirms a sub-scale of the revised Communications Scale.

Table 4-110. Factor Loadings on Factor 11

Factor 11 - ZDA		
Factor Eigenvalue = 1.88		
Name	Load	Item
DAA	.612	Our organization disperses knowledge quickly.
DAB	.420	Our organization disperses knowledge efficiently.
DAL	.320	I feel that I get the information that I need to do my job when I need it.

Factor 11 has a fairly high Cronbach's Alpha of 0.8357 indicating a significant relationship between the items (see Table 4-111).

Table 4-111. Cronbach's Alpha Statistics for the Factor 11 (ZDA) Scale

Raw Scale Alpha = 0.8357		
Scale Items	Correlation with total	α if item deleted
DAA Our organization disperses knowledge quickly.	0.7409	0.7281
DAB Our organization disperses knowledge efficiently.	0.7990	0.6648
DAL I feel that I get the information that I need to do my job when I need it.	0.5733	0.8828

Category I. Information Interpretation.

The first factor in the Information Interpretation category is Factor 12 with an eigenvalue of 6.02 (see Table 4-112). Factor 12 contains all five of the items in the Scenarios Scale and one item from the Systems Thinking Scale. This was interpreted as a confirmation of the Scenarios Scale.

Table 4-112. Factor Loadings on Factor 12

Factor 12 - ZID		
Factor Eigenvalue = 6.02		
Name	Load	Item
IDC	.812	The organization tries to anticipate environmental changes and react to them before being forced to change.
IDB	.769	The organization considers how specific sets of changes in the environment could change the way the organization operates.
IDD	.741	The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
IDE	.576	We try to visualize the future in order to build contingency plans.
IGB	.404	The organization is careful to fix the problem not just the symptoms.
IDF	.390	We encourage development of alternative views of where we are going.

The Cronbach's Alpha for Factor 12 is 0.8883 indicating a high level of reliability within the factor (see Table 4-113).

Table 4-113. Cronbach's Alpha Statistics for the Factor 12 (ZID) Scale

Raw Scale Alpha = 0.8883		
Scale Items	Correlation with total	α if item deleted
IDC The organization tries to anticipate environmental changes and react to them before being forced to change.	0.7614	0.8597
IDB The organization considers how specific sets of changes in the environment could change the way the organization operates.	0.7162	0.8675
IDD The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.	0.7914	0.8549
IDE We try to visualize the future in order to build contingency plans.	0.7034	0.8695
IGB The organization is careful to fix the problem not just the symptoms.	0.5607	0.8926
IDF We encourage development of alternative views of where we are going.	0.7114	0.8679

Factor 13 is the second factor placed in the Information Interpretation category. This factor has a eigenvalue of 4.87 and contains all of the Unlearning Scale items (see Table 4-114). This factor confirms the Unlearning Scale.

Table 4-114. Factor Loadings on Factor 13

Factor 13 - ZIC		
Factor Eigenvalue = 4.87		
Name	Load	Item
ICD	.835	Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
ICC	.819	The organization has very strong opinions about the way things are done that cannot be easily changed.
ICE	.795	A lot of negative information must be received before we change the ways we do things.
ICF	.651	The organization tends to hold on to old ideas even when we know that they are wrong.
ICA	.607	The organization is very slow to accept new ideas.

The Cronbach's Alpha value for Factor 13 is 0.8982 indicating a high level of reliability within this factor (see Table 4-115).

Table 4-115. Cronbach's Alpha Statistics for the Factor 13 (ZIC) Scale

Raw Scale Alpha = 0.8982		
Scale Items	Correlation with total	α if item deleted
ICD Many of the organizations processes never change because of an attitude that embraces the old way of doing things.	0.7935	0.8657
ICC The organization has very strong opinions about the way things are done that cannot be easily changed.	0.7876	0.8672
ICE A lot of negative information must be received before we change the ways we do things.	0.7959	0.8662
ICF The organization tends to hold on to old ideas even when we know that they are wrong.	0.7157	0.8835
ICA The organization is very slow to accept new ideas.	0.6571	0.8960

Factor 14 is the third factor placed in the Information Interpretation category. The eigenvalue for Factor 14 is 3.36 (see Table 4-116). The factor contains all five of the items that make up the revised Information Load Scale. This factor confirms the Information Load Scale.

Table 4-116. Factor Loadings on Factor 14

Factor 14 - ZIB		
Factor Eigenvalue = 3.36		
Name	Load	Item
IBF	.742	I sometimes feel "bombarde" with information which confuses the issues.
IBA	.682	The amount of information that must be reviewed to make decisions is overwhelming.
IBC	.677	Our problem isn't too little information, it is too much information.
IBE	.647	I regularly feel overwhelmed by all the things going on in our organization.
IBD	.608	I am on too many teams to be effective.

The Cronbach's Alpha for Factor 14 is 0.7725, indicating that a correlation does exists between the items making up Factor 14 (see Table 4-117).

Table 4-117. Cronbach's Alpha Statistics for the Factor 14 (ZIB) Scale

Raw Scale Alpha = 0.7725		
Scale Items	Correlation with total	α if item deleted
IBF I sometimes feel "bombarde" with information which confuses the issues.	0.6579	0.6892
IBA The amount of information that must be reviewed to make decisions is overwhelming.	0.4247	0.7676
IBC Our problem isn't too little information, it is too much information.	0.4675	0.7552
IBE I regularly feel overwhelmed by all the things going on in our organization.	0.5809	0.7182
IBD I am on too many teams to be effective.	0.5948	0.7126

The fourth factor that falls within the Information Interpretation category is Factor 15. This factor has an eigenvalue of 1.89 and contains three of the four items from the Mental Models Scale (see Table 4-118). This was considered confirmation of a Mental Models Scale very similar to the revised Mental Models Scale.

Table 4-118. Factor Loadings on Factor 15

Factor 15 - ZIA		
Factor Eigenvalue = 1.89		
Name	Load	Item
IAC	.449	Underlying assumptions that govern the organization's actions can be changed.
IAE	.385	When making decisions the organization analyses the assumptions underlying the alternative decisions.
IAB	.301	Underlying assumptions about the organization's environment can be constructively challenged.

The Cronbach's Alpha for Factor 15 is 0.8551 indicating that the scale can be considered reliable (see Table 4-119).

Table 4-119. Cronbach's Alpha Statistics for the Factor 15 (ZIA) Scale

Raw Scale Alpha = 0.8551		
Scale Items	Correlation with total	α if item deleted
IAC Underlying assumptions that govern the organization's actions can be changed.	0.7758	0.7530
IAE When making decisions the organization analyses the assumptions underlying the alternative decisions.	0.6629	0.8644
IAB Underlying assumptions about the organization's environment can be constructively challenged.	0.7521	0.7758

Factor 16 is the fifth factor identified by the factor analysis that fell within the Information Interpretation category. The eigenvalue for Factor 16 is 1.67. This factor contains four of the six Systems Thinking Scale items. This was considered confirmation of a Systems Thinking Sub-Scale (see Table 4-120).

Table 4-120. Factor Loadings on Factor 16

Factor 16 - ZIG		
Factor Eigenvalue = 1.67		
Name	Load	Item
IGF	.462	When solving problems the total-organization and its interrelationships are considered.
IGG	.422	When solving a problem we consider the impact of the solution on all parts of the organization.
IGI	.390	We believe that a change in one part of our organization affects all parts.
IGH	.377	We perform "deep" problem analysis to ensure effective problem solutions.

The Cronbach's Alpha for Factor 16 is 0.8735 indicating a significant relationship between the items in the Factor (see Table 4-121).

Table 4-121. Cronbach's Alpha Statistics for the Factor 16 (ZIG) Scale

Raw Scale Alpha = 0.8735		
Scale Items	Correlation with total	α if item deleted
IGF When solving problems the total-organization and its interrelationships are considered.	0.7170	0.8437
IGG When solving a problem we consider the impact of the solution on all parts of the organization.	0.8035	0.8074
IGI We believe that a change in one part of our organization affects all parts.	0.7099	0.8461
IGH We perform "deep" problem analysis to ensure effective problem solutions.	0.6907	0.8534

Category M. Organizational Memory.

The first factor identified in the Organizational Memory category is Factor 17 with an eigenvalue of 5.86 (see Table 4-122). Factor 17 is made up of all five items from the Computer Models Scale and three out of the four Systematic Problem Solving Scale items. This was considered confirmation of the Computer Models Scale.

Table 4-122. Factor Loadings on Factor 17

Factor 17 - ZMD		
Factor Eigenvalue = 5.86		
Name	Load	Item
MDC	.851	The organization uses computer models to test new strategies.
MDB	.828	The organization uses computer models to capture organizational knowledge.
MDG	.754	We use computer models to see how our decisions will affect the organization.
MDD	.745	The knowledge of experts from within the organization is captured on computer.
MDE	.696	The organizational expertise captured on computer is easily assessable to organization members.
IEC	.509	Statistical tools are used to organize data and draw inferences.
IED	.476	We construct and test hypotheses when trying to solve a problem.
IEE	.439	We use a step-by-step process for identifying, analyzing, and solving problems.

The Cronbach's Alpha for this eight item factor is 0.8959 indicating a high degree of reliability within the factor (see Table 4-123).

Table 4-123. Cronbach's Alpha Statistics for the Factor 17 (ZMD) Scale

Raw Scale Alpha = 0.8959		
Scale Items	Correlation with total	α if item deleted
MDC The organization uses computer models to test new strategies.	0.7926	0.8718
MDB The organization uses computer models to capture organizational knowledge.	0.7290	0.8776
MDG We use computer models to see how our decisions will affect the organization.	0.7381	0.8779
MDD The knowledge of experts from within the organization is captured on computer.	0.7072	0.8798
MDE The organizational expertise captured on computer is easily assessable to organization members.	0.6227	0.8882
IEC Statistical tools are used to organize data and draw inferences.	0.6142	0.8888
IED We construct and test hypotheses when trying to solve a problem.	0.6232	0.8875
IEE We use a step-by-step process for identifying, analyzing, and solving problems.	0.6040	0.8894

Factor 18 is the second factor to be identified within the Organizational Memory category. This factor has an eigenvalue of 4.97 and contains all four of the items from the Hard Information Storage Scale (see Table 4-124). This was considered confirmation of the Hard Information Scale.

Table 4-124. Factor Loadings on Factor 18

Factor 18 - ZMB		
Factor Eigenvalue = 4.97		
Name	Load	Item
MBD	.786	Documentation is updated to reflect changes in the procedures and processes.
MBC	.721	Standard operating procedures document how the procedures are actually accomplished.
MBA	.703	Standard operating procedures for the organization are written down.
MBB	.691	Important processes in the organization are documented.

The Cronbach's Alpha value for Factor 18 is 0.8848 (see Table 4-125). This indicated a high degree of reliability within the factor.

Table 4-125. Cronbach's Alpha Statistics for the Factor 18 (ZMB) Scale

Raw Scale Alpha = 0.8848		
Scale Items	Correlation with total	α if item deleted
MBD Documentation is updated to reflect changes in the procedures and processes.	0.7420	0.8546
MBC Standard operating procedures document how the procedures are actually accomplished.	0.7672	0.8449
MBA Standard operating procedures for the organization are written down.	0.7200	0.8633
MBB Important processes in the organization are documented.	0.7671	0.8454

The third factor identified in the Organizational Memory category was Factor 19. Factor 19 has a eigenvalue of 3.75 and contains the four items that make up the Membership Attrition Scale (see Table 4-126). This confirmed the revised Membership Attrition Scale.

Table 4-126. Factor Loadings on Factor 19

Factor 19 - ZMA		
Factor Eigenvalue = 3.75		
Name	Load	Item
MAA	.912	The organization experiences a high turnover of members.
MAB	.869	The organization experiences a high turnover of members in key positions.
MAC	.869	People are constantly joining and leaving our teams.
MAD	.817	Our turnover seems higher than other organizations' turnover.

The Cronbach's Alpha for this factor is 0.9050 indicating a high level of reliability within the factor (see Table 4-127).

Table 4-127. Cronbach's Alpha Statistics for the Factor 19 (ZMA) Scale

Raw Scale Alpha = 0.9050		
Scale Items	Correlation with total	α if item deleted
MAA The organization experiences a high turnover of members.	0.8457	0.8551
MAB The organization experiences a high turnover of members in key positions.	0.7711	0.8829
MAC People are constantly joining and leaving our teams.	0.8237	0.8635
MAD Our turnover seems higher than other organizations' turnover.	0.7102	0.9033

The fourth factor to fall within the Organizational Memory category is Factor 20 with an eigenvalue of 2.86 (see Table 4-128). This factor contains all three items that make up the Soft Information Scale. Factor 20 confirmed the revised Soft Information Scale.

Table 4-128. Factor Loadings on Factor 20

Factor 20 - ZMC		
Factor Eigenvalue = 2.86		
Name	Load	Item
MCB	.799	The organization has standard ways of thinking about things that are not written down.
MCC	.747	The organization has lots of unwritten rules.
MCA	.736	Many procedures are not written down, but everyone knows what they are.

Factor 20 has a Cronbach's Alpha coefficient of 0.8201 indicating that the factor is reliable (see Table 4-129).

Table 4-129. Cronbach's Alpha Statistics for the Factor 20 (ZMC) Scale

Raw Scale Alpha = 0.8201		
Scale Items	Correlation with total	α if item deleted
MCB The organization has standard ways of thinking about things that are not written down.	0.6145	0.8197
MCC The organization has lots of unwritten rules.	0.7085	0.7229
MCA Many procedures are not written down, but everyone knows what they are.	0.7333	0.6894

Category C. Organizational Culture.

The first factor that fit into the Organizational Culture category is Factor 21. This factor had an eigenvalue of 6.71 (see Table 4-130). This factor contains all items for both the Personal Commitment to Learning Scales and the Personal Commitment to the Organization Scales. Factor two also contains two of the five items from the Shared Vision Scale. This was considered confirmation of both the Personal Commitment to Learning and the Personal Commitment to the Organization Scales.

Table 4-130. Factor Loadings on Factor 21

Factor 21 - ZCB		
Factor Eigenvalue = 6.71		
Name	Load	Item
CBD	.838	I care about the organization and what it is doing.
CBC	.810	I personally committed to learning and growing.
CBF	.785	I take the initiative to learn about new technologies and processes associated with my job.
CBG	.781	I try to know as much about the organization and it's processes as possible.
CBE	.679	When the organization is successful I feel successful.
CBB	.633	I will go out of my way to make the organization a success.
CBA	.581	I value my involvement with the organization.
CCF	.551	I feel a personal commitment to helping the organization make it's vision a reality.
CCB	.413	I know and share the values of the organization.

Factor 21 has a Cronbach's Alpha of 0.9183, indicating that the nine item factor is very reliable (see Table 4-131).

Table 4-131. Cronbach's Alpha Statistics for the Factor 21 (ZCB) Scale

Raw Scale Alpha = 0.9183		
Scale Items	Correlation with total	α if item deleted
CBD I care about the organization and what it is doing.	0.8388	0.9003
CBC I personally committed to learning and growing.	0.6666	0.9134
CBF I take the initiative to learn about new technologies and processes associated with my job.	0.5908	0.9164
CBG I try to know as much about the organization and it's processes as possible.	0.6538	0.9130
CBE When the organization is successful I feel successful.	0.7629	0.9054
CBB I will go out of my way to make the organization a success.	0.7646	0.9054
CBA I value my involvement with the organization.	0.7967	0.9033
CCF I feel a personal commitment to helping the organization make it's vision a reality.	0.7551	0.9064
CCB I know and share the values of the organization.	0.6274	0.9153

The second factor to fit into the Organizational Culture category is Factor 22 with an eigenvalue of 6.57 (see Table 4-132). This factor contains items from three different scales. First, it contains all four of the Organizational Commitment to Learning Scale items. Next, Factor 22 contains all five of the Organizational Rewards Scale items. Finally, the factor contains two of the five Shared Vision Scale items. This confirmed both the Organizational Commitment to Learning and Organizational Rewards Scales. Items from the Shared Vision Scale fall into three different factors: two into Factor 22, two into the previously discussed Factor 21, and one in a one item factor that was dropped from the analysis. This suggests that the Shared Vision Scale items may actually fit better as a sub-scale of other factors.

Table 4-132. Factor Loadings on Factor 22

Factor 22 - ZCD		
Factor Eigenvalue = 6.57		
Name	Load	Item
CAG	.747	The organization has helped me develop a plan for my professional growth.
CDA	.660	The organizational reward system promotes my learning efforts.
CAF	.628	The organization is committed to my professional development.
CAC	.619	The organization's leaders work to provide a better environment for learning.
CAB	.617	The organization's leaders are committed to organizational learning.
CDB	.591	Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
CDG	.583	The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.
CDE	.566	The organization rewards personal development.
CCD	.517	Members of the organization know where they fit into the organization's overall vision.
CCE	.502	Managers take positive action to transmit the organization's vision to all members.
CDD	.484	The organization rewards risk taking.

The Cronbach's Alpha value for the 11 item Factor 22 is 0.9296. This suggest a high degree of reliability within the factor (see Table 4-133).

Table 4-133. Cronbach's Alpha Statistics for the Factor 22 (ZCD) Scale

Raw Scale Alpha = 0.9296		
Scale Items	Correlation with total	α if item deleted
CAG The organization has helped me develop a plan for my professional growth.	0.6569	0.9259
CDA The organizational reward system promotes my learning efforts.	0.7527	0.9211
CAF The organization is committed to my professional development.	0.7031	0.9234
CAC The organization's leaders work to provide a better environment for learning.	0.7492	0.9218
CAB The organization's leaders are committed to organizational learning.	0.6713	0.9248
CDB Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.	0.7509	0.9212
CDG The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.	0.7363	0.9219
CDE The organization rewards personal development.	0.7813	0.9201
CCD Members of the organization know where they fit into the organization's overall vision.	0.6546	0.9255
CCE Managers take positive action to transmit the organization's vision to all members.	0.7154	0.9229
CDD The organization rewards risk taking.	0.6596	0.9255

Summarization of Confirmatory Factor Analysis.

The factor analysis confirmed 69%, or 18 of the 26, refined scales as they were written. In addition, 4 sub-scales were confirmed for a total of 85%, or 22 of 26 scales. A sub-scale was considered confirmed when the factor contained several items from one particular scale with no items from any other scale. These results are summarized by factor and revised scale in Table 4-134. The notation after the sub and partial scales indicates how many of the total number of items in a scale were confirmed by the factor. The Grafting Scale was handled as a special case. Two Grafting Sub-scales were

confirmed that sum to include all Grafting Scale items. This was considered confirmation of the entire Grafting Scale.

Table 4-134. Confirmatory Factor Analysis Results

Factor	Full-Scale	Sub-Scale	Partial Scale
1. (ZAD)	Customer Opinion		Self-Appraisal (3/5)
2. (ZAA)	Experimentation		
3. (ZAC)	Vicarious Learning		Performance Monitoring (3/5)
			Systems Thinking (1/6)
4. (ZAE)	Grafting (3/5)		
5. (ZAB)			Self-Appraisal (2/5)
			Performance Monitoring (2/5)
			Communication (1/5)
			Mental Models (1/4)
6. (ZAG)	Grafting (2/5)		
7. (ZDC)	Lessons Learned		Personnel Rotation (2/4)
8. (ZDE)	Information Access		
9. (ZDB)	Dialogue		
10.(ZDD)		Personnel Rotation (2/4)	
11.(ZDA)		Communication (3/5)	
12. (ZID)	Scenarios		Systems Thinking (1/6)
13. (ZIC)	Unlearning		
14. (ZIB)	Information Load		
15. (ZIA)		Mental Models (3/4)	
16. (ZIG)		Systems Thinking (4/6)	
17. (ZMD)	Computer Models		Sys Problem Solving (3/4)
18. (ZMB)	Hard Info Storage		
19. (ZMA)	Membership Attrition		
20. (ZMC)	Soft Info Storage		
21. (ZCB)	Pers Commit to Lrng		Shared Vision (2/5)
	Pers Commit to Org		
22. (ZCD)	Org Commit to Lrng		Shared Vision (2/5)
	Org Rewards		
Totals	18	4	N/A

Exploratory Factor Analysis. Exploratory factor analysis was performed using the 22 composite Z-values defined below. This analysis produced the five learning factors identified in Table 4-135 below. The items that loaded heavily on a factor were generally put into that factor. In Table 4-135, the factor loadings with numbers in parenthesis in front of them identify the Z-Scales that belong to that factor are presented. These factors were further divided into refined scales that are discussed in detail in the following section. The number in parenthesis identifies which refined scale the Z-Scale was placed into.

Definition of the Composite Scales. The first step was to create a list of composite scales for the 22 significant factors identified in the confirmatory factor analysis. This was accomplished by summing the responses for each item in the factor and dividing by the number of total items in the factor. The result is an average, or composite, score for each factor that is called the "Z Value". The 22 factors identified in the previous section were all converted to composite scales and assigned variable names beginning with Z. The name assigned to each factor is noted in parenthesis in the table heading of the factor. The second and third letters in the name of each factor reflect the major category and primary scale that the factor falls under.

Table 4-135. Composite Factor Exploratory Analysis Results

Z-Scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
ZCB	(1) 0.8026	0.0755	0.1402	-0.0758	-0.0119
ZCC	(1) 0.7491	0.0892	0.1978	-0.8212	0.0520
ZDD	(2) 0.7282	-0.1082	0.0549	0.0088	0.2877
ZCD	(1) 0.7019	0.3867	0.2687	0.0764	0.0291
ZAD	(3) 0.6493	0.2509	0.4210	0.1303	-0.1165
ZDE	(4) 0.6443	0.0160	0.0297	0.4557	0.2551
ZAB	(2) 0.6225	0.2904	0.1947	0.2304	0.0698
ZDC	(5) 0.5817	0.3674	0.0523	0.1879	0.4225
ZID	(5) 0.5576	0.2941	0.3807	0.2883	0.1533
ZDB	(4) 0.5185	0.2813	0.3786	0.4290	0.0456
ZMC	0.0598	(6) -0.8131	-0.1697	0.0182	0.1343
ZMB	0.2806	(7) 0.7718	-0.05557	0.0956	0.2506
ZDA	0.4484	(7) 0.4773	0.0194	0.4762	0.2518
ZIG	0.4346	(7) 0.4571	0.3938	0.1511	0.3407
ZIC	0.3414	(7) 0.4203	0.2472	0.3986	-0.2521
ZAE	0.0942	-0.0440	(8) 0.8333	-0.0126	0.2097
ZAA	0.4839	0.1989	(8) 0.6157	0.2673	-0.1099
ZIA	0.5101	0.3138	(8) 0.5063	0.1966	0.0798
ZAC	0.4818	0.4533	(8) 0.4973	0.0353	0.0745
ZMA	-0.1518	0.0019	-0.0055	(9) 0.8180	-0.0978
ZAG	0.1865	0.0711	0.3681	(9) 0.5642	0.3138
ZIB	0.1423	0.1842	-0.1567	0.1204	(10) -0.6995
ZDF	0.2524	0.2835	-0.0048	0.1346	(10) 0.6772
ZMD	0.3397	0.1033	0.4638	0.1148	(10) 0.5172
Eigenvalues	5.9518	2.9686	2.8418	2.1614	2.0893

Refined Scale Analysis. The five composite scales identified above were broken into refined scales based on personal judgment and qualitative assessment. The following table summarizes the scale factor analysis.

Commitment to Learning. Refined Scale 1, Commitment to Learning, is composed of the ZCB, ZCD and ZCC Scales (see Table 4-136). The scale combines items addressing both the organizational and personal commitment to learning, rewards and shared vision. The Commitment to Learning Refined Scale measures the organizations commitment to learning at both the personal and leadership levels. It

measures the degree to which individuals are rewarded for learning and the overall sense of a shared vision among the organization's members.

Table 4-136. Composition of Refined Scale 1 Commitment to Learning

Commitment to Learning		
Factor	Item	Item
ZCB	CBD	I care about the organization and what it is doing.
	CBC	I personally committed to learning and growing.
	CBF	I take the initiative to learn about new technologies and processes associated with my job.
	CBG	I try to know as much about the organization and it's processes as possible.
	CBE	When the organization is successful I feel successful.X
	CBB	I will go out of my way to make the organization a success.X
	CBA	I value my involvement with the organization.X
	CCF	I feel a personal commitment to helping the organization make it's vision a reality.X
	CCB	I know and share the values of the organization.
ZCD	CAG	The organization has helped me develop a plan for my professional growth.
	CDA	The organizational reward system promotes my learning efforts.
	CAF	The organization is committed to my professional development.X
	CAC	The organization's leaders work to provide a better environment for learning.
	CAB	The organization's leaders are committed to organizational learning.
	CDB	Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
	CDG	The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.
	CDE	The organization rewards personal development.X
	CCD	Members of the organization know where they fit into the organization's overall vision.
	CCE	Managers take positive action to transmit the organization's vision to all members.X
ZCC	CDD	The organization rewards risk taking.X
	CCC	I feel that my personal goals align with the goals of the organization.

The Cronbach's Alpha for the Commitment to Learning Refined Scale is 0.9463 (see Table 137). This indicates a high degree of reliability among the twenty-one items in the scale. A shorter version of the Commitment to Learning Refined Scale called the

Workshop Version contains the items listed in Table 4-136, less the items with a X after them that were deleted. The Workshop Version of the Commitment to Learning Refined Scale contains eight less items than the complete version for a total of thirteen items. The Cronbach's Alpha for the workshop version is .8991 (see Table 4-138). This indicates that the reliability within the scale items is still high after the removal of the eight identified items.

Table 4-137. Cronbach's Alpha Statistics for the Complete Commitment to Learning Refined Scale

Raw Scale Alpha = 0.9463		
Scale Items	Correlation with total	α if item deleted
CBD I care about the organization and what it is doing.	0.6664	0.9437
CBC I personally committed to learning and growing.	0.4544	0.9463
CBF I take the initiative to learn about new technologies and processes associated with my job.	0.3996	0.9469
CBG I try to know as much about the organization and it's processes as possible.	0.4642	0.9462
CBE When the organization is successful I feel successful.X	0.6994	0.9431
CBB I will go out of my way to make the organization a success.X	0.6784	0.9435
CBA I value my involvement with the organization.X	0.7887	0.9417
CCF I feel a personal commitment to helping the organization make it's vision a reality.X	0.7491	0.9423
CCB I know and share the values of the organization.	0.7097	0.9430
CAG The organization has helped me develop a plan for my professional growth.	0.6007	0.9449
CDA The organizational reward system promotes my learning efforts.	0.6844	0.9434
CAF The organization is committed to my professional development.X	0.7291	0.9426
CAC The organization's leaders work to provide a better environment for learning.	0.7544	0.9423
CAB The organization's leaders are committed to organizational learning.	0.6355	0.9440
CDB Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.	0.6793	0.9435
CDG The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.	0.6490	0.9440
CDE The organization rewards personal development.X	0.7564	0.9422
CCD Members of the organization know where they fit into the organization's overall vision.	0.6382	0.9440
CCE Managers take positive action to transmit the organization's vision to all members.X	0.6907	0.9432
CDD The organization rewards risk taking.X	0.6432	0.9441
CCC I feel that my personal goals align with the goals of the organization.	0.7031	0.9430

Table 4-138. Cronbach's Alpha Statistics for the Workshop Version of the Commitment to Learning Refined Scale

Raw Scale Alpha = 0.8991		
Scale Items	Correlation with total	α if item deleted
CBD I care about the organization and what it is doing.	0.6061	0.8917
CBC I personally committed to learning and growing.	0.4208	0.8988
CBF I take the initiative to learn about new technologies and processes associated with my job.	0.3723	0.9002
CBG I try to know as much about the organization and it's processes as possible.	0.4528	0.8976
CCB I know and share the values of the organization.	0.7087	0.8868
CAG The organization has helped me develop a plan for my professional growth.	0.5845	0.8935
CDA The organizational reward system promotes my learning efforts.	0.6804	0.8879
CAC The organization's leaders work to provide a better environment for learning.	0.7761	0.8836
CAB The organization's leaders are committed to organizational learning.	0.6506	0.8894
CDB Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.	0.6727	0.8883
CDG The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.	0.6256	0.8910
CCD Members of the organization know where they fit into the organization's overall vision.	0.6048	0.8915
CCC I feel that my personal goals align with the goals of the organization.	0.6751	0.8882

Internal Interaction. Refined Scale 2, Internal Interaction, is composed of the ZAB, and ZDD Scales (see Table 4-139). The scale combines items addressing personnel rotation, organizational self-appraisal, communication, and performance monitoring. The Internal Interaction Refined Scale measures the degree of interaction that occurs among the different functions, projects, and departments in an organization.

Table 4-139. Composition of Refined Scale 2 Internal Interaction

Internal Interaction		
Factor	Item	Item
ZAB	IAF	We have commonly held beliefs about the way the organization should "behave."
	ABC	The organization takes action to correct problems identified by its members.
	DAJ	Organization members communicate with those in different functions, departments, and projects.
	ABD	The organization involves members in planning actions to correct problems.X
	AFG	We have identified those things about our performance that are important to external stakeholders.X
ZDD	DDC	A total organization perspective is favored over a functional perspective.
	DDD	Broad-based organizational experience is valued over strictly functional experience in the organization.

The Cronbach's Alpha for the full seven item refined scale is 0.8167, see (Table 4-140). This indicated a high level of reliability among the scale items. The workshop version of the scale includes five items with a Cronbach's Alpha of 0.7412 (see Table 4-141). This indicates a significant amount of reliability within the workshop version of the scale.

Table 4-140. Cronbach's Alpha Statistics for the Complete Internal Interaction Refined Scale

Raw Scale Alpha = 0.8167		
Scale Items	Correlation with total	α if item deleted
IAF We have commonly held beliefs about the way the organization should "behave."	0.4918	0.8028
ABC The organization takes action to correct problems identified by its members.	0.6263	0.7820
DAJ Organization members communicate with those in different functions, departments, and projects.	0.5355	0.7961
ABD The organization involves members in planning actions to correct problems.X	0.6280	0.7796
AFG We have identified those things about our performance that are important to external stakeholders.X	0.5956	0.7862
DDC A total organization perspective is favored over a functional perspective.	0.5108	0.8020
DDD Broad-based organizational experience is valued over strictly functional experience in the organization.	0.5293	0.7978

Table 4-141. Cronbach's Alpha Statistics for the Workshop Version of the Internal Interaction Refined Scale

Raw Scale Alpha = 0.7412		
Scale Items	Correlation with total	α if item deleted
IAF We have commonly held beliefs about the way the organization should "behave."	0.4628	0.7117
ABC The organization takes action to correct problems identified by its members.	0.5100	0.6955
DAJ Organization members communicate with those in different functions, departments, and projects.	0.4881	0.7022
DDC A total organization perspective is favored over a functional perspective.	0.5444	0.6807
DDD Broad-based organizational experience is valued over strictly functional experience in the organization.	0.5273	0.6873

Customer and Constituent Learning. Refined Scale 3, Customer and Constituent Learning, is made up of the ZAD Scale (see Table 4-142). This scale contains items from two primary areas, customer opinion and self-appraisal. The scale measures the degree that the organization seeks information from its customers and its members.

Table 4-142. Composition of Refined Scale 3 Customer and Constituent Learning

Customer and Constituent Learning		
Factor	Item	Item
ZAD	ADE	Individual/team goals in the organization are tied to customer satisfaction.
	ADD	The organization's goals are tied to customer satisfaction.
	ADB	The organization continuously solicits feedback from its customers.X
	ADC	The organization uses customer feedback to improve its products/services.
	ADG	We proactively seek information from customers even when there doesn't appear to be a problem.
	ADI	We ask customers how we can change our products/services to better meet their needs.X
	ABA	The organization actively solicits information about problems from its members.
	ABB	Organization members receive information on problems identified by other members.
	ABE	The organization involves members in implementing actions to correct identified problems.X

The Cronbach's Alpha for the nine item Customer and Constituent Learning Refined Scale is .9326 (see Table 4-143). This indicates a very high level of reliability within the scale. The six item workshop version of the Customer and Constituent Learning Refined Scale has a Cronbach's Alpha of 0.9066 (see Table 4-144). This indicates a very high level of reliability for the workshop version of the scale.

Table 4-143. Cronbach's Alpha Statistics for the Complete Customer and Constituent Learning Refined Scale

Raw Scale Alpha = 0.9326		
Scale Items	Correlation with total	α if item deleted
ADE Individual/team goals in the organization are tied to customer satisfaction.	0.7525	0.9247
ADD The organization's goals are tied to customer satisfaction.	0.8366	0.9193
ADB The organization continuously solicits feedback from its customers.X	0.8211	0.9202
ADC The organization uses customer feedback to improve its products/services.	0.8714	0.9169
ADG We proactively seek information from customers even when there doesn't appear to be a problem.	0.7641	0.9239
ADI We ask customers how we can change our products/services to better meet their needs.X	0.7550	0.9244
ABA The organization actively solicits information about problems from its members.	0.7364	0.9256
ABB Organization members receive information on problems identified by other members.	0.5843	0.9338
ABE The organization involves members in implementing actions to correct identified problems.X	0.6096	0.9325

Table 4-144. Cronbach's Alpha Statistics for the Workshop Version of the Customer and Constituent Learning Refined Scale

Raw Scale Alpha = 0.9066		
Scale Items	Correlation with total	α if item deleted
ADE Individual/team goals in the organization are tied to customer satisfaction.	0.7699	0.8859
ADD The organization's goals are tied to customer satisfaction.	0.8261	0.8773
ADC The organization uses customer feedback to improve its products/services.	0.7957	0.8818
ADG We proactively seek information from customers even when there doesn't appear to be a problem.	0.7302	0.8920
ABA The organization actively solicits information about problems from its members.	0.7585	0.8882
ABB Organization members receive information on problems identified by other members.	0.5773	0.9117

Knowledge Flow. Refined Scale 4, Knowledge Flow, contains the ZDE and ZDB Scales (see Table 4-145). This scale combines information access items with dialogue items. The result is a scale that measures the degree to which information is assessable within the organization and how openly and honestly that information can be discussed.

Table 4-145. Composition of Refined Scale 4 Knowledge Flow

Knowledge Flow		
Factor	Item	Item
ZDE	DEB	Information is not restricted within the organization.X
	DEC	Information is easy to obtain within the organization.
	DED	Members are sometimes denied information that they need to know.
	DEA	Organization members have broad access to all organization information except personnel records.
	DEG	Information is readily shared between organizational units.X
ZDB	DBC	Organization members feel free to express their true opinions without fear of reprisal.
	DBA	Organization members are willing to eliminate hidden agendas.
	DBB	Organization members try to understand the motives and reasoning of others without passing judgment.
	DBG	Organizational members can share ideas in an environment of openness and trust.X
	DBD	Organizations members feel that it is all right to disagree with the boss.X

The Cronbach's Alpha for the Knowledge Flow Refined Scale is 0.8962 (see Table 4-146). This indicates a high degree of reliability among the ten items in this scale. The shorter six item workshop version of the scale has a Cronbach's Alpha of 0.8240 (see Table 4-147). This indicates that the workshop version of the scale still has a high degree of reliability.

Table 4-146. Cronbach's Alpha Statistics for the Complete Knowledge Flow Refined Scale

Raw Scale Alpha = 0.8962		
Scale Items	Correlation with total	α if item deleted
DEB Information is not restricted within the organization.X	0.6606	0.8896
DEC Information is easy to obtain within the organization.	0.7744	0.8818
DED Members are sometimes denied information that they need to know.	0.5296	0.8981
DEA Organization members have broad access to all organization information except personnel records.	0.6798	0.8883
DEG Information is readily shared between organizational units.X	0.6792	0.8885
DBC Organization members feel free to express their true opinions without fear of reprisal.	0.6252	0.8920
DBA Organization members are willing to eliminate hidden agendas.	0.6558	0.8900
DBB Organization members try to understand the motives and reasoning of others without passing judgment.	0.5272	0.8978
DBG Organizational members can share ideas in an environment of openness and trust.X	0.7737	0.8823
DBD Organizations members feel that it is all right to disagree with the boss.X	0.6047	0.8931

Table 4-147. Cronbach's Alpha Statistics for the Workshop Version of Knowledge Flow Refined Scale

Raw Scale Alpha = 0.8240		
Scale Items	Correlation with total	α if item deleted
DEC Information is easy to obtain within the organization.	0.7028	0.7712
DED Members are sometimes denied information that they need to know.	0.4784	0.8192
DEA Organization members have broad access to all organization information except personnel records.	0.6113	0.7916
DBC Organization members feel free to express their true opinions without fear of reprisal.	0.5594	0.8030
DBA Organization members are willing to eliminate hidden agendas.	0.6612	0.7824
DBB Organization members try to understand the motives and reasoning of others without passing judgment.	0.5453	0.8052

Strategic Thinking. The fifth Refined Scale is Strategic Thinking. This scale contains the ZID and ZDC Composite Scales (see Table 4-148). The Strategic Thinking Refined Scale combines items from scenarios, lessons learned and personnel rotation. The scale measures the degree to which the organizations examines its past, through good and bad lessons learned, and its future, through scenarios, to develop appropriate competitive strategies.

Table 4-148. Composition of Refined Scale 5 Strategic Thinking

Personnel Management		
Factor	Item	Item
ZID	IDC	The organization tries to anticipate environmental changes and react to them before being forced to change.
	IDB	The organization considers how specific sets of changes in the environment could change the way the organization operates.
	IDD	The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
	IDE	We try to visualize the future in order to build contingency plans.
	IGB	The organization is careful to fix the problem not just the symptoms.X
	IDF	We encourage development of alternative views of where we are going.X
ZDC	DCD	Lessons learned from organizational failures are accessible to members.
	DCB	We actively analyze failures within the organization.
	DCC	Lessons learned from organizational success are accessible to members.
	DCE	The organization values the contribution failures can make to its lessons learned.X
	DCG	We have a system for keeping track of our successes and failures.X
	DDB	The organization requires members to rotate to other functions to gain experience.X
	DDA	The organization encourages members to master different functions.X

The thirteen item Strategic Thinking Refined Scale has a Cronbach's Alpha of 0.8962 (see Table 4-149). This indicates a high level of reliability within the scale items. The workshop version contains seven items and has a Cronbach's Alpha of 0.8163 (see

Table 4-150). This indicates that the reliability within the scale remains high after removal of six items.

Table 4-149. Cronbach's Alpha Statistics for the Complete Refined Scale 5

Raw Scale Alpha = 0.8962		
Scale Items	Correlation with total	α if item deleted
IDC The organization tries to anticipate environmental changes and react to them before being forced to change.	0.5659	0.8898
IDB The organization considers how specific sets of changes in the environment could change the way the organization operates.	0.5386	0.8910
IDD The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.	0.6035	0.8882
IDE We try to visualize the future in order to build contingency plans.	0.5804	0.8892
IGB The organization is careful to fix the problem not just the symptoms.X	0.6024	0.8881
IDF We encourage development of alternative views of where we are going.X	0.6611	0.8858
DCD Lessons learned from organizational failures are accessible to members.	0.6394	0.8864
DCB We actively analyze failures within the organization.	0.5663	0.8898
DCC Lessons learned from organizational success are accessible to members.	0.6107	0.8877
DCE The organization values the contribution failures can make to its lessons learned.X	0.6709	0.8848
DCG We have a system for keeping track of our successes and failures.X	0.6494	0.8959
DDB The organization requires members to rotate to other functions to gain experience.X	0.4246	0.8977
DDA The organization encourages members to master different functions.X	0.6743	0.8849

Table 4-150. Cronbach's Alpha Statistics for the Workshop Version of Refined Scale 5

Raw Scale Alpha = 0.8163		
Scale Items	Correlation with total	α if item deleted
IDC The organization tries to anticipate environmental changes and react to them before being forced to change.	0.5926	0.7858
IDB The organization considers how specific sets of changes in the environment could change the way the organization operates.	0.5858	0.7877
IDD The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.	0.6436	0.7773
IDE We try to visualize the future in order to build contingency plans.	0.5868	0.7863
DCD Lessons learned from organizational failures are accessible to members.	0.5240	0.7975
DCB We actively analyze failures within the organization.	0.4876	0.8039
DCC Lessons learned from organizational success are accessible to members.	0.4830	0.8049

Soft Information Storage. Refined Scale 6, Soft Information Storage, is composed entirely of items from the ZMC Scale. The ZMC Scale is composed entirely of items from the initial Soft Information Storage Scale (see Table 4-151). This scale measures the amount of unwritten rules and procedures that govern behavior in the organization.

Table 4-151. Composition of Refined Scale 6 Soft Information Storage

Soft Information Storage		
Factor	Item	Item
ZMC	MCB	The organization has standard ways of thinking about things that are not written down.
	MCC	The organization has lots of unwritten rules.
	MCA	Many procedures are not written down, but everyone knows what they are.

The Cronbach's Alpha for the three item Soft Information Storage Scale is 0.8201 (see Table 4-152). This indicates that the reliability within this scale is high. No items were dropped from the scale for the workshop version.

Table 4-152 Cronbach's Alpha Statistics for the Complete Soft Information Storage Refined Scale

Raw Scale Alpha = 0.8201		
Scale Items	Correlation with total	α if item deleted
MCB The organization has standard ways of thinking about things that are not written down.	0.6145	0.8197
MCC The organization has lots of unwritten rules.	0.7085	0.7229
MCA Many procedures are not written down, but everyone knows what they are.	0.7333	0.6894

Organizational Bureaucracy. Refined Scale 7, Organizational Bureaucracy, is composed of the ZBM, ZIC, ZDA, and ZIG Scales (see Table 4-153). This scale combines items addressing hard information storage, unlearning, communication, and systems thinking. The scale as a whole is the measure of the level of bureaucracy within the organization. It accesses the organizations reliance on hard information i.e. regulations, formal documentation, etc. The scale measures how difficult it is to change the statues quo, and to disperse knowledge within the organization.

Table 4-153. Composition of Refined Scale 7 Organizational Bureaucracy

Sub-Scale 7		
Factor	Item	Item
ZMB	MBD	Documentation is updated to reflect changes in the procedures and processes.
	MBC	Standard operating procedures document how the procedures are actually accomplished.
	MBA	Standard operating procedures for the organization are written down.X
	MBB	Important processes in the organization are documented.X
ZIC	ICD	Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
	ICC	The organization has very strong opinions about the way things are done that cannot be easily changed.X
	ICE	A lot of negative information must be received before we change the ways we do things.
	ICF	The organization tends to hold on to old ideas even when we know that they are wrong.X
	ICA	The organization is very slow to accept new ideas.
ZDA	DAA	Our organization disperses knowledge quickly.
	DAB	Our organization disperses knowledge efficiently.X
	DAL	I feel that I get the information that I need to do my job when I need it.
ZIG	IGF	When solving problems the total-organization and its interrelationships are considered.
	IGG	When solving a problem we consider the impact of the solution on all parts of the organization.
	IGI	We believe that a change in one part of our organization affects all parts.X
	IGH	We perform "deep" problem analysis to ensure effective problem solutions.X

The Cronbach's Alpha for the Organizational Bureaucracy Refined Scale is 0.9120 (see Table 4-154). This indicates a very high level of reliability among the sixteen items in the scale. The workshop version of the scale contains nine items and has a Cronbach's Alpha of 0.8505 (see Table 4-155). While dropping the seven items reduced the Cronbach's Alpha by 0.0615, the scale still has a high degree of reliability.

Table 4-154. Cronbach's Alpha Statistics for the Complete Organizational Bureaucracy Refined Scale

Raw Scale Alpha = 0.9120		
Scale Items	Correlation with total	α if item deleted
MBD Documentation is updated to reflect changes in the procedures and processes.	0.6777	0.9041
MBC Standard operating procedures document how the procedures are actually accomplished.	0.6412	0.9053
MBA Standard operating procedures for the organization are written down.X	0.5092	0.9097
MBB Important processes in the organization are documented.X	0.5715	0.9075
ICD Many of the organizations processes never change because of an attitude that embraces the old way of doing things.	0.5716	0.9075
ICC The organization has very strong opinions about the way things are done that cannot be easily changed.X	0.6009	0.9066
ICE A lot of negative information must be received before we change the ways we do things.	0.5671	0.9076
ICF The organization tends to hold on to old ideas even when we know that they are wrong.X	0.5976	0.9068
ICA The organization is very slow to accept new ideas.	0.5256	0.9091
DAA Our organization disperses knowledge quickly.	0.6112	0.9063
DAB Our organization disperses knowledge efficiently.X	0.7242	0.9025
DAL I feel that I get the information that I need to do my job when I need it.	0.5996	0.9067
IGF When solving problems the total-organization and its interrelationships are considered.	0.5470	0.9083
IGG When solving a problem we consider the impact of the solution on all parts of the organization.	0.6452	0.9053
IGI We believe that a change in one part of our organization affects all parts.X	0.6006	0.9066
IGH We perform "deep" problem analysis to ensure effective problem solutions.X	0.5781	0.9073

Table 4-155. Cronbach's Alpha Statistics for the Workshop Version of the Organizational Bureaucracy Refined Scale

Raw Scale Alpha = 0.8505		
Scale Items	Correlation with total	α if item deleted
MBD Documentation is updated to reflect changes in the procedures and processes.	0.6414	0.8270
MBC Standard operating procedures document how the procedures are actually accomplished.	0.5862	0.8331
ICD Many of the organizations processes never change because of an attitude that embraces the old way of doing things.	0.5600	0.8358
ICE A lot of negative information must be received before we change the ways we do things.	0.5782	0.8339
ICA The organization is very slow to accept new ideas.	0.5249	0.8397
DAA Our organization disperses knowledge quickly.	0.5334	0.8390
DAL I feel that I get the information that I need to do my job when I need it.	0.5877	0.8333
IGF When solving problems the total-organization and its interrelationships are considered.	0.5371	0.8382
IGG When solving a problem we consider the impact of the solution on all parts of the organization.	0.5848	0.8334

Pursuit of Improvement. The eighth Refined Scale, Pursuit of Improvement, is composed of the ZAA, ZAC, ZAE, and ZIA Composite Scales (see Table 4-156). This scale contains items from experimentation, vicarious learning, performance monitoring, systems thinking, grafting, and mental models. The Pursuit of Improvement Refined Scale is measuring the organization's ability to seek and implement new ways of doing things. These new ways are found by experimenting, looking at the way others do things, and by bringing in outside experts. This scale also assess the organization's ability to adjust to change and evaluate the potential improvements of a change.

Table 4-156. Composition of Refined Scale 8 Pursuit of Improvement

Sub-Scale 8		
Factor	Item	Item
ZAA	AAC	We are encouraged to search for new knowledge in this organization.
	AAB	Testing new products/services is encouraged in this organization.
	AAD	We are encouraged to test new knowledge in this organization.
	AAG	We are encouraged to try new ways of doing things.
	AAE	We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.X
ZAC	AFD	The organization continuously assesses its performance against industry standards.
	ACC	We attempt to identify processes used by others that could be adapted for use within our organization.
	ACD	When organizations similar to ours experience failures, we analyze these failures to improve our organization.
	ACA	We monitor the performance of comparable organizations.
	ACB	We search for information about what our competitors are doing.X
	AFC	The organization continuously assesses its performance against internal standards.X
	IGD	The organization considers the whole process rather than static “snap-shots” when problem solving.X
	AFE	The organization’s performance against the standards is communicated to all organization members.X
ZAE	AED	Management brings in outside experts to help us solve problems.
	AEC	We look outside the organization for needed expertise.X
	AEE	We have used outside consultants to help us solve problems.
ZIA	IAC	Underlying assumptions that govern the organization’s actions can be changed.
	IAE	When making decisions the organization analyses the assumptions underlying the alternative decisions.
	IAB	Underlying assumptions about the organization’s environment can be constructively challenged.X

The Cronbach’s Alpha for the nineteen item Pursuit of Improvement Refined Scale is 0.9293 (see Table 4-157). This indicates a very high level of reliability among the scale items. The workshop version of the scale contains twelve items with a Cronbach’s Alpha of 0.8960. This indicates a high level of reliability for the shortened version of this scale (see Table 4-158).

Table 4-157. Cronbach's Alpha Statistics for the Complete Pursuit of Improvement Refined Scale

Raw Scale Alpha = 0.9293		
Scale Items	Correlation with total	α if item deleted
AAC We are encouraged to search for new knowledge in this organization.	0.7249	0.9234
AAB Testing new products/services is encouraged in this organization.	0.6780	0.9244
AAD We are encouraged to test new knowledge in this organization.	0.6959	0.9239
AAG We are encouraged to try new ways of doing things.	0.6342	0.9254
AAE We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.X	0.7353	0.9233
AFD The organization continuously assesses its performance against industry standards.	0.6429	0.9251
ACC We attempt to identify processes used by others that could be adapted for use within our organization.	0.6780	0.9244
ACD When organizations similar to ours experience failures, we analyze these failures to improve our organization.	0.6187	0.9257
ACA We monitor the performance of comparable organizations.	0.6012	0.9260
ACB We search for information about what our competitors are doing.X	0.6818	0.9242
AFC The organization continuously assesses its performance against internal standards.X	0.5406	0.9272
IGD The organization considers the whole process rather than static "snap-shots" when problem solving.X	0.5929	0.9262
AFE The organization's performance against the standards is communicated to all organization members.X	0.6242	0.9255
AED Management brings in outside experts to help us solve problems.	0.5631	0.9270
AEC We look outside the organization for needed expertise.X	0.4712	0.9288
AEE We have used outside consultants to help us solve problems.	0.4446	0.9304
IAC Underlying assumptions that govern the organization's actions can be changed.	0.6041	0.9262
IAE When making decisions the organization analyses the assumptions underlying the alternative decisions.	0.6452	0.9252
IAB Underlying assumptions about the organization's environment can be constructively challenged.X	0.6624	0.9252

Table 4-158. Cronbach's Alpha Statistics for the Workshop Version of the Pursuit of Improvement Refined Scale

Raw Scale Alpha = 0.8960		
Scale Items	Correlation with total	α if item deleted
AAC We are encouraged to search for new knowledge in this organization.	0.7296	0.8816
AAB Testing new products/services is encouraged in this organization.	0.6794	0.8843
AAD We are encouraged to test new knowledge in this organization.	0.6951	0.8832
AAG We are encouraged to try new ways of doing things.	0.6331	0.8867
AFD The organization continuously assesses its performance against industry standards.	0.6013	0.8884
ACC We attempt to identify processes used by others that could be adapted for use within our organization.	0.6656	0.8850
ACD When organizations similar to ours experience failures, we analyze these failures to improve our organization.	0.6129	0.8875
ACA We monitor the performance of comparable organizations.	0.5720	0.8897
AED Management brings in outside experts to help us solve problems.	0.5804	0.8896
AEE We have used outside consultants to help us solve problems.	0.4816	0.8964
IAC Underlying assumptions that govern the organization's actions can be changed.	0.5424	0.8912
IAE When making decisions the organization analyses the assumptions underlying the alternative decisions.	0.6104	0.8879

Personnel Management. The ninth Refined Scale is Personnel Management. This scale contains the ZMA and ZAG Composite Scales (see Table 4-159). The Personnel Management Refined Scale measures the amount of turnover experienced by an organization and the type of individuals hired by the organization.

Table 4-159. Composition of Refined Scale 9 Personnel Management

Personnel Management		
Factor	Item	Item
ZMA	MAA	The organization experiences a high turnover of members.
	MAB	The organization experiences a high turnover of members in key positions.
	MAC	People are constantly joining and leaving our teams.
	MAD	Our turnover seems higher than other organizations' turnover.
ZAG	AEB	Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
	AEA	New organization members are skilled in areas that complement the organization's mission.

The Cronbach's Alpha for the Personnel Management Refined Scale is 0.8227 (see Table 4-160). This indicates a high level of reliability within the scale. The workshop version of the Personnel Management Refined Scale is the same as the complete version, no items were deleted.

Table 4-160. Cronbach's Alpha Statistics for the Complete Refined Scale 9

Raw Scale Alpha = 0.8227		
Scale Items	Correlation with total	α if item deleted
MAA The organization experiences a high turnover of members.	0.7274	0.7628
MAB The organization experiences a high turnover of members in key positions.	0.6983	0.7701
MAC People are constantly joining and leaving our teams.	0.7491	0.7583
MAD Our turnover seems higher than other organizations' turnover.	0.6654	0.7799
AEB Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.	0.3383	0.8521
AEA New organization members are skilled in areas that complement the organization's mission.	0.4099	0.8271

Information Processing. The tenth and final Refined Scale is Information Processing. This refined scale consists of the ZMD, ZIB, and ZDF Scales (see Table 4-161). The refined scale contains items from the computer models, systematic problem

solving, information load, and communication areas. The Information Processing Refined Scale measures the ability of computer modeling, systematic problem solving and the level of information load to impact the organization's capacity to learn.

Table 4-161. Composition of Refined Scale 10 Information Processing

Information Processing		
Factor	Item	Item
ZMD	MDC	The organization uses computer models to test new strategies.
	MDB	The organization uses computer models to capture organizational knowledge.
	MDG	We use computer models to see how our decisions will affect the organization.
	MDD	The knowledge of experts from within the organization is captured on computer.
	MDE	The organizational expertise captured on computer is easily assessable to organization members.
	IEC	Statistical tools are used to organize data and draw inferences.
	IED	We construct and test hypotheses when trying to solve a problem.
	IEE	We use a step-by-step process for identifying, analyzing, and solving problems.
ZIB	IBF	I sometimes feel "bombarded" with information which confuses the issues.
	IBA	The amount of information that must be reviewed to make decisions is overwhelming.
	IBC	Our problem isn't too little information, it is too much information.
	IBE	I regularly feel overwhelmed by all the things going on in our organization.
	IBD	I am on too many teams to be effective.
ZDF	DAC	Written reports are used to disperse knowledge throughout the organization.X

The Cronbach's Alpha for this fourteen item refined scale is 0.7584 (See Table 4-162). This indicates a significant level of reliability among the scale items. The Workshop Version of the Information Processing Refined Scale has thirteen items with a Cronbach's Alpha of 0.7451. This indicates a significant level of reliability among the scale items at a level very close to the complete scale (see Table 4-163).

Table 4-162. Cronbach's Alpha Statistics for the Complete Information Processing Refined Scale

Raw Scale Alpha = 0.7584		
Scale Items	Correlation with total	α if item deleted
MDC The organization uses computer models to test new strategies.	0.6587	0.7135
MDB The organization uses computer models to capture organizational knowledge.	0.6037	0.7183
MDG We use computer models to see how our decisions will affect the organization.	0.6317	0.7191
MDD The knowledge of experts from within the organization is captured on computer.	0.5946	0.7196
MDE The organizational expertise captured on computer is easily assessable to organization members.	0.4201	0.7392
IEC Statistical tools are used to organize data and draw inferences.	0.5589	0.7236
IED We construct and test hypotheses when trying to solve a problem.	0.5727	0.7239
IEE We use a step-by-step process for identifying, analyzing, and solving problems.	0.6029	0.7195
IBF I sometimes feel "bombarded" with information which confuses the issues.	-0.0752	0.7836
IBA The amount of information that must be reviewed to make decisions is overwhelming.	0.1949	0.7590
IBC Our problem isn't too little information, it is too much information.	0.0123	0.7731
IBE I regularly feel overwhelmed by all the things going on in our organization.	-0.0001	0.7792
IBD I am on too many teams to be effective.	0.0112	0.7766
DAC Written reports are used to disperse knowledge throughout the organization.X	0.3649	0.7451

Table 4-163. Cronbach's Alpha Statistics for the Workshop Version of the Information Processing Refined Scale

Raw Scale Alpha = 0.7451		
Scale Items	Correlation with total	α if item deleted
MDC The organization uses computer models to test new strategies.	0.6407	0.6958
MDB The organization uses computer models to capture organizational knowledge.	0.5741	0.7030
MDG We use computer models to see how our decisions will affect the organization.	0.6151	0.7020
MDD The knowledge of experts from within the organization is captured on computer.	0.5615	0.7049
MDE The organizational expertise captured on computer is easily assessable to organization members.	0.3885	0.7270
IEC Statistical tools are used to organize data and draw inferences.	0.5318	0.7087
IED We construct and test hypotheses when trying to solve a problem.	0.5510	0.7081
IEE We use a step-by-step process for identifying, analyzing, and solving problems.	0.5946	0.7015
IBF I sometimes feel "bombarded" with information which confuses the issues.	-0.0376	0.7701
IBA The amount of information that must be reviewed to make decisions is overwhelming.	0.2037	0.7449
IBC Our problem isn't too little information, it is too much information.	0.0473	0.7587
IBE I regularly feel overwhelmed by all the things going on in our organization.	0.0276	0.7658
IBD I am on too many teams to be effective.	0.0467	0.7622

Summarization of the Refined Scales. A summary of the Cronbach's Alpha and number of items for each version of the Refined Scales is in Table 4-164. The complete version contains 118 items from the ten refined scales detailed above. A sample questionnaire using these items is found in Attachment E. The workshop version contains 80 items from the ten refined scales. A sample workshop questionnaire is found in Attachment F. Multiple versions of the questionnaire are provided to facilitate the adaptation to future research objectives and operational applications.

Table 4-164. Summarization of Refined Scales

Refined Scale Name	Complete Version		Workshop Version	
	# of items	Cronbach's α	# of items	Cronbach's α
1. Commitment to Learning	21	0.9463	13	0.8991
2. Internal Interaction	7	0.8167	5	0.7412
3. Customer and Constituent Learning	9	0.9326	6	0.9066
4. Knowledge Flow	10	0.8962	6	0.8240
5. Strategic Thinking	13	0.8962	7	0.8163
6. Soft Information Storage	3	0.8201	3	0.8201
7. Organizational Bureaucracy	16	0.9120	9	0.8505
8. Pursuit of Improvement	19	0.9293	12	0.8960
9. Personnel Management	6	0.8227	6	0.8227
10. Information Processing	14	0.7584	13	0.7451
Totals	118	0.8730*	80	0.8322*

* This number represents the average Cronbach's Alpha for all refined scales.

Summary

This Chapter began with a discussion of the details concerning the administration of the pilot questionnaire. The sample size used for this analysis was 108. The demographic statistics show that the average respondent was a male, between 20 - 30 years old, in middle management, with a college degree.

The first large section of this chapter was a analysis of the reliability of the initial 27 scales made of 197 items. Cronbach's coefficient of reliability (α) was used to evaluate which items and scales could be eliminated from further analysis. The initial scales had Cronbach's Alpha values ranging from 0.9378 to 0.3616. At the conclusion of the analysis 26 scales consisting of 119 items remained. These revised scales had Cronbach's Alpha values ranging from 0.9332 to 0.7725.

Confirmatory factor analysis was then conducted using the 26 revised scales. Twenty-two significant factors were presented with eigenvalues ranging from 7.79 to

1.67. These factors confirmed 22 of the 26 revised scales, approximately 85%.

Cronbach's Alpha values for the resulting factors were presented that ranged from 0.9326 to 0.7725.

Composite Z-factors were developed representing the 22 factors identified in the confirmatory analysis. Exploratory factor analysis using these composite factors produced five significant scale factors that were divided into refined scales. Ten refined scales were presented that represented new measures of organizational learning potential. Two versions of each revised scale were presented, a complete version and a abbreviated workshop version. The complete version of the 10 refined scales contains 118 items with Cronbach's Alphas ranging from 0.7584 to 0.9463. The abbreviated workshop version of the 10 refined scales contains 80 items with Cronbach's Alpha values ranging from 0.7412 to 0.9066.

The following chapter will describe the conclusions reached as a result of this research and recommendations for further research.

V. Conclusions and Recommendations

Chapter Overview

This chapter contains the conclusions arrived at during the course of this research and recommendations for follow on research in the area of organizational learning. The conclusions will be presented in the order of the preceding chapters. First, conclusions resulting from the literature review will be addressed. In the following section conclusions developed through implementation of the methodology described in Chapter III are presented. Finally, the conclusions derived from analysis of the data collected and presented in Chapter IV of this research project are presented.

The next major section of this chapter contains recommendations for additional research in the area of organizational learning. The chapter concludes with a brief review of the research objectives for this project.

Conclusions

Conclusions From the Literature Review. The literature on organizational learning was rich yet did not appear to be very organized as a whole. Researchers have failed to agree on a common definition for organizational learning. Different schools of organizational learning seem to have developed, cognitive development versus behavioral development, but these are not mutually-exclusive categories. A hierarchy of learning seemed to be emerging from the literature as well. Several researchers referred to different levels of learning aspiring to define the next highest level. This leads to considerable confusion for the practitioner desiring to apply the research.

Extracting the theoretical parameters of organizational learning from the literature was a tedious process. Too much of the research is theoretical with very little empirical data backing it up. Many of the researchers failed to carefully define the parameters that

were proposed, leaving considerable interpretation to anyone wishing to study them further.

The potential benefits of organizational learning justify the empirical research necessary to refine the current understanding of this strategic organizational process.

Conclusions From the Methodology. The combination of Cronbach's reliability coefficient (α) with factor analysis was very effective for creating reliable scales. The factor analysis provided a very good starting point from which logical adjustments could be made based on other factors. The Cronbach's alpha analysis would then either confirm or deny a modified scale. This system provided for a healthy combination of science and art in our analysis. The biggest limiting factor of this analysis is the small sample size. This issue is addressed in the recommendations for future research section of this chapter as well.

Conclusions From the Data. The original scales developed for the 27 parameters identified in the literature review were very reliable. Only two of the original scales were dropped from the analysis due to low scale reliability. The average Cronbach's alpha value for the remaining scales was well above .80 indicating a high level of scale reliability overall.

The confirmatory factor analysis indicated that most of the items within the revised scales did in fact belong together. A total of 85%, or 22 of the 26 scales analyzed, were confirmed as factors with Cronbach's Alpha values ranging from 0.7725 to 0.9236.

Ten refined factors were also developed from the 22 factors that were confirmed. The complete version of the 10 refined scales contains 118 items with Cronbach's Alphas ranging from 0.7584 to 0.9463. The abbreviated workshop version of the 10 refined scales contains 80 items with Cronbach's Alpha values ranging from 0.7412 to 0.9066. These composite factors highlight interesting relationships between parameters that were

not easily discernible from the original scales and others that were not so subtle. The following ten paragraphs highlight each of the refined scales and identifies which of the original scales the items belonged to.

Commitment to Learning. The Commitment to Learning Refined Scale combines items addressing organizational and personal commitment to learning, rewards and shared vision. This refined scale measures the organizations commitment to learning at both the personal and leadership levels. It also measures the degree to which individuals are rewarded for learning and the overall sense of shared vision among the organization's members. The Cronbach's Alpha for the twenty-one item Commitment to Learning Refined Scale is 0.9463. The thirteen item workshop version of the scale has a Cronbach's Alpha value of .8991.

Internal Interaction. The Internal Interaction Refined Scale combines items addressing personnel rotation, organizational self-appraisal, communication, and performance monitoring. This scale measures the degree of interaction that occurs among the different functions, projects, and departments in an organization. The Cronbach's Alpha for the seven item Internal Interaction Refined Scale is 0.8167. The five item workshop version of the scale has a Cronbach's Alpha value of .7412.

Customer and Constituent Learning. The Customer and Constituent Learning Refined Scale contains items from two primary areas, customer opinion and self-appraisal. This refined scale measures the degree that the organization seeks information from its customers and its members. The Cronbach's Alpha for the nine item Customer and Constituent Learning Refined Scale is .9326. The six item workshop version of the Customer and Constituent Learning Refined Scale has a Cronbach's Alpha of 0.9066.

Knowledge Flow. The Knowledge Flow Refined Scale combines information access items with dialogue items. The result is a scale that measures the degree to which information is assessable within the organization and how openly and

honestly that information can be discussed. The Cronbach's Alpha for the Knowledge Flow Refined Scale is 0.8962. The six item workshop version of the scale has a Cronbach's Alpha of 0.8240.

Strategic Thinking. The Strategic Thinking Refined Scale combines items from the scenarios, lessons learned and personnel rotation areas. This scale measures the degree to which the organization examines its past, through good and bad lessons learned, and its future, through scenarios, to develop appropriate competitive strategies. The thirteen item Strategic Thinking Refined Scale has a Cronbach's Alpha of 0.8962. The workshop version contains seven items and has a Cronbach's Alpha of 0.8163.

Soft Information Storage. The Soft Information Storage Refined Scale is composed entirely of items from the initial Soft Information Storage Scale. This scale measures the amount of unwritten rules and procedures that govern behavior in the organization. The Cronbach's Alpha for the three item Soft Information Storage Scale is 0.8201. No items were dropped from the scale for the workshop version.

Organizational Bureaucracy. The Organizational Bureaucracy Refined Scale combines items addressing hard information storage, unlearning, communication, and systems thinking. The scale as a whole is the measure of the level of bureaucracy within the organization. It accesses the organizations reliance on hard information i.e. regulations, formal documentation, etc. The scale measures how difficult it is to change the statues quo, and to disperse knowledge within the organization. The Cronbach's Alpha for the Organizational Bureaucracy Refined Scale is 0.9120. The workshop version of the scale contains nine items and has a Cronbach's Alpha of 0.8505

Pursuit of Improvement. The Pursuit of Improvement Refined Scale contains items from experimentation, vicarious learning, performance monitoring, systems thinking, grafting, and mental models. This scale is measuring the organization's ability to seek and implement new ways of doing things. These new ways are found by

experimenting, looking at the way others do things, and by bringing in outside experts. This scale also assess the organization's ability to adjust to change and evaluate the potential improvements of a change. The Cronbach's Alpha for the nineteen item Pursuit of Improvement Refined Scale is 0.9293. The workshop version of the scale contains twelve items with a Cronbach's Alpha of 0.8960.

Personnel Management. The Personnel Management Refined Scale measures the amount of turnover experienced by an organization and the type of individuals hired by the organization. The Cronbach's Alpha for the Personnel Management Refined Scale is 0.8227. The workshop version of the Personnel Management Refined Scale is the same as the complete version, no items were deleted.

Information Processing. The Information Processing Refined Scale contains items from the computer models, systematic problem solving, information load, and communication areas. The scale measure the ability of computer modeling, systematic problem solving and the level of information load to impact the organizations capacity to learn. The Cronbach's Alpha for this fourteen item refined scale is 0.7584. The Workshop Version of the Information Processing Refined Scale has thirteen items with a Cronbach's Alpha of 0.7451.

Recommendations

Recommendations Concerning the Questionnaires. Three questionnaires were developed through the course of this research, see Appendices D through F. The questionnaire found in Appendix D can be used to test the 26 parameters extracted from the research and refined through correlation analysis using Cronbach's reliability coefficient. This questionnaire consists of 119 items broken into 26 parameters.

The questionnaires in Appendices E and F test the 10 refined learning factors extracted from the data using factor analysis. They represent the compression of the 26

revised parameter into 10 refined organizational learning factors. The questionnaire found in Appendix E represents the complete set of 118 items. The questionnaire in Appendix F is a shortened workshop version of the questionnaire that contains 80 items.

Recommendations for Future Research. The first recommendation for future research is to retest all of the alpha values. As previously discussed, a much larger sample size is required to verify some of the conclusions that have been drawn in this research. This is a particular concern for factor analysis where the conventional rules dictate a much larger sample size. A broader sample should also be used. This research used a sample composed primarily of military officers working in military organizations. The results of this research should be contrasted to those of a sample composed of civilians in a non-military organization.

The two versions of the refined factor questionnaire, the complete and workshop versions, should be administered to the same group. Results obtained from the two questionnaires should then be compared to determine if the results vary significantly. This test will assess the capability of the shorter workshop version to capture the same meaning conveyed in the larger complete version.

Assuming these questionnaires are to be used as diagnostic tools to assess the overall learning ability of an organization, a clever visual/graphical format for presenting the overall results should be developed. A set of recommendations to help strengthen learning capability by individual parameter should also be developed. These recommendations should provide practical tools that can be implemented where possible to increase the organization's ability to learn. *The Fifth Discipline Fieldbook*, written by Peter Senge and several associates, is a good example of this kind of resource. The book provides strategies and tools for building learning organizations.

Review of Research Objectives

The first research objective, to identify the theoretical writings related to organizational learning theory, was met in Chapter II. Fourteen different theories of organizational learning were identified and discussed.

The second objective, to define the theoretical parameters that impact an organization's learning potential, was met in Chapter II as well. Fifty potential organizational learning parameters were extracted from the literature and defined. The fifty parameters were refined to a listing of 27 composite parameters.

The 27 learning parameters were translated into 193 behavioral statements that made up a pilot organizational learning questionnaire. This questionnaire was developed in response to the third research objective, to develop a method to measure organizational learning potential.

In response to the fourth objective, to test the reliability of the scales used to measure the theoretical parameters and refine the concepts associated with organizational learning, the pilot questionnaire was revised. Correlation analysis was used to revise the initial scales. As a result the total number of parameters dropped to 26 and the questionnaire consisted of 119 behavioral statements. A revised questionnaire containing the 119 behavioral statements can be found in Appendix D.

Finally, factor and correlation analysis was used to collapse the 26 revised parameters into 10 refined learning factors. Two questionnaires were developed to operationalize these factors that can be found in Appendices E and F.

This research met each of the objectives established at its inception. It provides a solid foundation for future research into organizational learning. In addition, it provides the basis for a highly desirable organizational learning diagnostic tool. A tool that can help bridge the gap between theory and application for those organizations willing to learn.

Appendix A. Pilot Questionnaire

MEMORANDUM FOR QUESTIONNAIRE RESPONDENTS

FROM: AFIT/LAA (Capt Jeff Loyd)
2950 P Street
WPAFB, OH 45433-7765

SUBJECT: Organizational Learning Questionnaire

1. A multitude of theoretical organizational learning parameters have been identified by various researchers with very little data collected to substantiate them. The purpose of this questionnaire is to gather data that can be used to validate theorized organizational learning parameters. Valid organizational learning parameters can then be used as diagnostics to help measure and enhance an organization's potential for learning.
2. I appreciate your time and efforts in support of this project. Your help is strictly voluntary. Under no circumstances will you be compelled to participate in this research. If you begin but decide not to continue, simply hand back these papers to the person who gave them to you or return them to my mailbox. I want to assure you that I will hold in strictest confidence any of the answers you provide. The demographic information I've asked you to provide at the beginning of the questionnaire will be used for analysis only and is not complete enough to identify you.
3. It is my hope that this research will contribute to the body of knowledge concerning organizational learning. I believe that only you, an organization member, can adequately describe your organization's commitment to learning.
4. It would help me greatly if you could please fill out the attached questionnaire and return it to me by 09 June 95. If you have any questions please contact me at DSN: 785-7777 ext. 2164 or Lt Col Wayne Stone at DSN: 785-7777 ext. 3346.

JEFFERY D. LOYD, Capt, USAF
Graduate Student, GCA-95S
Graduate School of Logistics and
Acquisition Management

Attachment:

1. Questionnaire

Organizational Learning Questionnaire

Version A

Instructions

This questionnaire consists of a number of short behavioral statements. Please respond to the statements quickly, without too much thought, using the scale provided. The estimated time to complete the questionnaire is less than 30 minutes. All items are answered by filling in the appropriate spaces on the response sheet provided (AFIT Form 11E). **Please answer all of the questions in respect to the organization you were a member of before coming to AFIT.**

Please observe the following:

Use a No. 2 pencil.

Do not write your name anywhere on the survey, to ensure confidentiality.

Do not fold, bend, staple or otherwise mutilate the AFIT Form 11E.

Mark only one answer when responding to each question.

Completely fill in the numbered circle corresponding to your opinion on each statement.

Cleanly erase any responses you wish to change.

Please put the completed AFIT Form 11E, questionnaire, and any comments in the return envelope and place in my mailbox in room 314 by 9 June 95.

Again, thank you for your participation!

Demographic Questions

Please answer the following items concerning yourself. The information will be used to describe groups not individuals.

1. About how long have you been assigned to the organization?

1. Less than 6 months
2. 7-12 months
3. 13-18 months
4. 19-23 months
5. 2-3 years
6. 4-5 years
7. 6 years or more

2. Which category best describes your level in the organization?

1. Operational (non-supervisory)
2. Supervisory
3. Middle-management
4. Staff / Non-managerial
5. Executive management

3. What sex are you?

1. Male
2. Female

4. What was your age on your last birthday?

1. Less than 20 years
2. 20 - less than 30 years
3. 30 - less than 40 years
4. 40 - less than 50 years
5. 50 - less than 60 years
6. More than 60 years

5. If you are in the military what is your rank? (Leave blank if not applicable)

1. O1
2. O2
3. O3
4. O4
5. O5
6. O6 or above
7. other

6. If you are a civilian what is your grade? (Leave blank if not applicable)

1. GS 5 - GS 6
2. GS 7 - GS 8
3. GS 9 - GS 10
4. GS 11 - GS 12
5. GM 13 - GM 15
6. other

7. What is the highest education level you have completed?

1. Grade school
2. High school
3. Technical/associate degree
4. College degree
5. Masters degree
6. Masters degree plus

8. Testing new ideas/concepts is encouraged in this organization.
9. Testing new products/services is encouraged in this organization.
10. We are encouraged to search for new knowledge in this organization.
11. We are encouraged to test new knowledge in this organization.
12. We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.
13. There is a formal process for testing conducted by the organization.
14. We are encouraged to try new ways of doing things.
15. We are trained to perform and evaluate the "experiments" we do.
16. We are trained to use statistical methods to evaluate data.
17. We are trained to use "creativity" techniques to come up with new ideas/concepts/products/processes.
18. The organization actively solicits information about problems from its members.
19. Organization members receive information on problems identified by other members.
20. The organization takes action to correct problems identified by its members.
21. The organization involves members in planning actions to correct problems.
22. The organization involves members in implementing actions to correct identified problems.
23. We monitor the performance of comparable organizations.
24. We search for information about what our competitors are doing.
25. We attempt to identify processes used by others that could be adapted for use within our organization.
26. When organizations similar to ours experience failures, we analyze these failures to improve our organization.
27. We have adopted processes from other organizations.
28. The organization provides trade journals and publications for use by its members.

29. We are given time to read trade journals and publications.
30. The organization has clearly identified who its customers are.
31. The organization continuously solicits feedback from its customers.
32. The organization uses customer feedback to improve its products/services.
33. The organization's goals are tied to customer satisfaction.
34. Individual/team goals in the organization are tied to customer satisfaction.
35. I can see how my job relates to customer satisfaction.
36. We proactively seek information from customers even when there doesn't appear to be a problem.
37. We ask our customers how we rate in comparison to similar organizations.
38. We ask customers how we can change our products/services to better meet their needs.
39. We ask customers about creative uses for our products/services.
40. We include customers in new product/process design efforts.
41. New organization members are skilled in areas that complement the organization's mission.
42. Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
43. We look outside the organization for needed expertise.
44. Management brings in outside experts to help us solve problems.
45. We have used outside consultants to help us solve problems.
46. The organization has established internal performance standards.
47. Performance standards are communicated to all organization members.
48. The organization continuously assesses its performance against internal standards.
49. The organization continuously assesses its performance against industry standards.
50. The organization's performance against the standards is communicated to all organization members.

51. We have identified those organizations or people who have a stake in our success.
52. We have identified those things about our performance that are important to external stakeholders.
53. Severe consequences exist if the organization or its members fail.
54. Significant rewards exist if the organization or its members succeed.
55. Organization members are under pressure to perform.
56. Failure is never acceptable in our organization.
57. We are encouraged to learn from our mistakes.
58. I believe that I have experienced a stress-related illness.
59. Others in our organization have experienced stress-related illnesses.
60. Stress-related illnesses are common in our organization.
61. Our organization sponsors stress reduction activities.
62. Our organization disperses knowledge quickly.
63. Our organization disperses knowledge efficiently.
64. Written reports are used to disperse knowledge throughout the organization.
65. Oral reports are used to disperse knowledge throughout the organization.
66. Conversations "around the water cooler" are encouraged.
67. We use electronic media (E-mail, bulletin boards, etc.) to disperse knowledge.
68. Mentoring is encouraged in the organization.
69. Communication skills are taught within the organization.
70. Organization members socialize together at lunchtime and breaks.
71. Organization members communicate with those in different functions, departments, and projects.
72. We hold meetings when it is necessary to "get the word out" quickly.
73. I feel that I get the information that I need to do my job when I need it.

74. Organization members are willing to eliminate hidden agendas.
75. Organization members try to understand the motives and reasoning of others without passing judgment.
76. Organization members feel free to express their true opinions without fear of reprisal.
77. Organizations members feel that it is alright to disagree with the boss.
78. Negative feedback is valued as a positive contribution to the organization.
79. Honest opinions are valued more than noncontroversial opinions.
80. Organizational members can share ideas in an environment of openness and trust.
81. We regularly analyze the assumptions which underlie our decisions.
82. We actively analyze successes within the organization.
83. We actively analyze failures within the organization.
84. Lessons learned from organizational success are accessible to members.
85. Lessons learned from organizational failures are accessible to members.
86. The organization values the contribution failures can make to its lessons learned.
87. Organization members apply lessons learned to new projects.
88. We have a system for keeping track of our successes and failures.
89. The organization encourages members to master different functions.
90. The organization requires members to rotate to other functions to gain experience.
91. A total organization perspective is favored over a functional perspective.
92. Broad-based organizational experience is valued over strictly functional experience in the organization.
93. A regular rotation plan is part of each individuals career development plan.
94. We use cross-functional teams to help solve problems.
95. Organization members have broad access to all organization information except personnel records.

96. Information is not restricted within the organization.
97. Information is easy to obtain within the organization.
98. Members are sometimes denied information that they need to know.
99. The organization treats information as power.
100. The organization withholds information for no clear reason.
101. Information is readily shared between organizational units.
102. Easy and assessable methods exist for all organization members to transfer information within the organization.
103. Commonly held assumptions about the organization govern day to day decisions.
104. Underlying assumptions about the organization's environment can be constructively challenged.
105. Underlying assumptions that govern the organization's actions can be changed.
106. Underlying assumptions are changed when they are challenged and proven wrong.
107. When making decisions the organization analyses the assumptions underlying the alternative decisions.
108. We have commonly held beliefs about the way the organization should "behave."
109. The amount of information that must be reviewed to make decisions is overwhelming.
110. I often have too much information when making decisions.
111. Our problem isn't too little information, it is too much information.
112. I am on too many teams to be effective.
113. I regularly feel overwhelmed by all the things going on in our organization.
114. I sometimes feel "bombarded" with information which confuses the issues.
115. The organization is very slow to accept new ideas.
116. The organization is very slow to change old ways when better ways are identified.

117. The organization has very strong opinions about the way things are done that cannot be easily changed.
118. Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
119. A lot of negative information must be received before we change the ways we do things.
120. The organization tends to hold on to old ideas even when we know that they are wrong.
121. The organization evaluates how changes in the environment may impact it's future.
122. The organization considers how specific sets of changes in the environment could change the way the organization operates.
123. The organization tries to anticipate environmental changes and react to them before being forced to change.
124. The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
125. We try to visualize the future in order to build contingency plans.
126. We encourage development of alternative views of where we are going.
127. We use alternative future possibilities to test the quality of our decisions.
128. The organization uses the scientific method to diagnose problems.
129. The organization uses data to support decision making.
130. Statistical tools are used to organize data and draw inferences.
131. We construct and test hypotheses when trying to solve a problem.
132. We use a step-by-step process for identifying, analyzing, and solving problems.
133. The environment members work in is too complex to understand.
134. Our future organizational environment looks stable.
135. The organization is confident that it can predict its future environment.
136. The number of external organizations we must deal with seems to be increasing.
137. The speed with which our working environment is changing seems to be increasing.

138. The organization always looks for the long term solution rather than a quick fix.
139. The organization is careful to fix the problem not just the symptoms.
140. When solving problems the highest impact solution is sought out.
141. The organization considers the whole process rather than static “snap-shots” when problem solving.
142. Organization members view the organization as a system.
143. When solving problems the total-organization and its interrelationships are considered.
144. When solving a problem we consider the impact of the solution on all parts of the organization.
145. We perform “deep” problem analysis to ensure effective problem solutions.
146. We believe that a change in one part of our organization affects all parts.
147. The organization experiences a high turnover of members.
148. The organization experiences a high turnover of members in key positions.
149. People are constantly joining and leaving our teams.
150. Our turnover seems higher than other organizations’ turnover.
151. The knowledge lost from members leaving the organization is greater than the knowledge gained from the fresh ideas of people entering the organization.
152. It is better to hire new people with fresh ideas than to retain experienced people with organizational knowledge.
153. Standard operating procedures for the organization are written down.
154. Important processes in the organization are documented.
155. Standard operating procedures document how the procedures are actually accomplished.
156. Documentation is updated to reflect changes in the procedures and processes.
157. The organization maintains an archive of all documentation and records.
158. Our rules and regulations constrain us more than they guide us.

- 159. Our rules and regulations help us make consistent decisions when we are faced with new situations.
- 160. Many procedures are not written down, but everyone knows what they are.
- 161. The organization has standard ways of thinking about things that are not written down.
- 162. The organization has lots of unwritten rules.
- 163. The way we say we do things and the way that things actually get done are completely different.
- 164. We would operate just as effectively without our written rules and regulations.
- 165. The organization uses computer-based expert systems.
- 166. The organization uses computer models to capture organizational knowledge.
- 167. The organization uses computer models to test new strategies.
- 168. The knowledge of experts from within the organization is captured on computer.
- 169. The organizational expertise captured on computer is easily assessable to organization members.
- 170. Our computers are important to our decision processes.
- 171. We use computer models to see how our decisions will affect the organization.
- 172. Our computers are used more for administrative tasks than problem-solving tasks.
- 173. Continuous learning is a recognized way of life in the organization.
- 174. The organization's leaders are committed to organizational learning.
- 175. The organization's leaders work to provide a better environment for learning.
- 176. Creativity is encouraged in the organization.
- 177. The organization is concerned about me as an individual.
- 178. The organization is committed to my professional development.
- 179. The organization has helped me develop a plan for my professional growth.
- 180. My manager solicits my opinions, values, solutions, and ideas.

181. I value my involvement with the organization.
182. I will go out of my way to make the organization a success.
183. I personally committed to learning and growing.
184. I care about the organization and what it is doing.
185. When the organization is successful I feel successful.
186. I take the initiative to learn about new technologies and processes associated with my job.
187. I try to know as much about the organization and its processes as possible.
188. I know the organization's vision for the future.
189. I know and share the values of the organization.
190. I feel that my personal goals align with the goals of the organization.
191. Members of the organization know where they fit into the organization's overall vision.
192. Managers take positive action to transmit the organization's vision to all members.
193. I feel a personal commitment to helping the organization make its vision a reality.
194. The organizational reward system promotes my learning efforts.
195. Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
196. Promotions and compensation are tied to the intangible factors the organizations is trying to promote such as teamwork or quality improvement.
197. The organization rewards risk taking.
198. The organization rewards personal development.
199. When organizational groups discover better ways of doing business, the organization adequately recognizes their efforts.
200. The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.

Appendix B. Respondent Comments

The following comments were provided by questionnaire respondents.

May be helpful to have an "N/A" or "Do Not Know" option. I used borderline in those cases.

"Organization" can be a very vague term. It can range from a unit with a singular mission and 100 people to a varied mission (support group) with 1,000 people. You probably want to know this because it would probably skew your results. e.g. I come from a very small unit with a very unusual mission.

Some of the questions are repetitive or so it seemed.

This was painfully long!

Too long.

The organization I came from turned over 5 program directors in about three and one-half years. As a result, any organizational vision we had would go through a complete overhaul about every six months. Additionally, it was a compartmentalized (for security reasons) basket SPO so by design none of us really knew what the other was doing.

Excellent survey, I enjoyed it!

Appendix C. Revised Scales

The following tables represent the revised scales and items following the Cronbach's coefficient of reliability analysis. The following represents the coding for the first two letters for tables C-2 through C-27.

Table C-1. Revised Learning Category and Scale Name Codes

A = Knowledge Acquisition
AA = Experimentation
AB = Self-Appraisal
AC = Vicarious Learning
AD = Customer Opinion
AE = Grafting
AF = Performance Monitoring
D = Information Distribution
DA = Communication
DB = Dialogue
DC = Lessons Learned
DD = Personnel Rotation
DE = Information Access
I = Information Interpretation
IA = Mental Models
IB = Information Load
IC = Unlearning
ID = Scenarios
IE = Systematic Problem Solving
IG = Systems Thinking
M = Organizational Memory
MA = Membership Attrition
MB = Hard Information Storage
MC = Soft Information Storage
MD = Computer Models
C = Organizational Culture
CA = Organizational Commitment to Learning
CB = Personal Commitment to Learning
CE = Personal Commitment to the Organization
CC = Shared Vision
CD = Organizational Rewards

Tables C-2 through C-27 identify the revised variable code names assigned to each of the scale items after the initial Cronbach's Alpha scale reliability analysis.

Table C-2. Revised Item Codes for the Experimentation Scale

Experimentation Statements	
AAB	Testing new products/services is encouraged in this organization.
AAC	We are encouraged to search for new knowledge in this organization.
AAD	We are encouraged to test new knowledge in this organization.
AAE	We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.
AAG	We are encouraged to try new ways of doing things.

Table C-3. Revised Item Codes for the Self-Appraisal Scale

Self-Appraisal Statements	
ABA	The organization actively solicits information about problems from its members.
ABB	Organization members receive information on problems identified by other members.
ABC	The organization takes action to correct problems identified by its members.
ABD	The organization involves members in planning actions to correct problems.
ABE	The organization involves members in implementing actions to correct identified problems.

Table C-4. Revised Item Codes for the Vicarious Learning Scale

Vicarious Learning Statements	
ACA	We monitor the performance of comparable organizations.
ACB	We search for information about what our competitors are doing.
ACC	We attempt to identify processes used by others that could be adapted for use within our organization.
ACD	When organizations similar to ours experience failures, we analyze these failures to improve our organization.

Table C-5. Revised Item Codes for the Customer Opinion Scale

Customer Opinion Statements	
ADB	The organization continuously solicits feedback from its customers.
ADC	The organization uses customer feedback to improve its products/services.
ADD	The organization's goals are tied to customer satisfaction.
ADE	Individual/team goals in the organization are tied to customer satisfaction.
ADG	We proactively seek information from customers even when there doesn't appear to be a problem.
ADI	We ask customers how we can change our products/services to better meet their needs.

Table C-6. Revised Item Codes for the Grafting Scale

Grafting Statements	
AEA	New organization members are skilled in areas that complement the organization's mission.
AEB	Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
AEC	We look outside the organization for needed expertise.
AED	Management brings in outside experts to help us solve problems.
AEE	We have used outside consultants to help us solve problems.

Table C-7. Revised Item Codes for the Performance Monitoring Scale

Performance Monitoring Statements	
AFA	The organization has established internal performance standards.
AFC	The organization continuously assesses its performance against internal standards.
AFD	The organization continuously assesses its performance against industry standards.
AFE	The organization's performance against the standards is communicated to all organization members.
AFG	We have identified those things about our performance that are important to external stakeholders.

Table C-8. Revised Item Codes for the Communication Scale

Communication Statements	
DAA	Our organization disperses knowledge quickly.
DAB	Our organization disperses knowledge efficiently.
DAC	Written reports are used to disperse knowledge throughout the organization.
DAJ	Organization members communicate with those in different functions, departments, and projects.
DAL	I feel that I get the information that I need to do my job when I need it.

Table C-9. Revised Item Codes for the Dialogue Scale

Dialogue Statements	
DBA	Organization members are willing to eliminate hidden agendas.
DBB	Organization members try to understand the motives and reasoning of others without passing judgment.
DBC	Organization members feel free to express their true opinions without fear of reprisal.
DBD	Organizations members feel that it is alright to disagree with the boss.
DBG	Organizational members can share ideas in an environment of openness and trust.

Table C-10. Revised Item Codes for the Lessons Learned Scale

Lessons Learned Statements	
DCB	We actively analyze failures within the organization.
DCC	Lessons learned from organizational success are accessible to members.
DCD	Lessons learned from organizational failures are accessible to members.
DCE	The organization values the contribution failures can make to its lessons learned.
DCG	We have a system for keeping track of our successes and failures.

Table C-11. Revised Item Codes for the Personnel Rotation Scale

Personnel Rotation Statements	
DDA	The organization encourages members to master different functions.
DDB	The organization requires members to rotate to other functions to gain experience.
DDC	A total organization perspective is favored over a functional perspective.
DDD	Broad-based organizational experience is valued over strictly functional experience in the organization.

Table C-12. Revised Item Codes for the Information Access Scale

Information Access Statements	
DEA	Organization members have broad access to all organization information except personnel records.
DEB	Information is not restricted within the organization.
DEC	Information is easy to obtain within the organization.
DED R	Members are sometimes denied information that they need to know.
DEG	Information is readily shared between organizational units.

Table C-13. Revised Item Codes for the Mental Models Scale

Mental Models Statements	
IAB	Underlying assumptions about the organization's environment can be constructively challenged.
IAC	Underlying assumptions that govern the organization's actions can be changed.
IAE	When making decisions the organization analyses the assumptions underlying the alternative decisions.
IAF	We have commonly held beliefs about the way the organization should "behave."

Table C-14. Revised Item Codes for the Information Load Scale

Information Load Statements	
IBA R	The amount of information that must be reviewed to make decisions is overwhelming.
IBC R	Our problem isn't too little information, it is too much information.
IBD R	I am on too many teams to be effective.
IBE R	I regularly feel overwhelmed by all the things going on in our organization.
IBF R	I sometimes feel "bombarded" with information which confuses the issues.

Table C-15. Revised Item Codes for the Unlearning Scale

Unlearning Statements	
ICA R	The organization is very slow to accept new ideas.
ICC R	The organization has very strong opinions about the way things are done that cannot be easily changed.
ICD R	Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
ICE R	A lot of negative information must be received before we change the ways we do things.
ICF R	The organization tends to hold on to old ideas even when we know that they are wrong.

Table C-16. Revised Item Codes for the Scenarios Scale

Scenarios Statements	
IDB	The organization considers how specific sets of changes in the environment could change the way the organization operates.
IDC	The organization tries to anticipate environmental changes and react to them before being forced to change.
IDD	The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
IDE	We try to visualize the future in order to build contingency plans.
IDF	We encourage development of alternative views of where we are going.

Table C-17. Revised Item Codes for the Systematic Problem Solving Scale

Systematic Problem Solving Statements	
IEA	The organization uses the scientific method to diagnose problems.
IEC	Statistical tools are used to organize data and draw inferences.
IED	We construct and test hypotheses when trying to solve a problem.
IEE	We use a step-by-step process for identifying, analyzing, and solving problems.

Table C-18. Revised Item Codes for the Systems Thinking Scale

Systems Thinking Statements	
IGB	The organization is careful to fix the problem not just the symptoms.
IGD	The organization considers the whole process rather than static "snap-shots" when I problem solving.
IGF	When solving problems the total-organization and its interrelationships are considered.
IGG	When solving a problem we consider the impact of the solution on all parts of the organization.
IGH	We perform "deep" problem analysis to ensure effective problem solutions.
IGI	We believe that a change in one part of our organization affects all parts.

Table C-19. Revised Item Codes for the Membership Attrition Scale

Membership Attrition Statements	
MAA R	The organization experiences a high turnover of members.
MAB R	The organization experiences a high turnover of members in key positions.
MAC R	People are constantly joining and leaving our teams.
MAD R	Our turnover seems higher than other organizations' turnover.

Table C-20. Revised Item Codes for the Hard Information Storage Scale

Hard Information Storage Statements	
MBA	Standard operating procedures for the organization are written down.
MBB	Important processes in the organization are documented.
MBC	Standard operating procedures document how the procedures are actually accomplished.
MBD	Documentation is updated to reflect changes in the procedures and processes.

Table C-21. Revised Item Codes for the Soft Information Storage Scale

Soft Information Storage Statements	
MCA	Many procedures are not written down, but everyone knows what they are.
MCB	The organization has standard ways of thinking about things that are not written down.
MCC	The organization has lots of unwritten rules.

Table C-22. Revised Item Codes for the Computer Models Scale

Computer Models Statements	
MDB	The organization uses computer models to capture organizational knowledge.
MDC	The organization uses computer models to test new strategies.
MDD	The knowledge of experts from within the organization is captured on computer.
MDE	The organizational expertise captured on computer is easily assessable to organization members.
MDG	We use computer models to see how our decisions will affect the organization.

Table C-23. Revised Item Codes for the Organizational Commitment to Learning Scale

Organizational Commitment to Learning Statements	
CAB	The organization's leaders are committed to organizational learning.
CAC	The organization's leaders work to provide a better environment for learning.
CAF	The organization is committed to my professional development.
CAG	The organization has helped me develop a plan for my professional growth.

Table C-24. Revised Item Codes for the Personal Commitment to Learning Scale

Personal Commitment to Learning Statements	
CBC	I personally committed to learning and growing.
CBF	I take the initiative to learn about new technologies and processes associated with my job.
CBG	I try to know as much about the organization and its processes as possible.

Table C-25. Revised Item Codes for the Personal Commitment to the Organization Scale

Personal Commitment to Learning Statements	
CBA	I value my involvement with the organization.
CBB	I will go out of my way to make the organization a success.
CBD	I care about the organization and what it is doing.
CBE	When the organization is successful I feel successful.

Table C-26. Revised Item Codes for the Shared Vision Scale

Shared Vision Statements	
CCB	I know and share the values of the organization.
CCC	I feel that my personal goals align with the goals of the organization.
CCD	Members of the organization know where they fit into the organization's overall vision.
CCE	Managers take positive action to transmit the organization's vision to all members.
CCF	I feel a personal commitment to helping the organization make it's vision a reality.

Table C-27. Revised Item Codes for the Organizational Rewards Scale

Organizational Rewards Statements	
CDA	The organizational reward system promotes my learning efforts.
CDB	Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
CDD	The organization rewards risk taking.
CDE	The organization rewards personal development.
CDG	The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.

Appendix D. Revised Questionnaire

The following scales and corresponding items represent the revised scales and items after the Cronbach's Alpha scale reliability analysis.

Experimentation Statements

1. Testing new products/services is encouraged in this organization.
2. We are encouraged to search for new knowledge in this organization.
3. We are encouraged to test new knowledge in this organization.
4. We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.
5. We are encouraged to try new ways of doing things.

Self-Appraisal Statements

6. The organization actively solicits information about problems from its members.
7. Organization members receive information on problems identified by other members.
8. The organization takes action to correct problems identified by its members.
9. The organization involves members in planning actions to correct problems.
10. The organization involves members in implementing actions to correct identified problems.

Vicarious Learning Statements

11. We monitor the performance of comparable organizations.
12. We search for information about what our competitors are doing.
13. We attempt to identify processes used by others that could be adapted for use within our organization.
14. When organizations similar to ours experience failures, we analyze these failures to improve our organization.

Customer Opinion Statements

15. The organization continuously solicits feedback from its customers.
16. The organization uses customer feedback to improve its products/services.
17. The organization's goals are tied to customer satisfaction.
18. Individual/team goals in the organization are tied to customer satisfaction.
19. We proactively seek information from customers even when there doesn't appear to be a problem.

20. We ask customers how we can change our products/services to better meet their needs.

Grafting Statements

- 21. New organization members are skilled in areas that complement the organization's mission.
- 22. Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
- 23. We look outside the organization for needed expertise.
- 24. Management brings in outside experts to help us solve problems.
- 25. We have used outside consultants to help us solve problems.

Performance Monitoring Statements

- 26. The organization has established internal performance standards.
- 27. The organization continuously assesses its performance against internal standards.
- 28. The organization continuously assesses its performance against industry standards.
- 29. The organization's performance against the standards is communicated to all organization members.
- 30. We have identified those things about our performance that are important to external stakeholders.

Communication Statements

- 31. Our organization disperses knowledge quickly.
- 32. Our organization disperses knowledge efficiently.
- 33. Written reports are used to disperse knowledge throughout the organization.
- 34. Organization members communicate with those in different functions, departments, and projects.
- 35. I feel that I get the information that I need to do my job when I need it.

Dialogue Statements

- 36. Organization members are willing to eliminate hidden agendas.
- 37. Organization members try to understand the motives and reasoning of others without passing judgment.
- 38. Organization members feel free to express their true opinions without fear of reprisal.
- 39. Organizations members feel that it is alright to disagree with the boss.
- 40. Organizational members can share ideas in an environment of openness and trust.

Lessons Learned Statements

- 41. We actively analyze failures within the organization.

- 42. Lessons learned from organizational success are accessible to members.
- 43. Lessons learned from organizational failures are accessible to members.
- 44. The organization values the contribution failures can make to its lessons learned.
- 45. We have a system for keeping track of our successes and failures.

Personnel Rotation Statements

- 46. The organization encourages members to master different functions.
- 47. The organization requires members to rotate to other functions to gain experience.
- 48. A total organization perspective is favored over a functional perspective.
- 49. Broad-based organizational experience is valued over strictly functional experience in the organization.

Information Access Statements

- 50. Organization members have broad access to all organization information except personnel records.
- 51. Information is not restricted within the organization.
- 52. Information is easy to obtain within the organization.
- 53. Members are sometimes denied information that they need to know.
- 54. Information is readily shared between organizational units.

Mental Models Statements

- 55. Underlying assumptions about the organization's environment can be constructively challenged.
- 56. Underlying assumptions that govern the organization's actions can be changed.
- 57. When making decisions the organization analyses the assumptions underlying the alternative decisions.
- 58. We have commonly held beliefs about the way the organization should "behave."

Information Load Statements

- 59. The amount of information that must be reviewed to make decisions is overwhelming.
- 60. Our problem isn't too little information, it is too much information.
- 61. I am on too many teams to be effective.
- 62. I regularly feel overwhelmed by all the things going on in our organization.
- 63. I sometimes feel "bombarded" with information which confuses the issues.

Unlearning Statements

- 64. The organization is very slow to accept new ideas.
- 65. The organization has very strong opinions about the way things are done that cannot be easily changed.

- 66. Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
- 67. A lot of negative information must be received before we change the ways we do things.
- 68. The organization tends to hold on to old ideas even when we know that they are wrong.

Scenarios Statements

- 69. The organization considers how specific sets of changes in the environment could change the way the organization operates.
- 70. The organization tries to anticipate environmental changes and react to them before being forced to change.
- 71. The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
- 72. We try to visualize the future in order to build contingency plans.
- 73. We encourage development of alternative views of where we are going.

Systematic Problem Solving Statements

- 74. Statistical tools are used to organize data and draw inferences.
- 75. We construct and test hypotheses when trying to solve a problem.
- 76. We use a step-by-step process for identifying, analyzing, and solving problems.

Systems Thinking Statements

- 77. The organization is careful to fix the problem not just the symptoms.
- 78. The organization considers the whole process rather than static "snap-shots" when problem solving.
- 79. When solving problems the total-organization and its interrelationships are considered.
- 80. When solving a problem we consider the impact of the solution on all parts of the organization.
- 81. We perform "deep" problem analysis to ensure effective problem solutions.
- 82. We believe that a change in one part of our organization affects all parts.

Membership Attrition Statements

- 83. The organization experiences a high turnover of members.
- 84. The organization experiences a high turnover of members in key positions.
- 85. People are constantly joining and leaving our teams.
- 86. Our turnover seems higher than other organizations' turnover.

Hard Information Storage Statements

- 87. Standard operating procedures for the organization are written down.
- 88. Important processes in the organization are documented.
- 89. Standard operating procedures document how the procedures are actually accomplished.
- 90. Documentation is updated to reflect changes in the procedures and processes.

Soft Information Storage Statements

- 91. Many procedures are not written down, but everyone knows what they are.
- 92. The organization has standard ways of thinking about things that are not written down.
- 93. The organization has lots of unwritten rules.

Computer Models Statements

- 94. The organization uses computer models to capture organizational knowledge.
- 95. The organization uses computer models to test new strategies.
- 96. The knowledge of experts from within the organization is captured on computer.
- 97. The organizational expertise captured on computer is easily assessable to organization members.
- 98. We use computer models to see how our decisions will affect the organization.

Organizational Commitment to Learning Statements

- 99. The organization's leaders are committed to organizational learning.
- 100. The organization's leaders work to provide a better environment for learning.
- 101. The organization is committed to my professional development.
- 102. The organization has helped me develop a plan for my professional growth.

Personal Commitment to Learning Statements

- 103. I personally committed to learning and growing.
- 104. I take the initiative to learn about new technologies and processes associated with my job.
- 105. I try to know as much about the organization and its processes as possible.

Personal Commitment to Learning Statements

- 106. I value my involvement with the organization.
- 107. I will go out of my way to make the organization a success.
- 108. I care about the organization and what it is doing.
- 109. When the organization is successful I feel successful.

Shared Vision Statements

- 110. I know and share the values of the organization.
- 111. I feel that my personal goals align with the goals of the organization.
- 112. Members of the organization know where they fit into the organization's overall vision.
- 113. Managers take positive action to transmit the organization's vision to all members.
- 114. I feel a personal commitment to helping the organization make it's vision a reality.

Organizational Rewards Statements

- 115. The organizational reward system promotes my learning efforts.
- 116. Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
- 117. The organization rewards risk taking.
- 118. The organization rewards personal development.
- 119. The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.

Appendix E. Complete Version of the Refined Scales

The following behavioral statements represent the complete version of the refined scale questionnaire items.

Refined Scale 1 - Commitment to Learning

1. I care about the organization and what it is doing.
2. I personally committed to learning and growing.
3. I take the initiative to learn about new technologies and processes associated with my job.
4. I try to know as much about the organization and its processes as possible.
5. When the organization is successful I feel successful.
6. I will go out of my way to make the organization a success.
7. I value my involvement with the organization.
8. I feel a personal commitment to helping the organization make its vision a reality.
9. I know and share the values of the organization.
10. The organization has helped me develop a plan for my professional growth.
11. The organizational reward system promotes my learning efforts.
12. The organization is committed to my professional development.
13. The organization's leaders work to provide a better environment for learning.
14. The organization's leaders are committed to organizational learning.
15. Organizational rewards are tied to things the organization is trying to promote such as teamwork, quality improvement, and learning.
16. The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.
17. The organization rewards personal development.
18. Members of the organization know where they fit into the organization's overall vision.
19. Managers take positive action to transmit the organization's vision to all members.
20. The organization rewards risk taking.
21. I feel that my personal goals align with the goals of the organization.

Refined Scale 2 - Internal Interaction:

22. We have commonly held beliefs about the way the organization should "behave."
23. The organization takes action to correct problems identified by its members.
24. Organization members communicate with those in different functions, departments, and projects.
25. The organization involves members in planning actions to correct problems.

- 26. We have identified those things about our performance that are important to external stakeholders.
- 27. A total organization perspective is favored over a functional perspective.
- 28. Broad-based organizational experience is valued over strictly functional experience in the organization.

Refined Scale 3 - Customer and Constituent Learning:

- 29. Individual/team goals in the organization are tied to customer satisfaction.
- 30. The organization's goals are tied to customer satisfaction.
- 31. The organization continuously solicits feedback from its customers.
- 32. The organization uses customer feedback to improve its products/services.
- 33. We proactively seek information from customers even when there doesn't appear to be a problem.
- 34. We ask customers how we can change our products/services to better meet their needs.
- 35. The organization actively solicits information about problems from its members.
- 36. Organization members receive information on problems identified by other members.
- 37. The organization involves members in implementing actions to correct identified problems.

Refined Scale 4 - Knowledge Flow:

- 38. Information is not restricted within the organization.
- 39. Information is easy to obtain within the organization.
- 40. Members are sometimes denied information that they need to know.
- 41. Organization members have broad access to all organization information except personnel records.
- 42. Information is readily shared between organizational units.
- 43. Organization members feel free to express their true opinions without fear of reprisal.
- 44. Organization members are willing to eliminate hidden agendas.
- 45. Organization members try to understand the motives and reasoning of others without passing judgment.
- 46. Organizational members can share ideas in an environment of openness and trust.
- 47. Organizations members feel that it is alright to disagree with the boss.

Refined Scale 5 - Personnel Management:

- 48. The organization tries to anticipate environmental changes and react to them before being forced to change.
- 49. The organization considers how specific sets of changes in the environment could change the way the organization operates.
- 50. The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.

51. We try to visualize the future in order to build contingency plans.
52. The organization is careful to fix the problem not just the symptoms.
53. We encourage development of alternative views of where we are going.
54. Lessons learned from organizational failures are accessible to members.
55. We actively analyze failures within the organization.
56. Lessons learned from organizational success are accessible to members.
57. The organization values the contribution failures can make to its lessons learned.
58. We have a system for keeping track of our successes and failures.
59. The organization requires members to rotate to other functions to gain experience.
60. The organization encourages members to master different functions.

Refined Scale 6 - Soft Information Storage:

61. The organization has standard ways of thinking about things that are not written down.
62. The organization has lots of unwritten rules.
63. Many procedures are not written down, but everyone knows what they are.

Refined Scale 7 - Organizational Bureaucracy:

64. Documentation is updated to reflect changes in the procedures and processes.
65. Standard operating procedures document how the procedures are actually accomplished.
66. Standard operating procedures for the organization are written down.
67. Important processes in the organization are documented.
68. Many of the organizations processes never change because of an attitude that embraces the old way of doing things.
69. The organization has very strong opinions about the way things are done that cannot be easily changed.
70. A lot of negative information must be received before we change the ways we do things.
71. The organization tends to hold on to old ideas even when we know that they are wrong.
72. The organization is very slow to accept new ideas.
73. Our organization disperses knowledge quickly.
74. Our organization disperses knowledge efficiently.
75. I feel that I get the information that I need to do my job when I need it.
76. When solving problems the total-organization and its interrelationships are considered.
77. When solving a problem we consider the impact of the solution on all parts of the organization.
78. We believe that a change in one part of our organization affects all parts.
79. We perform "deep" problem analysis to ensure effective problem solutions.

Refined Scale 8 - Pursuit of Improvement:

- 80. We are encouraged to search for new knowledge in this organization.
- 81. Testing new products/services is encouraged in this organization.
- 82. We are encouraged to test new knowledge in this organization.
- 83. We are encouraged to try new ways of doing things.
- 84. We are encouraged to look for feedback from the environment about the new ideas/concepts/product/process we are trying out.
- 85. The organization continuously assesses its performance against industry standards.
- 86. We attempt to identify processes used by others that could be adapted for use within our organization.
- 87. When organizations similar to ours experience failures, we analyze these failures to improve our organization.
- 88. We monitor the performance of comparable organizations.
- 89. We search for information about what our competitors are doing.
- 90. The organization continuously assesses its performance against internal standards.
- 91. The organization considers the whole process rather than static "snap-shots" when problem solving.
- 92. The organization's performance against the standards is communicated to all organization members.
- 93. Management brings in outside experts to help us solve problems.
- 94. We look outside the organization for needed expertise.
- 95. Underlying assumptions that govern the organization's actions can be changed.
- 96. We have used outside consultants to help us solve problems.
- 97. When making decisions the organization analyses the assumptions underlying the alternative decisions.
- 98. Underlying assumptions about the organization's environment can be constructively challenged.

Refined Scale 9 - Personnel Management:

- 99. The organization experiences a high turnover of members.
- 100. The organization experiences a high turnover of members in key positions.
- 101. People are constantly joining and leaving our teams.
- 102. Our turnover seems higher than other organizations' turnover.
- 103. Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
- 104. New organization members are skilled in areas that complement the organization's mission.

Refined Scale 10 - Information Processing:

- 105. The organization uses computer models to test new strategies.
- 106. The organization uses computer models to capture organizational knowledge.

107. We use computer models to see how our decisions will affect the organization.
108. The knowledge of experts from within the organization is captured on computer.
109. The organizational expertise captured on computer is easily assessable to organization members.
110. Statistical tools are used to organize data and draw inferences.
111. We construct and test hypotheses when trying to solve a problem.
112. We use a step-by-step process for identifying, analyzing, and solving problems.
113. I sometimes feel "bombarded" with information which confuses the issues.
114. The amount of information that must be reviewed to make decisions is overwhelming.
115. Our problem isn't too little information, it is too much information.
116. I regularly feel overwhelmed by all the things going on in our organization.
117. I am on too many teams to be effective.
118. Written reports are used to disperse knowledge throughout the organization.

Appendix F. Workshop Version of the Refined Scales

The following behavioral statements represent the workshop version of the refined scales questionnaire items.

Refined Scale 1 - Commitment to Learning

1. I care about the organization and what it is doing.
2. I personally committed to learning and growing.
3. I take the initiative to learn about new technologies and processes associated with my job.
4. I try to know as much about the organization and its processes as possible.
5. I know and share the values of the organization.
6. The organization has helped me develop a plan for my professional growth.
7. The organizational reward system promotes my learning efforts.
8. The organization's leaders work to provide a better environment for learning.
9. The organization's leaders are committed to organizational learning.
10. Organizational rewards are tied to things the organizations is trying to promote such as teamwork, quality improvement, and learning.
11. The people who get ahead in this organization are those who are constantly trying to learn about better ways of doing business.
12. Members of the organization know where they fit into the organization's overall vision.
13. I feel that my personal goals align with the goals of the organization.

Refined Scale 2 - Internal Interaction:

14. We have commonly held beliefs about the way the organization should "behave."
15. The organization takes action to correct problems identified by its members.
16. Organization members communicate with those in different functions, departments, and projects.
17. A total organization perspective is favored over a functional perspective.
18. Broad-based organizational experience is valued over strictly functional experience in the organization.

Refined Scale 3 - Customer and Constituent Learning:

19. Individual/team goals in the organization are tied to customer satisfaction.
20. The organization's goals are tied to customer satisfaction.
21. The organization uses customer feedback to improve its products/services.

- 22. We proactively seek information from customers even when there doesn't appear to be a problem.
- 23. The organization actively solicits information about problems from its members.
- 24. Organization members receive information on problems identified by other members.

Refined Scale 4 - Knowledge Flow:

- 25. Information is easy to obtain within the organization.
- 26. Members are sometimes denied information that they need to know.
- 27. Organization members have broad access to all organization information except personnel records.
- 28. Organization members feel free to express their true opinions without fear of reprisal.
- 29. Organization members are willing to eliminate hidden agendas.
- 30. Organization members try to understand the motives and reasoning of others without passing judgment.

Refined Scale 5 - Personnel Management:

- 31. The organization tries to anticipate environmental changes and react to them before being forced to change.
- 32. The organization considers how specific sets of changes in the environment could change the way the organization operates.
- 33. The organization examines the assumptions that underlie our plans for the future and what changes will impact these assumptions.
- 34. We try to visualize the future in order to build contingency plans.
- 35. Lessons learned from organizational failures are accessible to members.
- 36. We actively analyze failures within the organization.
- 37. Lessons learned from organizational success are accessible to members.

Refined Scale 6 - Soft Information Storage:

- 38. The organization has standard ways of thinking about things that are not written down.
- 39. The organization has lots of unwritten rules.
- 40. Many procedures are not written down, but everyone knows what they are.

Refined Scale 7 - Organizational Bureaucracy:

- 41. Documentation is updated to reflect changes in the procedures and processes.
- 42. Standard operating procedures document how the procedures are actually accomplished.
- 43. Many of the organizations processes never change because of an attitude that embraces the old way of doing things.

- 44. A lot of negative information must be received before we change the ways we do things.
- 45. The organization is very slow to accept new ideas.
- 46. Our organization disperses knowledge quickly.
- 47. I feel that I get the information that I need to do my job when I need it.
- 48. When solving problems the total-organization and its interrelationships are considered.
- 49. When solving a problem we consider the impact of the solution on all parts of the organization.

Refined Scale 8 - Pursuit of Improvement:

- 50. We are encouraged to search for new knowledge in this organization.
- 51. Testing new products/services is encouraged in this organization.
- 52. We are encouraged to test new knowledge in this organization.
- 53. We are encouraged to try new ways of doing things.
- 54. The organization continuously assesses its performance against industry standards.
- 55. We attempt to identify processes used by others that could be adapted for use within our organization.
- 56. When organizations similar to ours experience failures, we analyze these failures to improve our organization.
- 57. We monitor the performance of comparable organizations.
- 58. Management brings in outside experts to help us solve problems.
- 59. Underlying assumptions that govern the organization's actions can be changed.
- 60. We have used outside consultants to help us solve problems.
- 61. When making decisions the organization analyses the assumptions underlying the alternative decisions.

Refined Scale 9 - Personnel Management:

- 62. The organization experiences a high turnover of members.
- 63. The organization experiences a high turnover of members in key positions.
- 64. People are constantly joining and leaving our teams.
- 65. Our turnover seems higher than other organizations' turnover.
- 66. Potential organization members are carefully screened to ensure that they will contribute something additional to the organization.
- 67. New organization members are skilled in areas that complement the organization's mission.

Refined Scale 10 - Information Processing:

- 68. The organization uses computer models to test new strategies.
- 69. The organization uses computer models to capture organizational knowledge.
- 70. We use computer models to see how our decisions will affect the organization.

71. The knowledge of experts from within the organization is captured on computer.
72. The organizational expertise captured on computer is easily assessable to organization members.
73. Statistical tools are used to organize data and draw inferences.
74. We construct and test hypotheses when trying to solve a problem.
75. We use a step-by-step process for identifying, analyzing, and solving problems.
76. I sometimes feel "bombarded" with information which confuses the issues.
77. The amount of information that must be reviewed to make decisions is overwhelming.
78. Our problem isn't too little information, it is too much information.
79. I regularly feel overwhelmed by all the things going on in our organization.
80. I am on too many teams to be effective.

References

- Argyris, Chris and Donald A. Schon. Organizational Learning: A Theory of Action Perspective, Reading MA: Addison-Wesley, 1978.
- Barrow, James W. "Does Total Quality Management Equal Organizational Learning?," Quality Progress, 26: 39-43 (July 1993).
- Bateson, Gregory. Steps to an Ecology of Mind, New York: Chandler Publishing, 1972.
- Cangelosi, Vincent E. and William R. Dill. "Organizational Learning: Observations Toward a Theory," Administrative Science Quarterly, 10:175-203 (October 1965).
- Comrey, Andrew L. and Howard B. Lee. A First Course in Factor Analysis, Hillsdale NJ: Lawrence Earlbaum Associates, 1992.
- Cyert, Richard M. and James G. March. A Behavioral Theory of the Firm, Englewood Cliffs NJ: Prentice-Hall, 1963.
- Daft, Richard L. and Karl E. Weick. "Toward a Model of Organizations as Interpretation Systems," Academy of Management Review, 9: 284-295 (February 1984).
- De Geus, Arie P. "Planning as Learning," Harvard Business Review, March-April: 70-74 (1988).
- Duncan, Robert and Andrew Weiss. "Organizational Learning: Implications for Organizational Design," in Barry M. Staw (Ed.), Research in Organizational Behavior, Vol. 1. Greenwich CT: JAI, 1979, 75-123.
- Fiol, Marlene C. and Marjorie A. Lyles. "Organizational Learning," Academy of Management Review, 10: 803-813 (April 1985).
- Garvin, David A. "Building a Learning Organization," Harvard Business Review, Jul-Aug: 78-91 (July-August 1993).
- Graham, Chief Master Sergeant Vickie M. "Streamlining Acquisition 101: An Introduction to Changing the Way We Do Business," Airman, 39: 21-25 (February 1995).
- Graham, Chief Master Sergeant Vickie M. "One Contractor's Viewpoint," Airman, 39: 27-29 (February 1995).

- Hedberg, B. "How Organizations Learn and Unlearn," P.C.Nystrom and W.H. Starbuck (Eds.) Handbook of Organizational Design, London: Oxford University Press, 1981, 8-27.
- Huber, George P. "Organizational learning: The contributing processes and the literatures," Organization Science, 2: 88-115 (February 1991).
- Isaacs, William N. "Taking Flight: Dialogue, Collective Thinking, and Organizational Learning," Don L. Bohl (Ed.) The Learning Organization In Action, New York: American Management Association, 1994, 40-55.
- Jelinek, Mariann . Institutionalizing Innovation: A Study of Organizational Learning Systems, New York: Praeger, 1979.
- Kim, Daniel H. "The Link Between Individual and Organizational Learning," Sloan Management Review, Vol: 37-50 (Fall 1993).
- Kim, Jae-On and Charles W. Mueller. Introduction to Factor Analysis: What It Is and How To Do It, Sage University Paper series on Quantitative Applications in the Social Sciences, 07-013. Beverly Hills and London: Sage Publications, 1978.
- Levitt, Barbara and James G. March. "Organizational Learning," W. Richard Scott (Ed.) Annual Review of Sociology, 14, Palo Alto: Annual Reviews, 1988, 319-340.
- Maidique, Modesto A. and Billie Jo Zirger "The New Product Learning Cycle," Research Policy, 14(6): 299,309 (1985).
- Nonaka, Ikujiro. "The Knowledge-Creating Company," Harvard Business Review, November-December: 96-104 (1991).
- SAS Institute Inc, SAS Procedures Guide, Release 6.03 Edition, Cary NC:SAS Institute Inc., 1988.
- SAS Institute Inc, SAS User's Guide: Statistics, Version 5 Edition, Cary NC:SAS Institute Inc., 1985.
- Scaggs, Staff Sergeant John B. "Taking Charge," Airman, 39: 31-32 (February 1995).
- Schein, Edgar H. "On Dialogue, Culture, and Organizational Learning," Don L. Bohl (Ed.) The Learning Organization In Action, New York: American Management Association, 1994, 56-67.
- Schnaars, Steven P. "How to Develop and Use Scenarios," Long Range Planning, 20 (February): 105-114 (1987).

Senge, Peter M., The Fifth Discipline: The Art and Practice of Building a Learning Organization, New York: Doubleday, 1990.

Simon, Herbert A. "Bounded Rationality and Organizational Learning," Organization Science, 2:125-134 (February 1991).

Wack, Pierre, "Scenarios: uncharted waters ahead," Harvard Business Review, September -October: 73-89 (1985).

Wack, Pierre, "Scenarios: shooting the rapids," Harvard Business Review, November-December: 139-150 (1985).

Watkins, Karen E. and Victoria J. Marsick, Sculpting The Learning Organization, San Francisco: Jossey-Bass, 1993.

Weick, Karl E. "The Nontraditional Quality of Organizational Learning," Organization Science, 2:116-124 (February 1991).

Wheatley, Margaret J. "Can the U.S. Army become a learning organization?," Journal for Quality and Participation, 17:50-55 (March 1994).

Vita

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE September 1995	3. REPORT TYPE AND DATES COVERED Master's Thesis
4. TITLE AND SUBTITLE A PRELIMINARY ANALYSIS OF THE THEORETICAL PARAMETERS OF ORGANIZATIONAL LEARNING			5. FUNDING NUMBERS
6. AUTHOR(S) Jeffery D. Loyd, Captain, USAF			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology, WPAFB OH 45433-7765			8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/GCA/LAR/95S-7
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) The goal of this research was to develop an instrument capable of measuring the theoretical parameters of organizational learning that could be used as a diagnostic tool to measure an organization's learning potential. This goal was accomplished by developing a pilot questionnaire based on 27 potential learning parameters. The potential parameters of learning were extracted from the literature. A scale of behavioral statements was developed for each potential parameter. The pilot questionnaire was completed by 108 Air Force personnel in Air Force Institute of Technology (AFIT) graduate education programs. The results confirmed 85% of the original scales. Ten refined scales were also developed based on the original scales. Three operational questionnaires were developed. First, a 119 item questionnaire based on a revised version of the initial scales with Cronbach's Alpha values of 0.7725 to 0.9332. Next, two versions of the refined scales questionnaire were developed. A full version containing 118 items with Cronbach's Alpha values ranging from 0.7584 to 0.9463 and a 80 item workshop version with Cronbach's Alpha values ranging from 0.7412 to 0.9066.			
14. SUBJECT TERMS Learning, Conditioning, Transfer of Training, Adaptation, Behavioral Development, Cognitive Development, Factor Analysis, Statistical Analysis, Instrument Development			15. NUMBER OF PAGES 255
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL