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Interaction Effects of Strategic Decision Models and Business Intelligence Tools on Knowledge Generation in Manufacturing Firms

by

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Submitted as partial fulfillment of the requirements for
The Doctor of Philosophy degree in
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An Abstract of

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Nimble competitors competing in a dynamic global marketspace increasingly characterize the current business environment faced by many manufacturing organizations. These manufacturing organizations are bombarded with geometrically increasing amounts of information obtained from a variety of internal and external sources. To provide the manufacturing organization's knowledge workers with the business intelligence tools to mine this data has become the number one issue facing information systems managers. Yet implementation of these tools and the subsequent knowledge utilization remains a complex task and is portrayed as high-risk. To succeed in this environment, the manufacturing organization's knowledge workers must have more than just access to tools and business models. They must be proficient in the use of leading-edge business intelligence tools; they must understand, apply, and synthesize theoretically sound business analytical models;

and they must demonstrate critical questioning skills and strategic thinking competence when applying those business analytical models.

This research study focused on investigating the potential combined impact of the knowledge worker's proficiency with business intelligence tools and with their ability to synthesize and gain understanding from business analytical models as they relate to the generation of insights gained from strategic thinking and critical questioning. Achieving superior performance and gaining competitive advantage is dependent upon the ability of the knowledge workers to gain insights into and make sense of uncertain environments. The findings from this research demonstrate that those manufacturing organizations focusing on either the tool or model component separately can increase the strategic thinking competence of the knowledge worker.

This research demonstrated that combining leading edge business intelligence tools and proven business models results in improved business insights into the competitive environment. This research found that knowledge workers can generate insights in dramatically reduced time with greater specificity of the market, product, customer, and channel. The implications of this study are important. Competitive advantage can be to manufacturing organizations able to rapidly discern their competitors' intent and to develop responses. Competitive advantage accrues to those manufacturing organizations able to uncover market niches and to develop products and services to match requirements of consumers.

This study provides manufacturing managers a logical approach to resource allocation decisions that will increase the firms' ability to develop products and services that meet and exceed customer requirements.

Dedications

This dissertation effort is dedicated to my wife, my son, and parents.

I would like to thank my wife, Karen for her love, support and assistance during this entire endeavor. I truly appreciated them. It has made the process of obtaining the degree much easier and more rewarding.

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Chapter One
Introduction

The Fortune 500 listing of companies experienced 238 corporate dropouts between the years of 1955 and 1980. The rate of dropouts from the Fortune 500 listing increased between the years of 1983 and 1988 with 143 corporations exiting the Fortune 500 listing (Stamen, 1990). Part of the explanation for this phenomenon could be the changing business climate. The business climate faced by all organizations is characterized by increasing complexity and market diversity as well as by market and technological change requiring knowledge workers to cope with product, manufacturing, and market uncertainty (Doll & Vonderembse, 1991; Gerwin, 1993; Huber, 1984). The manufacturing organization's knowledge workers can cope with this uncertainty by processing information to reduce equivocality and uncertainty (Daft & Lengel, 1986). In the turbulent environment faced by knowledge workers, the one sure source of competitive advantage for manufacturing organizations, then, becomes knowledge (Nonaka, 1991). In fact, achieving superior performance and competitive advantage is dependent upon the ability of the knowledge workers to gain insights into and make sense of uncertain environments (Vandenbosch & Higgins, 1995).

To gain knowledge in the uncertain environment, an increasing amount of the work performed by the manufacturing organization has become intellectual in nature and has become information-intensive. In fact, information-intensive work has become greater than fifty percent of the work performed in some manufacturing organizations (Black, 1991). This information-intensive intellectual work has been defined as planning, coordinating, controlling, and decision-making (Ramaprasad & Rai, 1996). The knowledge workers who perform this information-intensive work offer the manufacturing organization their greatest capability and their greatest asset. This asset is the knowledge workers' problem-solving skill and ability. This ability allows the knowledge workers to gain insight into the uncertain and dynamic environment from presented information (Doll & Vonderembse, 1991; Huber, 1984; Susman, 1990).

As this information-intensive work continues to become more intellectual in nature and as the manufacturing organization's data warehouses provide the knowledge workers access to an ever-expanding volumes of data and information, power in the manufacturing organization is shifting (Benjamin & Levinson, 1994). The organizational power center is shifting to the knowledge workers who can use and apply this information to gain competitive advantage. Capitalizing on this fact, knowledge workers must become educated to make informed decisions and must become reskilled to visualize the manufacturing organization's work processes through various analytical models to ensure that the manufacturing organization remains competitive (Benjamin & Levinson, 1994).

Given this changing competitive situation, the acquisition and utilization of information by the knowledge workers is becoming a paramount issue for manufacturing organizations. The current dynamic global environment faced by manufacturing organizations is characterized by the tremendous volume and growth of information from a variety of sources (Brush, 1992; Li, 1993). Senior information system (IS) executives have identified the implementation and subsequent utilization of executive support system (ESS) as a key issue they must address (Palvia, Rajagopalan, Kumar & Kumar, 1996). ESS is defined as computer-based information systems that integrates information from both internal and external data sources enabling knowledge workers to access, monitor, and request information of importance to them in various presentation formats (Leidner & Elam, 1993; Millet & Mawhinney, 1992).

To meet the competitive challenges and financially prosper in the business climate of the 21st century, the manufacturing organizations' knowledge workers require improved tools for understanding changing competitive environments (Leidner & Elam, 1993; Peters & Brush, 1996). Historically, forecasting tools have been used to analyze the competitive environment and formulate strategy (Clark, 1992). Recently, the trend has been to increase the usage of decision support tools to analyze the environment. The objective in using these various tools was to help senior management predict the future of a given market segment or of a given product line (Clark, 1992).

Decision support tools aided in reducing uncertainty for various decisions. They performed this task by providing a degree of confidence to those decisions related to the success of market segments and product lines. However, despite the importance senior IS executives place on implementing these decision support systems, only thirty-two percent of the organizations surveyed were satisfied with the information they received from their existing ESS (Li, 1995).

Problem Statement

Expert practitioners have stated that ESS applications are high-risk, high-return projects. They are expensive to implement, and experience almost a twenty-five percent failure rate (Kuehn & Fleck, 1991; Millet & Mawhinney, 1992; Rainer & Watson, 1995; Volonino & Watson, 1991; Walstrom & Wilson, 1997). Case studies and various monographs yield a variety of reasons for these failures. The reasons cited include issues of technical complexity, database inflexibility, lack of management focus, and difficulty in assessing benefits (Belcher & Watson, 1993; Kuehn & Fleck, 1991; Millet & Mawhinney, 1992). The technical complexity and database inflexibility issues occur because of the requirement of structured and often inflexible data structures, predefined and unchanging data presentation views, and limited ad-hoc calculation capabilities. These issues are also possible explanations for the the thirty-two percent satisfaction rate with the information provided by ESS applications that are implemented (Heinrichs, Hudspeth, & Lim, 2001).

During the initial stages of the creation of Executive Support Systems, IS development personnel and systems analysts have always assumed that the knowledge workers should understand the meaning of the information delivered to them. The IS development personnel have assumed that the knowledge workers knew where to get the required information because those knowledge workers defined the system's requirements in the first place (Chen, 1995). Yet, forty-five percent of the respondents to surveys cited deficient market analysis as the primary cause of new product failures (Deschamps & Nayak, 1995). Is it no wonder that Maltz and Kohli (1996) state that manufacturing organizations often fail to use the market knowledge readily available to them? To develop that knowledge and to gain competitive insight into uncertain market situations, knowledge workers seek to manage uncertainty by bringing evidence to bear on the problems they encounter (Browne, Curley, & Benson, 1997). Yet, Li (1995) stated that two-thirds of the respondents in his survey cited lack of effective market research skills or unavailability of market research personnel as the major source of dissatisfaction.

By facilitating the analysis of evidence and guiding knowledge workers in the application of business analytic models and leading-edge business concepts, ESS can foster the creation and maintenance of the knowledge worker's mental model. Mental models are the thought constructs that affect how people and organizations operate in the world (Kim, 1993). They are the knowledge workers' deeply held internal images of how the world works (Senge, 1990). Mental models have a powerful influence on what is done because they also affect what is seen. Mental models provide the context in which to view and interpret new information and material. As such, mental model creation is an important attribute to enhancing competitive performance. Improved analytic and modeling capabilities are ESS attributes required for mental model creation and enhancement (Rockart & DeLong, 1988; Vandenbosch & Higgins, 1995).

Research Requirements

With the impact that ESS can have on the manufacturing organization's competitive performance, research studies are required to identify the conditions that affect how effectively executive support systems are utilized (Vandenbosch & Higgins, 1995). Yet, more than studying the outcome from the usage of these tools is required. There is a definite need to shift attention from the outcome of decision-making activities to the processes and mechanisms that explain a knowledge worker's overt behavior and performance (Singh, 1998). Singh (1998) states that an understanding of why and how some applications provide better decision support than other applications is essential. Vessey (1994) calls for training knowledge workers in the ability to choose the display format that is most appropriate to the type of task they wish to solve. DeLone and McLean (1992) inquire as to what should the dependent variable be in these studies. They argue that end user satisfaction and use of the systems are not related to competitive advantage. Therefore, they are not as appropriate as dependent variables.

Summarizing and categorizing these researchers' studies provides a proposed direction for research studies in this field. The researchers' statements can be categorized into three related areas. These areas are labeled tool utilization and processes, training and decision outcome, and new dependent variable investigation. The focus of the first area is on understanding the conditions that affect how business intelligence tools are utilized and the processes that help explain the knowledge workers' performance. The focus of the second area is to explain why various business intelligence tools provide different decision outcomes and to explain the impact of training on problem resolution. The focus of the third area is on developing different dependent variables for greater insight into the organization and for organizational performance.

Given the logical and empirical support for the relationship among the knowledge worker's mental model, ESS usage, and competitive performance, four major research themes can be identified. The first theme is described as "Can knowledge workers in a manufacturing organizations keep gaining new insights by having access to and training in business intelligence software tools?". This first theme investigates the tool or technology aspect in this field. The second theme is stated as "Can knowledge workers in a manufacturing organization keep gaining new insights by having training in and the ability to apply leading-edge business analytical models?". This theme seeks to understand the mental model of the knowledge worker and their ability to absorb and apply structured decision models. The third theme becomes "Is there a synergistic effect between the technical business intelligence tool usage and application of business analytical models?". This theme seeks to understand the relationship between the two variables. Flitman (1996) states that reporting tools that actively track progress toward strategic goals and encourage knowledge workers to achieve strategic success are needed. Given this statement, the fourth research theme becomes “Can the integration of business intelligence software tools and business analytic model application foster or increase strategic thinking competence?”. This theme focuses on developing new dependent variables to expand knowledge in this field.

Research Objective

Business decisions are not uni-dimensional. They have many interrelated facets. Looking at a problem while holding other elements of the environment constant is acceptable for understanding a part of the picture. Yet, in the practical environment of day-to-day decisions and competitive pressures, knowledge workers do not have the luxury of holding various components of the problem constant and then optimizing the results. They must look at all parts of the problem simultaneously and expect the various elements of the environment to continually change.

Many researchers have called for research studies to identify conditions that affect how effectively business intelligence tools are utilized and how knowledge utilization occurs. The primary objective for this research study was to investigate the relationship between business intelligence tools and the application of key business models on the outcome of strategic thinking competence of the knowledge worker in a manufacturing organization. Specifically, this research study focused on the effect and interaction of business intelligence tools and business concepts and models on strategic thinking skills. The knowledge workers' skill of market assessment, insight generation, critical questioning, and pattern generation skills were explored.

Research Contributions

Research and insight in this newly emerging area can produce many advantages. Researchers have asked for studies to "open the black box", to explore the mental model creation process of knowledge workers, and to identify the reasons for both success and failure of ESS (Vandenbosch & Higgins, 1995; Singh, 1998). One fundamental premise that has not been challenged in previous studies is the ability of the knowledge worker to synthesize, apply and understand various business models and concepts coupled with the use of business intelligence software tools. In fact, Chen (1995) stated that IS development personnel proceed with the assumption that knowledge workers implicitly know their requirements as a given.

The contribution from this research effort includes development of a construct for business intelligence software tool usage, development of a construct for business model application, and an integration of these ideas into a construct for demonstrated strategic thinking competence. The research further links these three constructs into a model. It is posited that the synergistic interaction of these constructs will yield a greater competence in strategic thinking competence and ultimately in manufacturing organizational performance.

The model developed and used in this research study has implications for resource allocation decisions for the manufacturing organization. The research study demonstrated the integration of the business models and business intelligence tools. The implications from this study can positively impact the manufacturing organization's resource allocation decisions.

The model demonstrates the integration of the technical concept of business intelligence tools usage and academic business model development. This research study argues for and supports the idea that these fields of study should be more closely integrated to produce future business leaders with greater insight generation capabilities. This argument earned national acclaim and support at the 1999 Decision

Science Institute annual meeting. The contribution of this study is to provide an innovative method of delivering leading edge educational concepts to knowledge workers.

This research study demonstrated the impact of a knowledge evocation feature of the business intelligence tool. This research study demonstrates the ability to capture expert knowledge in the guided analysis routines and to enable novice knowledge workers to generate increased insights into the competitive landscape. The contribution from this effort can provide justification for business intelligence firms to enhance the guided analysis capability of their products.

This research study demonstrated the ability to rapidly link massive volumes of data from diverse and disparate sources to proven business models to generate insights. These business models can provide focus to the knowledge workers. Coupling these business models with the guided analysis routines can facilitate the fact-based problem solving and opportunity identification of the knowledge worker.

The various avenues of contribution from this cross-disciplinary research effort have been described. These contributions included the development of a new model integrating tools and models to provide the manufacturing organization with speed and focus, the description of decisions paths for resource allocation decisions, the rationale for integration of educational methods, the justification for increased guided analysis development efforts, and a demonstration of data based decisions. Investigating the potential of different dependent variable of study generated these contributions. This study contributes to improving the strategic thinking capabilities of the manufacturing organization's knowledge workers.

Summary

Why is the usage of and proficiency in business intelligence software tools important? Why are the synthesis, understanding and application of leading-edge business analytic models and concepts important? Why is the integration of business intelligence software tools and business analytic models important? To succeed in the dynamic, global marketplace where manufacturing organizations are competing requires improving the productivity of the knowledge workers, improving the certainty of strategic decisions, gaining strategic insights, and gaining additional elements of time. Each of these factors enables the manufacturing organization to achieve improved performance and competitive advantage. Business intelligence software tools inform the knowledge workers about the performance of a manufacturing organization based on agreed upon competition-based performance objectives. The insights derived from the analysis allow the knowledge worker to make decisions about strategic direction, as well as decisions to add additional resources to an important project, change task priorities, or fundamentally alter the existing manufacturing organizational strategy.

Chapter Two
Literature Review

As manufacturing organizations progress into the 21st century, they are being challenged by tremendous increases in information, global hyper-competition in markets, accelerating rates of change, and extreme product complexity (Lim, Heinrichs & Hudspeth, 1999). Organizational data warehouses are expanding geometrically in storage capacities to handle the volume of available information. It was estimated that thirty percent of the organizational data warehouses exceeded one trillion characters of storage capacity in 1999 (Meta Group, 1999). The issues of global hyper-competition, accelerating rates of change, and extreme complexity require that the knowledge workers in the manufacturing organization completely assess and clearly understand potential opportunities and competitive threats being created. The very survival of the manufacturing organization is at stake (Stamen, 1990).

One of the organizational keys to survival in the dynamic and turbulent 21st century is the ability to capitalize on the skills and capabilities of the manufacturing organization's knowledge workers. The manufacturing organization's knowledge workers possess the ability to generate insights into information. They can utilize their unique problem-solving skills to decipher the complex hyper-competitive environment and then to generate strategies and critical insights through strategic thinking to ensure the survival of the manufacturing organization (Huber, 1984; Susman, 1990). To capitalize on these problem-solving and insight generation capabilities, manufacturing organizations are being advised to realign their organizational operations by implementing and using a process view of their business procedures (Day, 1994; Neely, Mills, Platts, Gregory, & Richards, 1996). Alignment of the business procedures using a process orientation is not enough to ensure the manufacturing organization's survival.

Manufacturing organizations often fail to use the market knowledge or market intelligence readily available to them. Competitors increasingly have access to the same market intelligence. Thus, competitive advantage increasingly lies in a manufacturing organization's ability to use market intelligence (Maltz & Kohli, 1996). Successful use often requires business intelligence software tools to aid the knowledge worker in filtering and sifting through the volumes of information (Chen, 1995). Figure 1 illustrates how filtering and scanning tools of a manufacturing organization's ESS update the manufacturing organization's information base. Data arrives from the manufacturing organization's transaction processing system and is stored in the manufacturing organization's data warehouse. Based upon predefined rules, the data warehouse is filtered and that information is stored in the information base used by the ESS. The information base is also

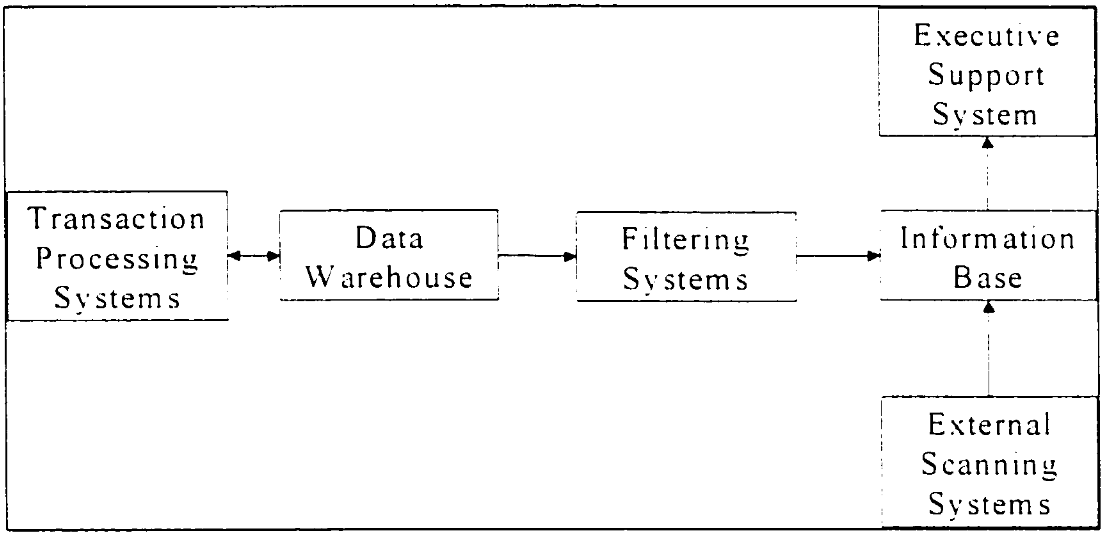

Figure 1: Manufacturing Organization's ESS Architecture

supplemented by information obtained from various external sources. Again, predefined rules are utilized in the scanning of these systems and the accepted information is stored in the information base. The ESS utilized by the manufacturing organization's knowledge workers then has information from both internal and external sources. This information can be used to create, support, or challenge the knowledge worker's view of the environment. The successful use of the business intelligence software tools then requires more than just challenging the knowledge worker's existing mental model. Successful usage of the business intelligence software tools requires the creation of new mental models (Vandenbosch & Higgins, 1995).

The research issues being investigated in this study, then, focus on the impact of both the proficiency in the usage of these business intelligence software tools and the synthesis of business analytic models and concepts on the strategic thinking competence of the knowledge worker. (The specific research model used in this study is introduced in Chapter 3 and is presented in Figure 9.) The research model focuses on understanding the component elements associated with the proficiency of the knowledge worker utilizing business intelligence tools and on the synthesis, understanding and application by the knowledge worker of the various business analytic models and concepts. The proficiency in utilizing business intelligence software tools and the understanding and application of various business analytic models and concepts positively impacts the knowledge worker's strategic thinking competence and ability to generate meaningful insights.

The Development of a Learning Organization

Business intelligence software tools currently available provide the knowledge worker with access to powerful multidimensional analytic databases, leading-edge information presentation management features, and knowledge evocation capabilities. These business intelligence software tool features and capabilities enable dynamic manufacturing enterprise analysis with features of power, flexibility, and ease of use. These tools are especially well suited for coping with the size and complexity of the typical market and product analysis tasks performed by the manufacturing organization's knowledge worker. The vast number of features and capabilities provided by these business intelligence software tools may enhance the mental model creation capabilities of knowledge workers. It is through these knowledge workers' mental models that the framework for insight generation is created and strategic thinking competence occurs.

As part of the market and product analysis tasks performed by the knowledge workers in manufacturing organizations, Day (1994) and Zirger and Maidique (1990) detail three key points. First knowledge workers need to engage in continuous learning about markets in this turbulent, dynamic and uncertain environment. Second, knowledge workers must clearly understanding the importance of both the markets the manufacturing organization conducts business in and the various product offerings the manufacturing organization provides. Finally, the knowledge workers must clearly articulate the need for a value-to-customer focus by manufacturing organizations. (The concept of value-to-customer is explored in greater detail in the third section of this chapter entitled "Strategic Thinking Paradigm" beginning on page 58.) It is this continuous organizational learning emphasis combined with the detailed understanding of both markets and products and the application of leading edge business analytical insight models held together by knowledge management capabilities that form the underlying components of this construct.

Mental Models

Before discussing the relevance of this construct, it is necessary to define the term mental models and the term organizational learning. Kenneth Craik coined the term mental models by suggesting that thinking is the manipulation of internal representations of the world (Chen, 1995). Senge (1990) defined mental models as images of other people, institutions and every aspect of the world. Mental models are the knowledge workers deeply held internal images of how the world operates. They can have a powerful influence on what the knowledge workers do because they also affect what the knowledge workers see (Senge, 1990). Mental models are the thought constructs that affect how people and organizations operate in the world (Kim, 1993).

The knowledge workers' mental models are where a vast majority of a manufacturing organization's knowledge (both "know-how" knowledge and "know-why" knowledge) lies. Each knowledge worker's mental model is a clustering or an aggregation of data that prescribes a viewpoint or an intended plan of action. Knowledge workers then consciously create mental models to improve their understanding of how a manufacturing organization operates within its environments, how its products are perceived by the market, and how the various distribution channels accept the manufacturing organizations programs and action plans. Mental models facilitate organizational learning.

Organizational Learning

Organizational learning is also defined in multiple ways. It can be defined as increasing an organization's capacity to take effective action. Organizational learning can also be defined as growing insights and successful restructuring of organizational problems accomplished by the knowledge workers. Organizational learning is reflected in the structural elements and outcomes of the organization. (In the next section, Strategic Information Management for Problem Solving, the concept of problem structure is presented. Figure 4 on page 40 highlights the various components of the problem-solving model and Figure 5 on page 50 expands on the problem structure framework.) As Fiol and Lyles (1985) state, organizational learning involves the understanding of the reasons beyond the immediate event. The reasons or meaning obtained from organizational learning must be actionable and easy to apply (Garvin, 1993). Additional definitions and citations of organizational learning are detailed in Table 1.

Table 1: Definitions of Organizational Learning

Author	*Year*	*Definition*
Chris Argyris & Donald Schon	1974 / 1978	<u>Organizational learning</u> is a process of detecting and correcting error.
C. Marlene Fiol & Marjorie A. Lyles	1985	<u>Organizational learning</u> means the process of improving actions through better knowledge and understanding.
George Huber	1991	An entity learns if, through its processing of information, the range of its potential behaviors is changed.
Barbara Levitt & James G. March	1988	Organizations are seen as learning by encoding inferences from history into routines that guide behavior.
Ray Stata	1989	<u>Organizational learning</u> occurs through shared insights, knowledge, and mental models ... {and} builds on past knowledge and experience – that is, on memory.

In isolation, individual pieces of information generated by the manufacturing organization may mean very little or perhaps nothing. Those individual pieces of information only become useful in a particular context. Mental models provide the context in which to view and interpret this information. The context serves as a basis for the knowledge workers' understanding of a situation. This understanding includes the tasks they must perform, the roles they must play, the relationships of the tasks to other tasks, and the high-level goals and strategies of the manufacturing organization. Problems and confusion in the manufacturing organization arise from failing to recognize the importance of the prevailing mental model being used. Therefore, there exists a strong need to have a shared organization-wide mental model.

The definitions of organizational learning in Table 1, as well as those defined earlier, embody several key ideas that should be linked together. Capturing and linking these ideas of organizational learning yield a statement of purpose for understanding and applying business analytic models and concepts. That statement of purpose is that organizational learning is a process of detecting a situation, encoding relevant portions of it into organizational memory, developing shared insights perhaps through problem restructuring, and then taking corrective action based upon the inferences and insights that are beyond the unique event.

Organizational learning then is best described and categorized by routine-based, history-dependent, and target-oriented learning. It is argued that learning occurs by encoding inferences from history into the organizational routines. Learning occurs by doing; learning occurs from experiences; and learning occurs from the best practices of others (Levitt & March, 1988).

Constructing A Learning Organization

The type of learning being inferred from the discussion of organizational learning is higher-level learning. In Table 2 a comparison between higher-level learning and lower-level learning is demonstrated. The characteristics of each type of learning highlight the requirements for and expectations of the knowledge workers. The consequences from these levels of learning highlight individual knowledge workers' behavioral changes and the collective insights generated from the organizational mental model.

Table 2: Levels of Learning

	Lower-Level Learning	*Higher-Level Learning*
Characteristics	➢ Occurs through repetition	➢ Occurs through the use of heuristics and insights
	➢ Routine	➢ Nonroutine
	➢ Control over immediate task, rules, & structure	➢ Development of differentiated structures and rules to deal with lack of control
	➢ Well-understood context	➢ Ambiguous context
	➢ Occurs at all levels in organizations	➢ Occurs mostly in upper levels of the organization
Consequences	➢ Behavioral outcomes	➢ Insights, heuristics, and collective consciousness
Examples	➢ Institutionalize formal rules	➢ New missions and new definitions of direction
	➢ Adjustments in management systems	➢ Agenda setting
	➢ Problem-solving skills	➢ Problem-defining skills
		➢ Development of new myths, stories and culture for the organization

A learning organization is an organization skilled at creating, acquiring, and transferring knowledge. A learning organization can modify its behavior to reflect new knowledge and insights. A learning organization is skilled at systematic problem solving, relies on the scientific method of inquiry, and insists on data-based facts. Learning faster than the manufacturing organization's current and potential competitors is the only sustainable competitive advantage (Nonaka, 1991; Senge, 1990).

The reasons for an organization to learn must be established. Failure to establish clear objectives and expected outcomes is a potential problem for effective learning (Zirger & Maidique, 1990). Defining the differences between single loop learning and double loop learning further differentiates higher-level and lower-level learning. The knowledge worker not questioning the underlying objective characterizes single loop learning. Whereas double loop learning is characterized by having the knowledge worker surface and challenge deep-rooted assumptions and norms in an organization that may have previously been inaccessible. Double loop learning is also characterized by modifying an organization's implicit norms and objectives (Meyers & Wilemon, 1989). Double loop learning becomes a requirement for the knowledge workers as they develop and maintain their mental models and as the manufacturing organization develops a shared mental model of its environment.

Knowledge Acquisition

Transferring knowledge quickly and efficiently throughout the manufacturing organization is a major challenge to organizational learning, mental model creation and mental model update. However, when rapid knowledge transfer is accomplished, the actionable insights from the knowledge workers become the basis for strategic thinking competence.

A review of the literature based upon the previously described concepts provides monographs and studies that describe the impact of mental models and organizational learning on the manufacturing organization. In Table 3 three articles that develop these ideas are listed. The article by Kim (1993) develops the link between individual knowledge worker's learning and organizational learning. Cohen and Levinthal (1990) expand this idea and describe how it can be translated into application by the manufacturing organization. Vandenbosch and Higgins (1995) demonstrate how the knowledge worker can change their mental model of an identified situation with given information. Once the insight is obtained, it can be applied to commercial ends and for competitive advantage for the manufacturing organization. These selected articles describe the pathway from individual learning of the knowledge worker to mental model creation then to insight generation and finally to the commercial application of a product or service or to the competitive response to a particular opportunity or marketing situation.

Table 3: Selected Organizational Learning Articles / Studies

Organizational Learning			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Cohen & Levinthal	1990	Survey of 318 Firms	*Learning and Absorptive Capacity* -- The ability of an organization to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities.
Kim	1993	Model Development	*Link Between Individual and Organizational Learning* – Organizational learning and individual learning are linked through mental models.
Vandenbosch & Higgins	1995	Survey of 73 Executives	*EIS and Learning* -- The model developed in this study explores mental-model maintenance and mental-model creation.

The constant accumulation of knowledge in a manufacturing organization increases the ability to put new knowledge into memory and the ability of the manufacturing organization to recall and use it. Prior knowledge and skill give rise to the creativity of the knowledge worker permitting the associations and linkages that may have never been considered before. Outside sources of information are crucial to this creativity process. Information scanning and acquisition processes ensure that this information from external sources is available to the knowledge worker. As such, manufacturing organizations must recognize the value of new information, assimilate it, and apply it to commercial ends. Yet, a competency trap can be created for a manufacturing organization when favorable performance with an inferior procedure or process leads the manufacturing organization to accumulate more experience with it (Cohen & Levinthal, 1990).

A Learning Model for Competitive Advantage

As previously discussed, organizational learning is the process through which individual learning becomes embedded in the manufacturing organization's memory and structure. Individual learning is the process of acquiring knowledge, skill, and /or ability. Individual learning becomes the "know-how" and "know-why" (Kim, 1993). This "know-how" and "know-why" is linked to the knowledge worker's mental models. As can be inferred, organizational learning is fundamentally different from individual learning simply because the knowledge workers must impart their intelligence and learning capabilities to a non-human entity (such as the manufacturing organization) without ultimately anthropomorphizing it (Kim, 1993).

Mental model update or maintenance is the process by which new information fits into the existing mental models of the knowledge worker and confirms those mental models. Mental model creation or building is the process by which the mental models of the knowledge worker are changed to accommodate new information. The presence of analysis capability, such as business intelligence software tools, is a key differentiator between mental-model update and mental-model creation.

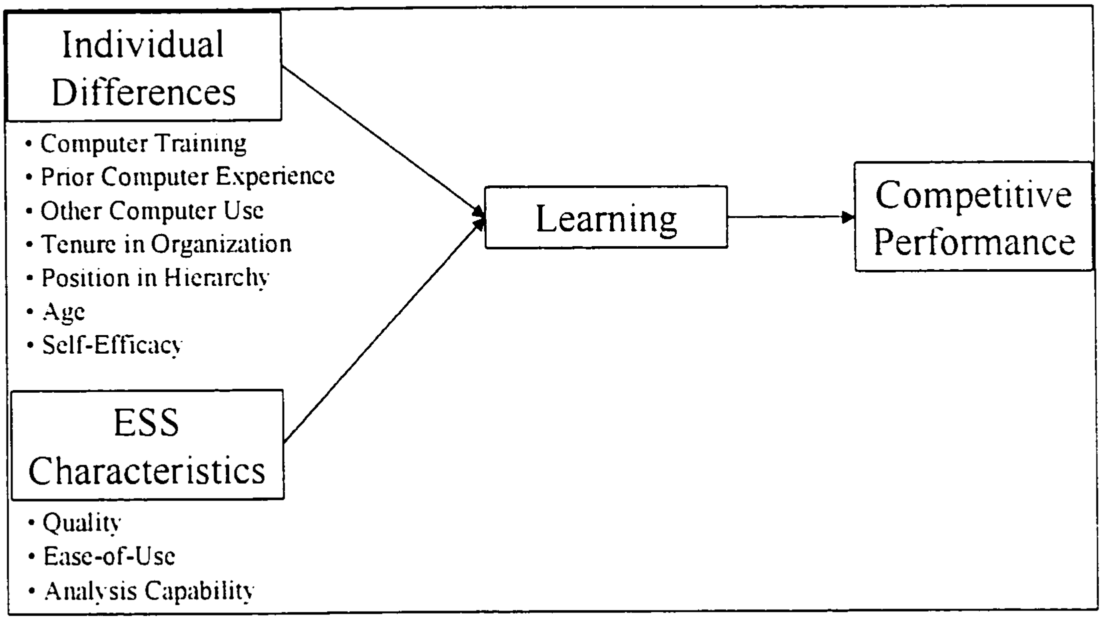

Figure 2: Learning Model -- Adapted from Betty Vandenbosch and Christopher Higgins, Executive Support Systems and Learning: A Model and Empirical Test", *Journal of Management Information Systems*, 1995

The perception of competitive performance is strongly related to mental model creation (Vandenbosch & Higgins, 1995).

The relationship between mental models, analysis capability, and competitive performance is detailed in Figure 2. In this figure, Vandenbosch and Higgins (1995) relate mental model creation with learning capabilities. Compeau and Higgins (1991) found that computer self-efficacy (self-efficacy being defined as a judgement of a knowledge worker's ability to competently use a computer) was significantly related to outcome expectations and system use. Their study encompassed over one thousand end-users. The findings from the Vandenbosch and Higgins' (1995) study were that perceived competitive performance was strongly related to mental-model creation. Ease of use and information value were both strong predictors of mental model update and mental model creation.

In situations where resources are constrained, knowledge workers are more interested in new and unusual information. Analysis capability is the construct that most clearly distinguished between mental model update and mental model creation. Vandenbosch and Higgins (1995) hoped that their study would encourage the development of a deeper understanding of what it takes to develop systems that stimulate mental model creation. They argued that there should be an investigation into the nature of analysis capability and how ESS can be designed to provide the support that knowledge workers need to build mental models. According to their model, without mental model creation, competitive performance gains seem distant or unlikely. Therefore, providing knowledge workers with analysis capability to look at new and unusual information should take precedence over providing more accurate, timely, and reliable versions of currently available information.

Organizational learning uses statistical tools to organize data and draw inferences, and involves experimentation with new approaches. Manufacturing organizations need knowledge workers who are trained in the skills and have the abilities required to perform and evaluate experiments, and the knowledge to distinguish between knowing how things are done and knowing why they occur (Garvin, 1993).

Knowledge Management

The knowledge management component of mental model creation and update is defined as the acquiring and disseminating of information. The acquired and disseminated information is used in learning, mental model update and creation, and in the application of business analytical models. In order for the manufacturing organization to develop a shared mental model, management must ensure that the manufacturing organization's knowledge workers have access and availability to the requisite information and then it must manage the information it acquires.

If the manufacturing organization is required to manage knowledge, knowledge must first be defined and described. Heinrichs, Hudspeth, and Lim (2001) describe various types of knowledge. Several types of categorized knowledge include quiescent knowledge, active problem knowledge, and meta-knowledge. The category of quiescent knowledge deals with general patterns, facts, and strategies. The active problem knowledge category refers to the relevant rules and assertions of the organization. Meta knowledge focuses on and deals with the procedures for acquiring knowledge and for focusing attention during the problem-solving phase. Each of these categories of knowledge is used by the knowledge worker in synthesizing, understanding and applying business analytical models in various scenarios (Heinrichs, Hudspeth, & Lim, 2001).

Additional categories of knowledge include declarative, procedural, and casual knowledge (Heinrichs, Hudspeth, & Lim, 2001). Declarative knowledge is descriptive. Declarative knowledge is the basis of a shared and explicit understanding of concepts, ideas, relationships and categories. It enables effective communication among people in manufacturing organizations. Procedural knowledge refers to how an activity is performed or how the activity happens. Procedural knowledge shared among knowledge workers in the manufacturing organization enables their actions to be smoothly coordinated. Casual knowledge refers to why something occurs. As such, causal knowledge becomes the assumptions and theory-in-action that drives the formation of strategies and organizational practices. Knowledge in this category becomes something that is stored and manipulated. It is the process of enacting expertise.

Table 4: Selected Knowledge Management Articles / Studies

Knowledge Management – Information Scanning and Acquisition			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Auster & Choo	1994	Study of 13 CEOs	*Scanning and Information Use for Decision-Making* – Executives scan the competition, customer, regulatory, and technological sectors.
Brush	1992	Survey of 66 New Ventures	*Scanning Behaviors and Performance* -- Customer opinion and attitudes correlated to higher performance.
Li	1995	Survey of 138 Firms	*Marketing Information Systems* -- A longitudinal analysis of the overall status of Market Information Systems (MKIS) in U.S. companies.
Maltz & Kohli	1996	Survey of 788 Managers	*Market Intelligence Dissemination* -- Dissemination frequency and formality have nonlinear effects on the perceived intelligence quality.
Moorman, Zaltman & Deshpande	1992	Survey of 779 Users	*Relationships between Providers and Users of Market Research* – The results of the study indicate that trust and perceived quality of interaction contribute most significantly to research utilization.
Peters & Brush	1996	Survey of 120 Firms	*Scanning Activities* -- A comparison of service and manufacturing businesses.
Ramaprasad & Rai	1996	Development	*Management of Information* – A discussion of the information generation--dissipation cycle and its role in knowledge development.
Vandenbosch & Huff	1997	Field Study of 7 Organizations	*Searching and Scanning* – EIS may lead an executive to challenge fundamental assumptions when using it to scan without specific questions in mind.

In Table 4 various journal articles and research studies are identified to elucidate the knowledge management component. The focus of these journal articles and research studies is on environmental scanning which is used to provide the knowledge workers with available information. It is also used to translate the required information into competitive advantage for the manufacturing organization. In this current era characterized by more and increasing knowledge, more and increasing complexity, and more and increasing turbulence an experimenting organization is required to survive (Huber, 1984). Therefore, in addition to being a learning organization, the manufacturing organization must also be an organization willing to experiment with various ideas and concepts. However, before it can experiment with leading-edge business analytical models, it must first acquire the necessary information. This is to ensure that the manufacturing organization manages from facts.

Searching and Scanning

Environmental scanning is the acquisition and use of information about events and trends in a manufacturing organization's external environment (Auster & Choo, 1994). The environment is defined as the totality of physical and social factors that are taken directly into consideration in the decision-making behavior of knowledge workers in the manufacturing organization (Duncan, 1972). Six environmental sectors available for scanning are customer, competition, technology, regulatory, economic, and socio-cultural (Daft, 1988). Two common methods for the use of the manufacturing organization's ESS are for scanning and for focused search. The scanning method relates to the general browsing of data. It is the process of searching for information to respond to a specific question or inquiry. In contrast, the focused search method is the searching for answers to specific questions or well-defined problems (Vandenbosch & Huff, 1997). Focused searching fine tunes the manufacturing organization's internal operations and verifies the knowledge worker's assumptions. Also, focused searching can be used y knowledge workers to help formulate problems and challenge fundamental assumptions thereby improving the effectiveness. Figure 3 illustrates the scanning concept. Browsing or searching is compared to viewing information without a specific information need in mind. The knowledge obtained from environmental scanning can assist in planning the manufacturing organization's future. Information obtained from environmental scanning is the raw material of the knowledge worker's analysis. Learning about the environment, then, is a critical activity of knowledge workers. Figure 3 relates the knowledge workers differences, organizational factors and ESS characteristics with the perceived improvement outcomes.

A sizable amount of literature has recently emerged to explain how a manufacturing organization's capabilities serve as a source of competitive advantage. The strategic importance of capabilities lies in their demonstrable contribution to sustainable competitive advantages and superior profitability (Day, 1994). A critical capability for the manufacturing organization is knowledge management. Nonaka (1991)

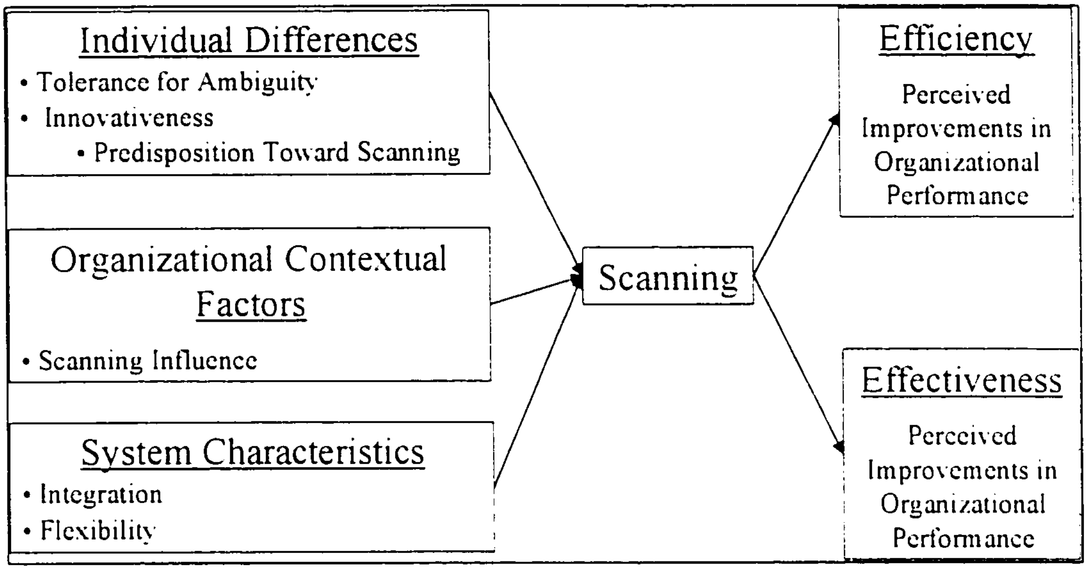

Figure 3: Information Scanning Model -- Adapted from Betty Vandenbosch and Sid Huff, "Searching and Scanning: How Executives Obtain Information from Executive Information Systems", *MIS Quarterly*, 1997

states that the only certainty is uncertainty and that the one sure source of competitive advantage is knowledge. If knowledge can become a competitive advantage, then access to information to produce knowledge and the processes used to share that knowledge become the lifeblood for the manufacturing organization.

Interpreting Information

Interpretation systems entail the movement of information from the scanning phase to the interpreting step and finally to individual learning. Environmental scanning was described as the process of monitoring and obtaining data. Interpreting then is the process of translating events and developing concepts consistent with the knowledge worker's prior understanding of the environment. Learning is the process of acquiring knowledge about the interrelationship between the manufacturing organization's actions and the environment as well as the actions that are taken on the basis of such knowledge.

Mintzberg (1973) states that senior executives and knowledge workers need to monitor information from a myriad of sources. Information is the fuel required for planning and strategizing. However, the relationship between ESS and organizational success is more complex than just scanning for information. If a senior executive or knowledge worker is not receptive to new and unanticipated information or if new information simply does not arise during the scanning process, creative insight and consequent improvements in organizational effectiveness are unlikely to occur (Vandenbosch & Huff, 1997). So, scanning becomes part of the process of learning.

Seventy-five percent of the knowledge workers in the Vandenbosch and Huff study sample did not use their ESS to scan for information; rather, they used their ESS to answer specific questions or to monitor organizational performance (Vandenbosch & Huff, 1997). Thus, the system characteristics affected the way in which an ESS was used and the impact it was perceived to have on the manufacturing organization. Even with a predisposition to scanning, without flexibility and analytic capabilities, knowledge workers are still unlikely to scan for information from an ESS. Cross-functional information and the ability to combine information from diverse sources coupled with latitude in how the information can be used are important characteristics (Vandenbosch & Huff, 1997).

For the most part, a lack of strategic intent in the use of ESS was found in these various studies. ESS promotional literature identified in this study suggests that executive support systems will enhance a manufacturing organization's effectiveness thereby enabling manufacturing organizations to stay ahead of competitors and make better decisions (Vandenbosch & Huff, 1997). A stated implication from this study is that manufacturing organizations should determine if their ESS are employed for scanning. Another implication from the study is that the manufacturing organizations should implement a proactive program for training their knowledge workers in this mode.

Insight Generation

The Marketing Science Institute (MSI) listed "improving the utilization of market information" at the very top of its research priorities for the 1990's (Menon & Varadarajan, 1992; Moorman, Zaltman & Deshpande, 1992). A variety of business analytical models that exist and have been extensively studied can be used to help knowledge workers accomplish the MSI stated objective. Understanding these business models and applying them in the appropriate situation is posited by these researchers to lead to improved utilization of market and product information.

Table 5: Selected Insight Generation Models Articles / Studies

Insight Generation Tools			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Aaker	1991	Book	<u>*Managing Brand Equity*</u> -- This book develops the concepts and constructs relating to brand equity. The Powergrid model is created to show movement in brand stature and brand strength.
Decastro, Chrisman, Schweiger & Sandberg	1994	Survey Utilizing the PIMS Database	<u>*Competitive Strategies and Financial Performance*</u> – This study argues that business performance is a function of an organization's product-market domain and alignment of resources.
Gale	1994	Book	<u>*Managing Customer Value*</u> -- This book develops the customer value map consisting of perceived quality and perceived price.
Lim, Heinrichs & Hudspeth	1999	Book	<u>*Tools for Knowledge Based Actions*</u> -- This book integrates the various business models and provides examples of each in a sample setting.
Ziethaml, Parasuraman & Berry	1990	Book	<u>*Delivering Service Quality*</u> -- This book describes the Service Quality Model and details its application in various businesses.

There are four business concepts and insight models utilized in this research study. Those models include the Aaker or Powergrid brand management model, the Boston Consulting Group (BCG) growth share matrix, the customer value map, and the service quality model (Aaker, 1991; Gale, 1994; Lim, Heinrichs & Hudspeth, 1999; Ziethaml, Parasuraman, & Berry 1990). Each of these business analytic models potentially provides the knowledge worker with different insight into the competitive environment. These insights provide the knowledge worker with direction and a theoretical foundation for their proposed knowledge-based actions. Table 5 provides a review of various literature discussing these business insight models.

The manufacturing organization's products and services form the basis of their market offerings. The brands and product names portray an image that the organization either has developed or wants to portray. As such, the manufacturing organization must understand and protect its brands. The first model utilized in this study is the Powergrid model. The Aaker or Powergrid model provides the knowledge worker with the ability to make insights into brand equity assessment and the cycle of brand development (Aaker, 1991; Keller, 1998). The PowerGrid model provides the knowledge worker in the manufacturing organization with an understanding of how the customers and consumers have acquired specific brand perceptions. The model informs the knowledge worker of the brand strength. Keller (1998) argues that brand strength is an important predictor of future performance and market potential. The model also informs the knowledge worker as to the level of that the consumer holds the brand. This is the brand stature. It represents the consumer's knowledge of the brand and the level of esteem that the consumer values the brand. This information can then be used to understand and position products, services, and brands. The information can assist in understanding a competitor's position in the market and can be used to target markets for a unique brand (Keller, 1997).

The second model utilized in this research study is the Boston Consulting Group (BCG) growth share matrix. The BCG growth share matrix is another tool that can provide the knowledge worker with an ability to perform business portfolio analysis (Kotler, 1997). By focusing on the various components in this model, the knowledge worker can gain insight into what objectives and budget allocation should be made to each of the manufacturing organization's divisions. This model can provide a framework to understand market and product potential. This model can help the knowledge worker estimate realistic growth rates for the market and for the product.

The customer value map is the third model utilized in this study. The customer value map provides insight into the manufacturing organization's strategy. The customer value map is created based upon the relative quality rating and relative value rating as defined by the customer. The customer value map becomes the tangible output from the customer value management process of the manufacturing organization. The customer value management process is the logical expansion of the total quality management programs of many manufacturing organizations (Gale, 1994). The customer value map concept has its empirical origins in the Profit Impact of Market Strategy (PIMS) program. This model or tool is used to focus the product and market strategy of the manufacturing organization on quality and pricing. As such, it can improve the customer perceived value of the product and service offerings. It can be used to locate market niches and focus the manufacturing organization operational strategy (Gale, 1994).

With more manufacturing organizations using service as the key differentiator in their product offerings, understanding and managing service quality becomes a key organizational requirement (Zeithaml, Parasuraman, & Berry, 1990). The service quality (ServQual) model provides the knowledge worker with insight into the dimensions of service quality or customer satisfaction. As such this is the fourth model used in this study. The five major dimensions defined by the service quality model are labeled tangible, reliability, responsiveness, assurance, and empathy. The focus for the knowledge worker is on understanding the gap between the customer's expectations and the manufacturing organization's performance. Once these gaps are identified and understood, the service quality model provides a methodology to close the gaps. The methodology provides various actions based upon each of the dimensions of service quality.

Each of these models provides the knowledge worker with additional information to develop insights into the competitive landscape. This information can be used to build a framework to gain insight into and propose actions to manage the competitive environment. The PowerGrid model, the ServQual model, and the Customer Value Map use the concept of the customer's perceived quality. As such, it can be seen that these models provide different views and applications for the knowledge worker to gain insight.

These models can help the manufacturing organization to determine the requirements for its competitive strategy. Strategic competitive weapons used to develop competitive strategy describe the ways a manufacturing organization uses its limited resources to create a competitive advantage. For example, the manufacturing organization can use low cost for its product or product differentiation as two of their strategic competitive weapons. The manufacturing organization's competitive strategy ultimately defines the match between the external environment and the resources used by the manufacturing organization in pursuit of its defined objectives (Decastro, Chrisman, Schweiger & Sandberg, 1994). It has been stated that a positive relationship exists between a manufacturing organization's breadth of scope and its financial performance (Decastro, Chrisman, Schweiger & Sandberg, 1994). Also, a positive relationship exists between the number of strategic competitive weapons utilized by the manufacturing organization and its financial performance (Decastro, Chrisman, Schweiger & Sandberg, 1994).

Summary

The understanding and application of business analytical models by the knowledge workers improves their ability to detect and correctly react to patterns in the information. The previous discussion on developing a learning organization has focused on three key ideas. Those ideas are organizational learning and the mental models of the knowledge workers, knowledge acquisition and management, and insight generation based upon utilizing leading edge business models. Each of these constructs provides the knowledge worker with additional capability and functionality to enhance the detection of data patterns and develop knowledge based actions.

Strategic Information Management for Problem Solving

Strategic information management for problem solving deals with three major ideas. The first idea deals with the concept of information presentation. The knowledge worker can be presented with information in the form of various charts and grids. The second idea deals with the manner in which knowledge is evoked from the knowledge worker. Knowledge evocation can utilize the guided analysis capabilities of the business intelligence software tools. The third idea to be presented deals with the access to information stored in the data warehouse and to the manufacturing organization's balanced scorecard information.

The capabilities of insight generation tools are expanding and thus, it is believed, enabling knowledge workers to remain in mental model creation mode for a longer period and ultimately generating additional meaningful insights. The mental model creation for knowledge workers involves how information is presented, how knowledge is evoked from the knowledge workers and from the organization, and the tools that the knowledge worker can utilize to access data in the organization's data warehouse. Based upon their analysis and creation of new mental models, the knowledge workers can pose new questions and utilize the data to gain further insights into their data. Insight generation tool use is then defined as the extent to which the knowledge worker uses the information disseminated from the tool to understand the environment, gain insights, and make and implement decisions (Maltz & Kohli, 1996).

Problem Representation Concepts

One of the key components in the problem-solving model is problem representation. The presentation capability of insight

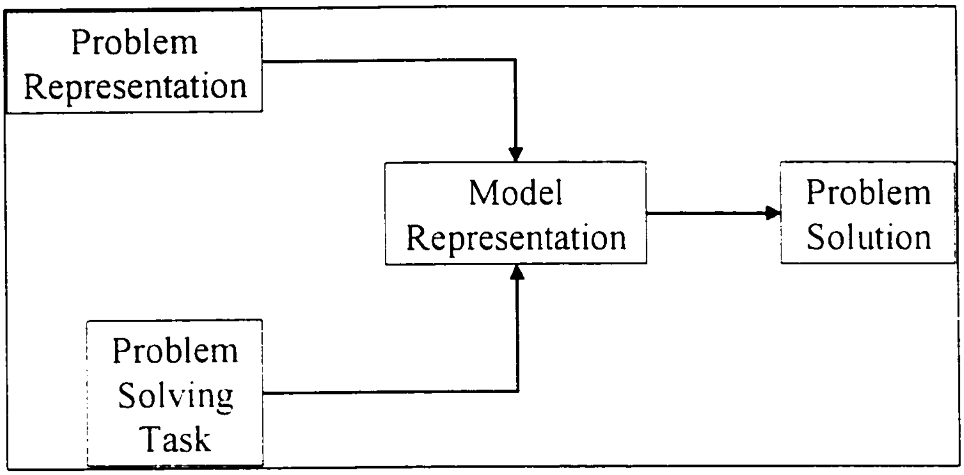

Figure 4: Problem-Solving Model -- Adapted from Iris Vessey, "The Effect of Information Presentation on Decision-making: A Cost-Benefit Analysis", *Information & Management*, 1994

generation tools can aid in mental model creation by linking problem representation with the problem-solving task (Vessey, 1994). This concept developed by Vessey is graphically portrayed in Figure 4. Information can be presented to the knowledge worker in either graph/chart or grid/table format to represent the identified or perceived problem.

Graphs/charts are spatial problem representations. They emphasize the relationships in the data. The data presented in the graphs/charts are assessed using the knowledge worker's perceptual capabilities. Graphs/charts enable the knowledge worker to assess the problem as a whole whereby the knowledge worker looks for relationships in the data (Vessey, 1994). Knowledge workers utilizing their perceptual skills can achieve a faster response time in uncovering problems and developing insights using graphs/charts when compared to utilizing grids/tables.

Table 6: Selected Information Presentation Articles / Studies

Information Presentation Management			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Vessey	1991	Meta-analysis	*Cognitive Fit Theory* -- This study investigated the graphs versus tables literature. Various studies detailing the performance results of accuracy versus time were detailed.
Vessey	1994	Meta-Analysis	*Cost-Benefit Analysis* -- This study examines the cost versus benefit approach to utilization of graphs and tables and links them to DSS effectiveness.

Grids/tables are symbolic problem representations that emphasize discrete data values (Vessey, 1994). The knowledge workers using analytical processes assess the data in grids/tables. Grids/tables enable the knowledge worker to assess precise data values in the problem (Vessey, 1994). The knowledge workers use analytical processes when the problem solution requires their responses to be more accurate and precise.

Depending upon the required problem-solving task, usage of one or the other problem representation methods or both in combination may be appropriate. Yet, in various research studies, it was determined that over twenty-six percent of the knowledge workers did not choose the appropriate problem representation (graphs/charts or grids/tables) to support the problem solution (Vessey, 1994). The inappropriate selection of the problem representation ultimately has an impact on the time required to analyze the data and the accuracy of the results used in the problem solution.

Problem Representation Theories

Two potential theories discuss the rationale for the presentation management choice selected by the knowledge worker. These two theories are the cognitive fit theory and the cost benefit theory. The cognitive fit theory describes problem-solving that involves information acquisition and well-defined evaluation. Problem representation is a step in the process to reach the problem solution step in Figure 4. The problem-solving tasks can be divided into spatial or symbolic tasks. In business, spatial tasks tend to involve understanding performance over time whereas symbolic tasks involve understanding the contribution of a market or channel. The problem-solving task requires the information to be presented in different ways. The ultimate performance of the task will be enhanced when there is a cognitive fit (i.e. a match) between requirement for problem representation and the problem-solving task. Cognitive fit theory argues that knowledge workers trade-off the effort required in making a decision (or solving a problem) against the accuracy of the outcome of that decision (or problem solution). Insight generation tool usage by knowledge workers provides a method to reduce the effort required in formulating a problem solution and thereby increase the likelihood of utilizing the appropriate problem solving task.

The cost benefit theory provides a way of organizing knowledge about information presentation via graph/chart, grid/table problem solving. The cost benefit theory suggests that knowledge workers change their strategy so that they minimize the joint cost of effort and error in making a decision. In this theory, strategy is defined as a general approach to problem solving that involves a number of steps or sub-tasks, including information presentation management (Vessey, 1994). The aim of a manufacturing organization's ESS is to support and extend the capabilities of the knowledge worker. The ESS can perform some amount of work for the knowledge worker so the knowledge worker is required to expend less effort in representing the problem. The manufacturing organization's ESS also can permit knowledge worker to change their strategy to simply investigate alternatives that could increase the problem solution's accuracy.

These two theories address the role of model representation in the problem-solving model of Figure 4. The cognitive fit theory positions the requirement for information presentation while the cost benefit theory explains levels of accuracy and precision for the problem solution. These referenced studies investigated the effectiveness of different presentation formats (graph/chart or grid/table) and the appropriate usage based upon the required problem-solving task (spatial or symbolic). However, the issues presented in the graphs/charts and grids/tables studies do not provide sufficient details about the task. Naïve assumptions in these studies are that decision-making performance, hence problem solution, is manifested in result accuracy alone. Yet, when a problem reaches a certain level of complexity, it may not be possible to solve it with just analytical or perceptual processes (Vessey, 1994). Additional tools are required to support the knowledge worker.

Knowledge Evocation

Evocation of relevant information is a critical aspect for the problem-solving task in Figure 4. One technique to accomplish knowledge evocation is to prompt the knowledge worker to search for relevant propositions. (Recall from the discussion in the Developing a Learning Organization section that searching and scanning for information is a critical activity in developing effective and efficient outcomes. This is illustrated in Figure 3.) This technique for knowledge evocation is called practical reasoning (Browne, Curley, & Benson, 1997). Practical reasoning acts to guide the knowledge worker through the voluminous amounts of available internal and external information. The guided analysis capability of insight generation tools functions as a structured aid for knowledge workers. It provides a starting point or an initial prompt for the knowledge worker to begin the exploration of the data via searching or scanning. Guided analysis seeks to create or update the knowledge worker's mental model based upon the training, insights, and experiences of experts who have domain-specific knowledge (Spence & Brucks, 1997).

With the guided analysis capability of insight generation tools evoking knowledge, the knowledge worker can strive to understand and gain additional insight into the information being presented. The information presented in response to the prompting questions can spark insights and additional questions from the knowledge worker, leading to additional insights. The interaction of information presentation management and the guided analysis function of knowledge evocation create enhanced capabilities for evoking knowledge.

To perform these activities effectively, knowledge workers need a mental model of the manufacturing organization drawn from discussions, model analyses, and reports (Mintzberg, 1973). The original belief held by the manufacturing organization's ESS designers was that greater flexibility and choice in cognitive software aids would promote improved knowledge worker performance (Dos Santos & Bariff, 1988). However, additional research studies suggest the counter-intuitive notion of restricted decision-making may actually lead to better results than unrestricted decision-making (Dos Santos & Bariff, 1988). The ESS with a focused guided analysis can direct or restrict the knowledge worker. It then provides an improved learning environment for the understanding of the modeled manufacturing organization. That improved understanding, in turn, can affect the manufacturing organization's performance.

Knowledge Evocation Studies

If reducing the knowledge worker's potential options results in better decisions, then the cognitive fit theory discussed earlier could be used as the rationale or guiding principle for restricting the knowledge worker's choices without the negative consequences arising from seemingly arbitrary restrictions. Each of the following three selected knowledge evocation studies focuses on investigating the impact of restricted guided analysis. These studies are summarized in Table 7.

User Interface Aids

In the first study, Dos Santos and Bariff (1996) examined the impact of guided analysis on knowledge workers. In the second study, Singh (1998) studied the impact of cognitive aids designed to compensate for knowledge worker's inherent weaknesses. In the third study, Spence and Brucks (1997) investigated the performance of novices as compared to experts on ill-structured problems. Each of these studies provides insight into the structure and capability of the guided analysis knowledge evocation functional capability.

Table 7: Selected Knowledge Evocation Articles / Studies

Knowledge Evocation			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Dos Santos & Bariff	1988	Experiment with 46 Business Students	*User Interface Aids for Decision Support Systems* -- This experiment investigated the system guided interface significantly improving performance.
Singh	1998	Experiment Using 144 Students	*Cognitive Aids* -- The experiment attempts to explore the black box of decision-making.
Spence & Brucks	1997	Experiment with 69 Experts and 72 Novices	*Problem Characteristics on Experts' & Novices' Judgement Aids* -- This experiment evaluated the impact of expertise on ill-structured problems.

Dos Santos and Bariff (1988) used students in their study to examine the impact of and the need for user interface aids. The researchers focused on three questions in their study. These research questions involved system guidance, exception reporting, and variance analysis. Each of these concepts that were studied pertains to finding and prioritizing problems. The first research question that was developed was that knowledge workers receiving system guidance for the manipulation of model variables would be better at finding and prioritizing problems than knowledge workers not receiving system guidance would. The research study supported this argument. This provides evidence to support the importance of guided analysis as a prompt or starting point for knowledge workers. The second research question that was investigated was that knowledge workers receiving reports developed by criteria-based exception reporting would be better at finding and prioritizing problems than users receiving reports containing self-selected variables. The study did not support this argument. While the question as stated was not supported, the implication is that the knowledge worker requires the ability to select performance metrics and dimensional variables to uncover insight when the knowledge worker needs it. The manufacturing organization's ESS should not encroach on the creativity and insight generation process of the knowledge workers. The third research question that was explored was that knowledge workers receiving model results as differences from a base case with which they are familiar (i.e. the current plan) will be better at finding and prioritizing problems than knowledge worker's receiving actual model results. The study supported this argument. This suggests knowledge workers perform better on problems when they are focused on the area of concern. This is as expected from the previous discussion of the cost-benefit theory. The knowledge workers focus their time and energy on key problem areas.

The overall conclusion from this study by Dos Santos and Bariff (1988) is that problem finding and problem prioritization are facilitated by structured interfaces. The results also imply that the knowledge worker's creativity will not be hindered. The results from the study are reasonable and expected when viewed from the cost-benefit theory standpoint. The capabilities of system guidance and variance analysis focus the knowledge worker's attention. The guided analysis capability provides a systematic approach to structuring the problem finding and prioritization.

Cognitive Aids

With knowledge workers increasingly focused on intellectual work involving planning, control, and monitoring tasks, understanding the effect of cognitive mechanisms and cognitive aids on strategy execution processes is important. Strategy execution is defined as the step-by-step implementation of the various activities that make up a formulated decision-making strategy (Singh, 1997). The argument that is presented is that once the strategy is developed or formulated, the execution of the strategy depends on logistical and environmental conditions. Hence, a manufacturing organization's ESS should be designed to capitalize on knowledge worker's strengths and compensate for their inherent weaknesses. A successful strategy execution process is predicated upon the extent to which knowledge workers actively monitor their activities in order to detect potential deviations from the agreed upon business plan.

Yet, using this process monitoring is dependent on a knowledge worker's level of attention.

A study to investigate the efficiency and effectiveness of the strategy execution process of knowledge workers was developed by Singh (1997). The investigation was focused on introducing strategy complexity and interruptions. It investigated how computerized support affected each of these variables. The results of incorporating cognitive aids into decision support systems indicate that cognitive aids can have a significant positive impact on both decision-making efficiency and decision-making effectiveness (Singh, 1998).

Judgement Aids

Spence and Brucks (1997) examined the judgement of experts as compared to novices based upon various classifications of problems. The study focused on problem structure as moderating the effect of expertise on decision performance. This is illustrated in Figure 5. Problems can be characterized as structured, structurable, or unstructured. When problems or tasks are unstructured, experts use their judgements and heuristics. Problems or tasks that are essentially structurable are information rich and require large amounts of internal knowledge (Spence & Brucks, 1997). Using their existing knowledge, experts can reformulate, decompose, and/or impose constraints on these types of problems. By doing this, experts reduce the size of the problem space. Spence and Brucks (1997) believed that the performance differential between experts and novices would be greatest for ill-structured problems. Figure 5 provides a conceptual framework for contrasting the roles and actions of experts versus novices in various problem structures.

Their study was constructed to provide insights into when experts would outperform novices and determine why experts are able to

	Well-Structured	Ill-Structured, but Structurable	Unstructured
Experts	Experts Solve the Problem on the Basis of Their Knowledge and External Information	Experts Apply Their Knowledge to Form an Internally Well-Structured Problem That Can Be Solved More Easily	Experts Reason by Analysis or Use Heuristics
Novices	Novices Figure Out How to Solve the Problem on the Basis of General Knowledge and External Information	Novices Cannot Reliably Structure the Problem. They Evoke Simplifying and Often Inappropriate Heuristics	

Figure 5: Problem Structure Framework -- Adapted from Mark T. Spence and Merrie Brucks. The Moderating Effects of Problem Characteristics on Experts' and Novices' Judgments. *Journal of Marketing Research*. May, 1997

outperform them. Spence and Brucks (1997) argued that clearly defined rules for selecting, evaluating, and combining inputs to make judgements and decisions are not common in the real world and that (manufacturing) organizations ultimately depend upon the knowledge worker's expertise to deal with these complex environments. The research questions developed for this study then were based upon the belief that experts would outperform novices in solving complex, ill-structured problems. The developed questions focused on the speed of problem-solving, the selection of information inputs, the evaluation of information inputs, the consistency and accuracy of their judgements, and the confidence in their judgements.

The results from their research showed that by increasing the problem or task structure by providing the novices with a decision aid actually helps novices work through an analytical problem-solving process. This in turn reduces the likelihood of novices making large errors by reducing the variance associated with their judgements. This also increases the confidence levels of novices. The research project demonstrated that experts are better than novices are at selecting and evaluating inputs. It is argued that when faced with realistic real-work problem-solving conditions, experts can reliably outperform novices. Experts can outperform novices because they have the ability to impose structure onto large complex problems or tasks. Given the expert's skill, training, and experience, they can evoke viable solution strategies from memory.

The study also explored how withholding or providing a decision aid moderates the expert decision-making link. When novices were provided with the structuring aid, they made more accurate decisions. The decision aid drew attention to specific inputs, thereby helping novices impose a meaningful structure onto the problem. This demonstrates the improvement in decision performance of the novice knowledge workers using decision support tools (Spence & Brucks, 1997).

A manufacturing organization's ESS is a computerized aid designed to enhance the outcomes of a knowledge worker's decision-making activities. Historically, the primary focus of ESS research has been to study the impact of various decision aids on decision-making efficiency and decision-making effectiveness. There is a definite need to "open up the black box" and shift attention from the outcome of decision-making activities to the processes and mechanisms that explain a knowledge worker's overt behavior and performance (Singh, 1998).

Emergence of Dynamic Enterprise Analysis

At times, pursuing the implications of a new insight might require the knowledge worker to make on-line changes without a computer analyst's intervention. A multidimensional database allows knowledge workers to change analytical dimensions and/or utilizing new cross-dimensional business logic or arithmetic/statistical expressions (Heinrichs & Doll, 1999). These analytical capabilities enhance analytical, information presentation management, and guided analysis capabilities. This dynamic capability enables knowledge workers to "move at the speed of questions" rather than being delayed by the need for intervention to change analytical dimensions. Therefore, knowledge workers should be engaged in mental model creation for a longer period of time and, thus, demonstrate increased strategic thinking competence.

Table 8: Selected Dynamic Enterprise Analysis Articles / Studies

Multidimensional Analytic Capabilities			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Codd, Codd & Salley	1994	Monograph	*Multidimensional Analytic Capabilities* -- A description and positioning of various features and capabilities.
Rainer & Watson	1995	Survey of 48 Individuals	*Keys to Executive Information System Success* – Operational EIS factors included information delivery, information quality, impact on work, EIS functionality, and ease-of-use.

Further expianation of multidimensional analytic capabilities and ESS success factors is warranted. Various studies have explored these issues. Several of these studies are detailed in Table 8.

Multidimensional Analytic Capabilities

In the early 1980s, Codd developed the concepts that form the rules and standards for relational database technology. Relational database concepts are used in transactional processing systems and traditional ESS applications. In the early 1990s, Codd also defined the rules and features for the database technology to be used in On-line Analytical Processing (OLAP) (Codd, Codd & Salley, 1993; Radding, 1994). OLAP became the term synonymous with this multidimensional database technology. OLAP is defined as the name given to the dynamic enterprise analysis required to create, manipulate, animate, and synthesize information from enterprise data models (Codd, Codd & Salley, 1993).

This definition of OLAP database management capability includes the ability to discern new or unanticipated relationships between variables, identify the parameters necessary to handle large quantities of data, create an unlimited number of analytic dimensions, and specify cross-dimensional arithmetic and business logic expressions.

Nigel Pendse (1997) summarized these OLAP rules and features into a simple five words expression labeled *"Fast Analysis of Shared Multidimensional Information".* In this expression, the term "fast" implies that the majority of responses requested by the knowledge worker are handled in less than five seconds. The term "analysis" means that the information system can handle statistical analysis and business logic relevant to the manufacturing organization. The term "shared" means that the security requirements to protect the manufacturing organization's data are addressed. The term "multidimensional" means that a multidimensional conceptual view of the data can be obtained and presented to the knowledge worker. The term "information" means that all required data and calculations are available when required by the knowledge worker.

ESS Success Factors

With the concept of multidimensional analytical capabilities defined and specified, understanding the importance placed upon these capabilities by the manufacturing organization becomes a priority. Rainer and Watson (1995) sought to describe the factors associated with the ongoing successful utilization of ESS in manufacturing organizations. ESS are high-risk, high-return systems (Rainer & Watson, 1995; Volonino & Watson, 1991; Walstrom & Wilson, 1997). These researchers based this statement on the fact that the sponsor or champion for an ESS is usually a high level senior manager in the organization and that the information requirements for this senior manager are difficult to provide.

In their study, surveyed executives mentioned, on the average, ten factors related to successful ongoing operations of an ESS. Using exploratory factor analysis techniques, the success factors were categorized into five areas. These five areas were related to information delivery, information quality, impact on work, functionality, and ease of use. The executives were interested in how the system directly affects them (Rainer & Watson, 1995). The importance of the operational ESS was based upon improving their efficiency and receiving information that was accurate, relevant, current, and convenient to access. Access to external data, concise information, system reliability, and higher quality decisions were stated as significant to successful operation of ESS. The conclusion of the study was that the most important variables affecting successful operation of the ESS are those variables that affect the executives and their work (Rainer & Watson, 1995).

The focus of the business intelligence tool construct is on detailing the required capabilities for a successful ESS and on confirming the success factors from an executive perspective. The capabilities are all the elements required to create, manipulate, and synthesize information. They include calculation support, statistical tools, business logic, and multidimensional analysis. These tools and capabilities were shown to support the improving of the knowledge worker's mental model of the manufacturing organization.

Summary

The discussion on information presentation management has focused on three key constructs. They are information presentation management, knowledge evocation, and dynamic enterprise analysis. Each of these constructs provides the knowledge worker with additional capability and functionality to enhance the speed and efficiency of their problem structuring and problem solving skill. Information presentation management provides the business focus for knowledge workers in the manufacturing organization.

Strategic Thinking Paradigm

Enriching the repertoire of ideas and frameworks that knowledge workers have available to them facilitates strategic thinking (Liedtka, 1998). The new viewpoint championed by the strategic thinking philosophy is the belief that all knowledge workers need to possess the ability to think strategically. Strategic thinking is not the domain of the manufacturing organization's senior management or a particular functional department. Strategic thinking involves all of those knowledge workers who have responsibility for the implementation of the manufacturing organization's strategies (Flitman, 1996; Wilson, 1994).

Given this viewpoint that the knowledge workers require the ability to think strategically and that they are responsible for the implementation of the manufacturing organization's strategies, it then becomes necessary to understand the framework used by the manufacturing organization to facilitate strategic thinking and strategy implementation. The manufacturing organization's philosophical orientation to the marketplace and the manufacturing organization's strategic planning process provide such a framework. The manufacturing organization's market orientation provides the vision and guiding principles for the knowledge workers. The planning process provides the tools and structure to implement the vision.

Orientation to the Marketplace

A growing body of empirical evidence supports the proposition that a market orientation by the manufacturing organization is positively associated with superior performance (Day, 1994). Market orientation is defined as a philosophy of management based upon an organization wide acceptance of the need for customer orientation, profit orientation, and organizational coordination. The coordination role is required to communicate the needs of the marketplace to all knowledge workers within the organization (Kohli & Jaworski, 1990; Kotler, 1988; Pitt, Caruana, & Berthon, 1996). This coordination role focuses on the generation and dissemination of market and product intelligence. The manufacturing organization's response to this intelligence closes the feedback loop.

Table 9: Selected Market Orientation Articles / Studies

Market Orientation			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Kohli & Jaworski	1990	Framework Development based upon 62 Field Interviews	*Market Orientation Framework* – An integrating framework that includes the antecedents and consequences of market orientation.
Pitt, Caruana & Berthon	1996	Market Orientation Evidence based upon Survey Research	*Market Orientation Evidence* A survey based study linking market orientation to business performance

Market orientation is the organization-wide generation of market and product intelligence pertaining to current and future customer needs, the organization-wide dissemination of that intelligence to all knowledge workers and the organization-wide responsiveness to that information. It can be seen that market orientation focuses on specific activities in the manufacturing organization. The generation of market intelligence involves analysis of customer and product databases, performing market research to frame the analysis, and understanding the sales response to the organizational actions.

The generation of market intelligence does not stop at just obtaining the customer's opinions, but proceeds to the careful analysis and interpretation of the environmental forces that impact the customer's needs and preferences. The rate of change in the customer's opinions and preferences and the competitors' actions is labeled as market dynamism. It is felt that manufacturing organizations operating in dynamic markets need to track the changes in the market more frequently than manufacturing organizations operating in relatively stable markets. Therefore, market intelligence ages rapidly in dynamic markets requiring greater information generation frequency (Kohli & Jaworski, 1990). It also requires that the manufacturing organization efficiently disseminate the obtained market intelligence utilizing formal and informal communication channels within the manufacturing organization (Kohli & Jaworski, 1990; Kotler, 1988).

Each step in the manufacturing organization's business processes generates and demands information (Day, 1994). The goal of the manufacturing organization should be to provide this information to the knowledge workers as efficiently and effectively as possible. With the expansion of information available to the knowledge workers for problem-solving and the increased time pressure for manufacturing organizations competing in a global marketplace, a central issue in intelligence generation and dissemination becomes the management of information.

Intelligence Dissemination

But what are the characteristics of an effective intelligence dissemination process? Kohli and Jaworski (1990) suggest that the more frequent sharing of market intelligence characterize a superior dissemination process. The ultimate use of the market intelligence by the knowledge worker, however, is affected by the trust the knowledge worker places in the individual sending the market intelligence. A substantial body of literature suggests that the knowledge workers' perception of the market intelligence quality influences the degree to which they act upon that information (Menon & Varadarajan, 1992; Moorman, Zaltman, & Deshpande, 1992). It has been empirically shown that market intelligence disseminated through the manufacturing organization's formal channels is used more than that market information disseminated through the manufacturing organization's information channels. It is posited that this occurs because of the verifiability of the formal communications within the manufacturing organization.

But what is the source of the market intelligence required by the knowledge workers? The data sources used by the manufacturing organization can simply be defined as being either internal or external in origin. Internal data sources are where the facts (data and information) are gained from the internal experience of the manufacturing organization. External data sources are where the facts are obtained from external sources (Brown, Curley & Benson, 1997). Li (1995) surveyed various organizations regarding usage and satisfaction of various internal information sources and various external information sources. The empirical study highlighted the overall dissatisfaction that the knowledge worker's had with the available information presented from these systems. While the internal financial information was available, the linkages and ability to apply both the internal and external data sources to problem identification was difficult. The knowledge workers expressed dissatisfaction with the tools to generate and disseminate market intelligence.

Strategic Planning Competence

Market orientation provides the philosophy for the manufacturing organization. The market intelligence processes provided the knowledge worker with the tools and capability to implement the articulated vision. The missing elements become the articulation of the vision and the processes to translate that vision into reality. Figure 6 displays the relationship among the concepts of synthesis, intuition, and creativity as being key integrative elements in the creation of the strategic vision. The vision provides the manufacturing organization with the desired state. Figure 6 illustrates the movement from the desired state to the current state as requiring an intermediate step of strategic planning.

After the mixed results of strategic planning by American businesses in the 1960s, strategic planning evolved into a system of strategic management or strategic thinking. Strategic thinking is characterized by a shift of the planning responsibility from a staff function to a line function. Strategic thinking places an emphasis on the increased attention to the changing market and competitive environment. Figure 6 illustrates the linkages of strategic thinking and strategic planning as moving between the current state and the desired state. The manufacturing organization requires a greater focus with an emphasis on the external environment to accomplish this objective. The goal for strategic thinking then becomes an increased understanding of the manufacturing environment. Strategic thinking involves an increased emphasis on competitive analysis. Given the rapidly changing competitive environment, manufacturing organizations are recognizing that they must change their thinking and behavior to deal with this new environment and become market-oriented.

Strategic Thinking

The need to create a capability for strategic thinking at multiple levels in the manufacturing organization has increasingly been recognized as central to creating and sustaining competitive advantage for the manufacturing organization (Liedtka, 1998). Strategic thinking

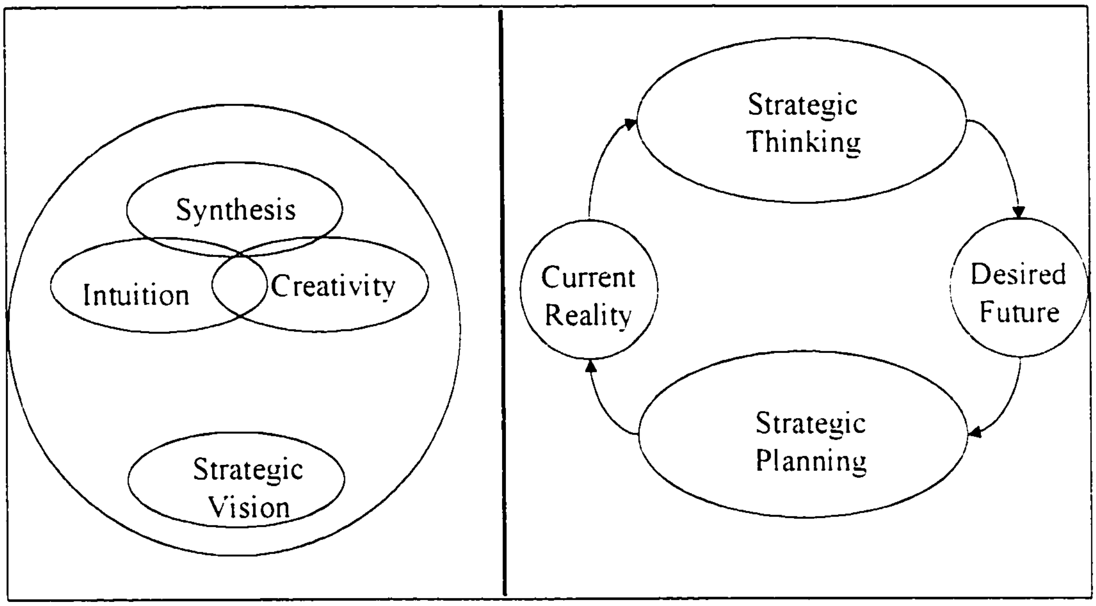

Figure 6: Strategic Thinking Model -- Adapted from Andrew Flitman, "Reporting for Strategic Control", *Management Decision*, 1996 and from Jeanne M. Liedtka, "Linking Strategic Thinking with Strategic Planning", *Strategy and Leadership*, 1998

has been conceptualized and described by Liedtka (1998) as having five major components. These major components are labeled systems view, focus on intent, thinking in time, hypotheses driven, and intelligently opportunistic.

The first component of strategic thinking involves taking a systems view. A systems view for systems thinking occurs when the knowledge worker (a strategic thinker) has a complete or an end-to-end mental model of the entire value creation process in the manufacturing organization. By taking the systems view, the knowledge worker (strategic thinker) clearly understands the contribution that is made to the larger system that ultimately produces outcomes of value for the customer. The systems view helps the knowledge worker focus on the customer orientation.

The second component of strategic thinking is focusing on intent. Focusing on intent provides the opportunity for the knowledge workers within a manufacturing organization to marshal and leverage their collective energy. This focus is required to move to the desired state. The third component of strategic thinking is the ability to think in time. Thinking in time allows the knowledge worker to link the past, the present, and the future together. It is believed that the future states ultimately comes from the past states. There is no discontinuity from the past state to the future state. What matters is the change from the past state to the present state. Thinking in time uses institutional memory and organizational learning.

The fourth component of strategic thinking is being hypotheses-driven. Hypotheses-driven implies that the knowledge worker brings data and information to bear on the required analysis. The analysis becomes the basis for knowledge based actions for the manufacturing organization. The fifth component of strategic thinking is being intelligently opportunistic. Intelligently opportunistic leaves the possibility of emergent strategies open. This is a key point in the movement of strategic planning from a staff responsibility to a line responsibility. For it is at the line level that emergent strategies occur. In this scenario, strategy formulation and strategy implementation become an interactive process rather than being a sequential and discrete exercise conducted annually.

Strategic Thinking versus Traditional Thinking

To bring the strategic thinking perspective into focus, it may be helpful to contrast it with the traditional method of thinking. The strategic thinking perspective can be contrasted with the traditional thinking perspective in five distinctive ways. The first contrasted perspective deals with the idea that intelligence is essential. Strategic thinking assumes a future by which only the overall outcome can be predicted. Exact future states and specific scenario outcomes are not specified. The traditional perspective of thinking is based upon the idea that the future can be predictable and that the future states can be specified in detail. Controlling uncertainty through prediction or forecasting tools is required for traditional thinking. Resource dependence theory predicts how manufacturing organizations respond to uncertainty within their external environment (Handfield, 1993). Manufacturing organizations will either absorb the environment (acquire control), create the environment (control via legal means) or negotiate the environment (collective structures of action). The goal of the manufacturing organization, according to the resource dependence theory, is to reduce uncertainty. Therefore, since this occurs, it is believed that strategy formulation and strategy implementation responsibilities can be divided and that different knowledge workers can be assigned the responsibility to formulate strategy from those required to implement that strategy.

The second perspective to be contrasted is based upon the idea of self-reference. In the strategic thinking view, self-reference focuses the manufacturing organization on a sense of strategic intent and strategic purpose. However, the traditional perspective to thinking is to control the manufacturing organization through measurements systems. The difference between the strategic thinking view and the traditional view is in the understanding of why an event occurs rather than just reporting the outcomes of that event.

The third perspective being contrasted is based upon the systems view. In the systems view, an understanding of the system and the interconnectedness of the system is required. The traditional perspective holds that knowledge workers need to know only their specific role in the manufacturing organization. It holds that they will focus mainly on protecting their manufacturing organizational function. The difference is one of understanding the interrelationships of the other functional areas. The fourth perspective assumes strategy and change are linked. This perspective assumes that finding and implementing options are harder and more important than evaluating them. The traditional perspective assumes setting direction is an analytic function. The fifth perspective of strategic thinking states that the planning process is the critical value-adding element. The traditional view is that the plan is important but not critical. Each of these views helps differentiate the requirement for strategic thinkers in today's dynamic global environment.

Strategic Thinking Process

Figure 7 begins to position these concepts. The goal is for the manufacturing organization to be positioned to the right of line "A". Boisot (1995) argues that the manufacturing organization's focus should not be solely in controlling uncertainty to reduce turbulence, but rather should be on increasing understanding to enable the manufacturing organization to thrive at higher levels of turbulence. The proposed path is from the emergent strategy through strategic planning to gain insight through strategic intent. The path accepts turbulence in the market and utilizes understanding to maintain the manufacturing organization's direction.

Strategic Thinking Process Results

In an empirical study, it was shown that there exists a positive relationship between strategic planning and overall manufacturing organizational performance. It was argued that this occurred because of the manufacturing organization's focus on adaptation to the environment and the formal thinking through of strategic issues and resource allocation priorities (Capon, 1994). Strategic direction stressing resource allocation at the corporate level to growing businesses in which the manufacturing organization is well positioned improves the performance

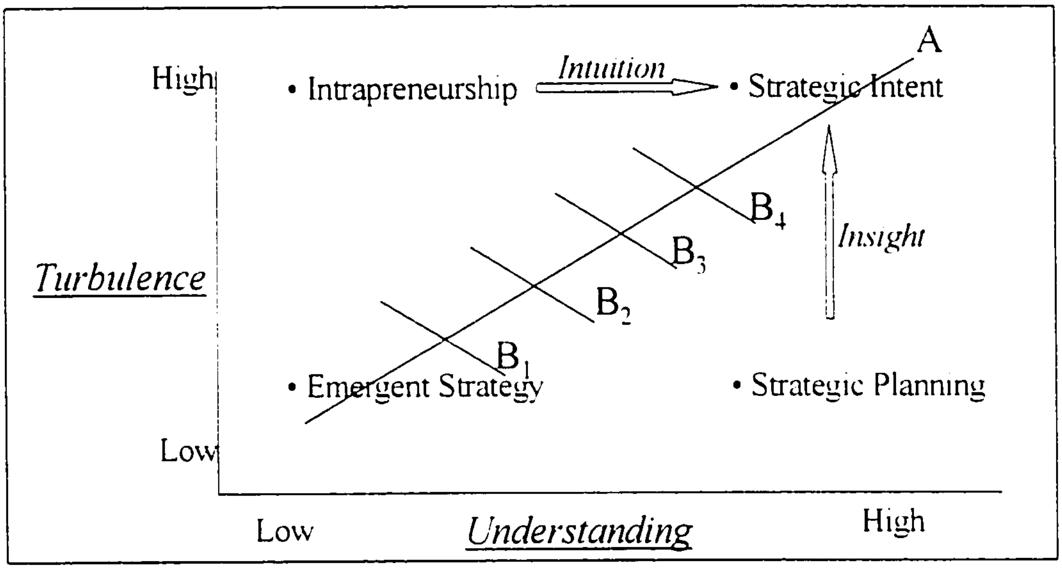

Figure 7: Strategic Responses -- Adapted from Max Boisot, "Preparing for Turbulence: The Changing Relationship Between Strategy and Management Development in the Learning Organization", 1995

of manufacturing organizations that plan strategically by more than one percent return on capital. Planning systems that focus on financial and budgeting do not improve.

Table 10: Selected Strategic Thinking Process Articles / Studies

Strategic Thinking Competence			
Author(s)	*Year*	*Type of Article*	*Topic Area*
Capon, Faley & Hulbert	1994	Meta-Analysis	*Strategic Planning and Performance* -- A strategic direction stressing resource allocation improves performance of firms that plan strategically.
Boisot	1995	Monograph	*Strategy and Management Development* -- A discussion of the strategic repertoire of the organization by examining the environmental turbulence and organizational understanding.
Leidner & Elam	1994	Survey of 46 Firms	*Impact of Executive Information Systems on Executive Decision-Making* -- A focus on the use of EIS as it impacts decision-making.
Lumpkin & Dess	1995	Survey of 32 Firms	*Simplicity as a Strategy-Making Process*-- A simple approach to strategy making can be effective during the early stages of an organization's growth but may impede performance in later stages.
Mintzberg	1994	Case Description	*Strategic Planning Is Not Strategic Thinking* -- An investigation of the fallacies of strategic planning and implications for strategic thinking.
Porter	1996	Case Description	*What is Strategy?* -- An investigation of what encompasses strategy. Examines unique activities, strategic position, and the role of leadership.

Bracker (1988) investigates planning process sophistication and financial performance. His research identified five points that were identified on the strategic planning continuum. Those five points are labeled short term forecasting, budgeting, annual planning, long-range planning, and strategic planning. This research further identified eight planning components for understanding the process sophistication. Those planning components are objective setting, environmental analysis, strength, weakness, opportunity, and threat (SWOT) analysis, strategy formulation, financial projections, functional budgets, operating performance measures, and control and corrective procedures. The levels of planning are labeled unstructured, intuitive, structured, operational, and structured strategic plans. Additional empirical studies have shown that planning sophistication is positively related to performance (Braker, 1988). Forty-six percent of the variance in the financial performance of the organization was explained by the construct, planning sophistication. Manufacturing organizations that used structured strategic plans were shown statistically more effective than those organizations employing any other type of planning level. Manufacturing organizations are able to plan, implement, and control plans. It was shown in this empirical study that the planning process not the actual plan was the key component of performance. It was also noted that it takes two or three planning iterations to lead to performance gains.

Problem-Solving Stages

Once the direction has been established and the various strategies have been planned, the knowledge workers must now move to action.

The knowledge worker's job is to uncover opportunity and then to exploit it.

To understand how knowledge workers move to action, it is required to distinguish between choosing between options, deciding on a solution or course of action, and problem-solving. Choice is used to encompass the sorting out of options, whether conscious or unconscious (Coscarelli, Burk, & Cotter, 1999). Deliberate choices are to be referred to as decisions. These decisions set the stage for actions. Problem-solving, however, is defined as a process that involves, at a minimum, three stages. Those stages are recognition of a problem, selection from among alternative courses of action and evaluation of potential outcomes.

The business intelligence software tools that are available to the knowledge worker to move to action include an Executive Support System (ESS). An ESS is a computer-based information system designed to provide knowledge workers with access to information relevant to their insight generation and problem finding/problem-solving activities (Leidner & Elam, 1994). Previous empirical studies have shown that ESS use was positively and significantly related with problem identification speed and the extent of analysis performed by the knowledge workers.

Analysis for the knowledge workers is defined as the reflective thought and deliberation given to a problem and the array of proposed responses. Time spent on interrelating symptoms to get at the root cause of problems and the effort spent to generate solutions are

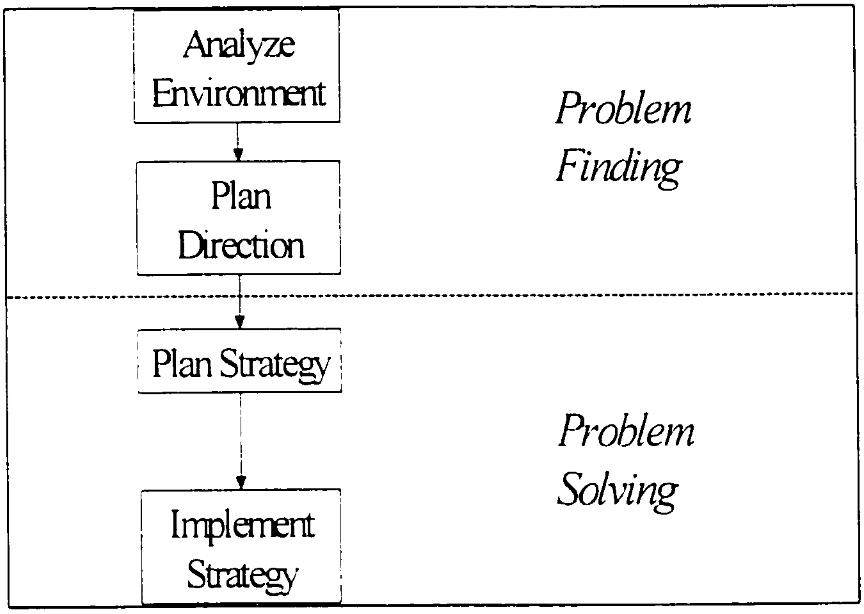

Figure 8: Problem Finding/Solving Model -- Adapted from John van den Hoven, "Executive Support Systems and Decision-making", *Journal of Systems Management*", 1996

examples of the analytic process. The time frame for analysis has hardly been studied although speed is considered particularly important in highly uncertain, dynamic or high-velocity environments. Leidner and Elam (1994) state that El Sawy suggests that to compete effectively in today's time-compressed information intensive environment, fast response is increasingly becoming a critical strategic capability (Leidner & Elam, 1994). Eisenhardt found that the most effective organizations made strategic decisions quickly (Leidner & Elam, 1994). The knowledge worker's confidence and anxiety associated with their problem solutions were identified as key components determining the speed of the process. It is posited that business intelligence software tools and business analytic models enhance the knowledge workers' confidence and reduce their anxiety.

Manufacturing organizations have begun to use multiple analytical techniques and methodologies in their strategic planning process. This is a shift from the 1960s and 1970s where the focus in strategic planning was on the methodology and one best technique. Strategic planning has evolved into strategic thinking. The practice employed by strategic thinking now is to employ a mix of methodologies. One methodology employed in the past was Group Decision Support Systems (GDSS). The GDSS was used to assist the knowledge workers in defining problems through group interaction and brainstorming techniques. The emphasis in the strategic planning process is on the thinking behind the words and on a focused dialogue of the issues facing the manufacturing organization. The nineties introduced the definition of multidimensional databases and executive support systems. This research study focuses on ESS and the integration of OLAP technology using multidimensional databases. The business models or decision models portrayed in this study are used to aid strategic thinking with regard to ESS. It is with this ESS perspective that the term decision model or business model is used. Strategic thinking is now more a matter of continuous organizational learning (scanning, interpreting, and adapting to environmental change) than it is of control (Wilson, 1994). The knowledge worker's level of skill has emerged as a significant challenge facing the manufacturing organization (Flitman, 1996).

Summary

The discussion on demonstrating strategic thinking competence has focused on market orientation of the manufacturing organization, the movement to strategic thinking and on the results of the strategic planning process. Demonstrating strategic action-oriented thinking is a result of the speed related to problem structuring and detecting data patterns.

Conclusion

The strategic thinking process adds richness to the problem identification/problem solution perspective by recognizing the crucial learning that takes place during the complex iterative process of moving toward a solution in anything by the simplest situation (Gorry & Morton, 1989). However, more quantitative and heuristic approaches are needed by knowledge workers (Gorry & Morton, 1989). Developing and providing these approaches has become the challenge for research in the 21st century.

Competitive advantage can be won or lost by marginal differences in the speed, accuracy, and the comprehensive nature of information being delivered to the knowledge workers (Sloan & Green, 1995). Information technology is enabling every manufacturing organization to have access to various sources and types of market intelligence. The key in taking advantage of this abundant intelligence is in the timely and correct use of that market intelligence. The competitive advantage lies in a manufacturing organization's ability to use market intelligence to create knowledge not solely in its access to market intelligence (Maltz & Kohli, 1996; Nonaka, 1991).

Volatile market conditions force managers to make strategic decisions concerning new product development, process innovation, and capacity planning within a more limited time space than ever before. This time pressure inevitably calls for a higher degree of consensus on cross-departmental decision problems (Rho, 1994).

Chapter Three
Research Model, Hypotheses, and Design Procedures

Strategic problem solving is believed to unfold as a nonlinear process in which knowledge workers gather intelligence, set direction, uncover and evaluate alternatives, and then implement a favored course of action (Mintzberg, 1995; Nutt, 1998). Also, Nutt (1998) states that organizational politics call for the knowledge workers to have well-conceived arguments for their decisions. This is necessary in the event that senior management questions their actions or in the event that pragmatics in the manufacturing organization call for knowledge workers to look further for a better (or for the best) course of action. Therefore, as the number of decision alternatives available to the knowledge workers increase, knowledge workers tend to use analytical techniques more often and tend to use their judgement less often to develop and to support their favored decision alternatives (Nutt, 1988).

Research Model

Based upon the previous discussion and literature review, this research study investigated the combined impact that computer-aided business intelligence software tools and applied analytical business models have on the knowledge workers demonstrated strategic thinking competence. The specific variables of interest and their proposed relationship are presented in the research model graphically illustrated in Figure 9a. The presented theoretical research model has three major component elements under investigation. The first component in this model is entitled the "Business Analytical Models for Insight Generation " and the second component in this model is entitled "Information Management Tools for Problem Solving". Together, these two components become the independent variables for this research study. The third component in the model is labeled "Strategic Thinking Ability". This component is the dependent variable analyzed in this research study. It is posited that increases in the knowledge worker's capabilities related to the independent variables will yield demonstrably higher levels of performance on the dependent variable, strategic thinking ability. Both Figure 10 and Figure 11 graphically display the expected results and outcomes from this research study.

Business Models

The first major independent variable, "Business Model Utilization", focuses on how the knowledge worker combines diverse business analytic models to derive a complete picture or more detailed understanding of the phenomenon under investigation or under review.

This information is combined with various analytic models that are used that to generate insights. These insights can then support, alter or create new mental models for the knowledge workers. The obtained information from the analysis can then be shared with other knowledge workers in the organization and stored for future use.

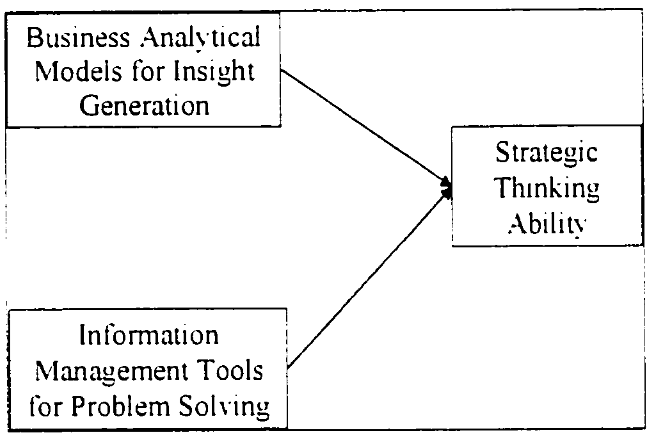

Figure 9a: Conceptual Research Model

"Insight Generation Models" is a key construct for the business models independent variable. As described earlier, these theoretically sound business models provide the knowledge worker with the ability to frame and organize the data and information collected and provided by the manufacturing organization's ESS. It was argued that these models also provide the knowledge worker with potential proven responses to their insights. The insight generation models provide the knowledge worker with a structured theoretically sound methodology for developing their mental model. As such, the focus of these skills is on the development of tactical and strategic plans. These skills require the knowledge worker to be adept at insight generation and pattern recognition. Because of this capability, this construct is a focal point for this research study.

Information Management Tools

The construct "Information Management Tools for Problem Solving" is composed of several components. Those components include the presentation form of the data or information, the guided analysis or knowledge evocation, and the dynamic enterprise analysis capability. When the knowledge worker is presented with an issue or begins an investigation into a problem, the knowledge worker starts the iterative investigation process by scanning the internal and external environment to obtain relevant, meaningful information. The knowledge worker utilizes their perceptual and analytic abilities to gain insights and develop alternatives to address the identified problems or opportunities. Information management tools enable the knowledge worker to utilize various formats to represent the data and information. The theory of cognitive fit postulates that the knowledge worker will use the proper presentation method whereas the theory of cost-benefit argues for employing the least effort to gain the greatest insights. Based upon the previous discussion the knowledge worker's ability to make observations, understand identified issues, develop meaning, and create and customize graphs/charts and grids/tables were deemed the variables to investigate.

Guided Analysis

The knowledge worker can use the shared experiences and knowledge of the manufacturing organization to aid in finding and prioritizing problems and potential opportunities. As discussed earlier, the evocation of knowledge requires a guided analysis capability of the business intelligence software tool. The guided analysis functionality for the manufacturing firm used in this research study separates the key functional areas of the manufacturing organization into the major categories of Products and Brands, Markets, Customers, and Channels. Within these functional areas or categories for analysis are prompting questions that are divided into subcategories. These subcategories include promotional allocations, contribution analysis, performance compared to various time elements, and competitive positioning. The evocation of knowledge from the knowledge workers by using the guided analysis capability is to ensure focus on patterns, trends, and performance as compared to expectations.

Strategic Thinking Skills

Market orientation is a philosophy of business management based upon a manufacturing organization-wide acceptance of the need for customer orientation, profit orientation, and the recognition of the important coordination role required in communicating the needs of the marketplace to all major departments within the organization (Kohli & Jaworski, 1990; Kotler, 1988). This philosophy is created and sustained by the senior executive leadership in a manufacturing organization. It occurs and is demonstrated through the words and actions of these leaders. This philosophy is further described by how the manufacturing organization focuses and deals with the generation, dissemination, and response to market intelligence. To understand how the manufacturing organization deals with the market intelligence, this study evaluated the knowledge worker's skills at pattern recognition and insight generation. The pattern recognition skills include the ability to interpret Pareto analysis. The ability to respond to the information includes the ability to utilize various methodologies. The knowledge worker's skills at the "fishbone" methodology are evaluated.

Empirical Research Model

The empirical research model is obtained by translating the concepts obtained from the literature review and the information developed from the construction of the research model. The empirical model is presented in Figure 9b. To evaluate the business intelligence tool construct, the knowledge worker's understanding and use of the guided analysis capability, the presentation features and the calculation and formula generation capability were assessed.

To evaluate the business model application construct, the knowledge worker's perceived ability to use and interpret the results from the application of strategic and tactical models is assessed. The strategic models that are employed include the contribution model, customer value model, the Powergrid model, and the service quality model.

To evaluate the strategic thinking skills construct the knowledge worker's perceived skills with developing meaning, making observations, and gaining understanding from the use of the information presented is assessed. In addition, the knowledge worker's skill at assessing the business model's performance metrics is captured.

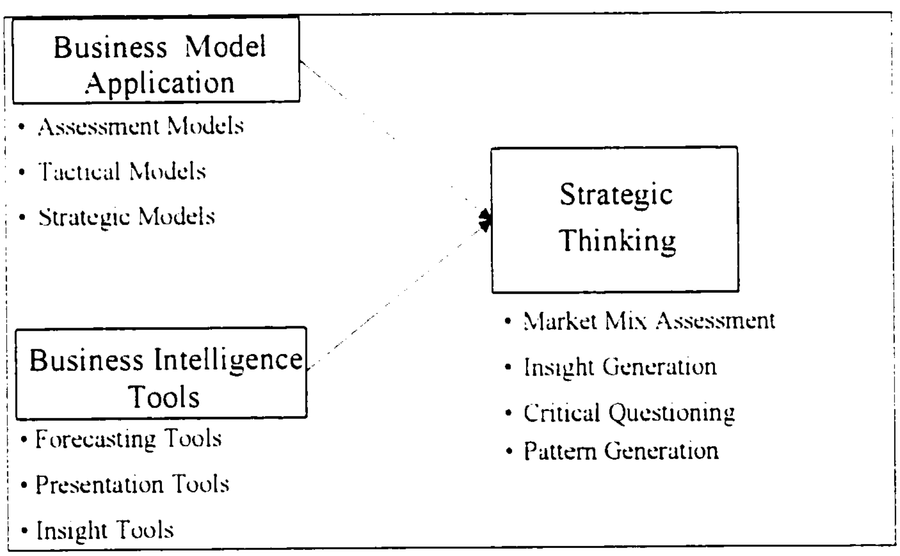

Figure 9b: Empirical Research Model

Development of Hypotheses

Business intelligence software tool features and performance capability is growing geometrically as information technology capabilities continue to advance. However, it is believed that the knowledge worker's knowledge of usage and application of the generated information to organizational problems and opportunities is not growing at the same rate. Hence a gap between tool usage and knowledge worker capability is appearing. In 1997, the Gartner Group stated their belief that all organizations are facing a business intelligence gap. They argue that this gap is being created for three fundamental reasons. The first reason is based upon the geometrically expanding volume of data available to manufacturing organizations for analysis. The second reason is based upon the shear number of critical decisions facing manufacturing organizations in today's environment. The third reason is based upon the tremendous disparity between the number of available, properly trained, analytical knowledge workers and the demand by manufacturing organizations for knowledge workers with those specialized skills.

This research study begins by focusing on educating students on the application of content-oriented knowledge, critical questioning skills, and business intelligence software tool usage and skills. The presented research model in Figure 9a argues that the independent variables "Proficiency in Business Intelligence Tool Usage" and "Business Model Utilization" affect the dependent variable "Demonstrated Strategic Thinking Competence". The expected outcome from this study of the research model is depicted in Figure 10 and Figure 11. The expected outcome in Figure 10 relates the level of proficiency in business intelligence software tool usage and the level of application of business models to the demonstrated level of strategic thinking competence. It highlights the concept of business focus and insight speed on strategic thinking competence. The expected outcome displayed in Figure 11 relates the time provided for education and training on the independent variables to the expected outcome on the dependent variable.

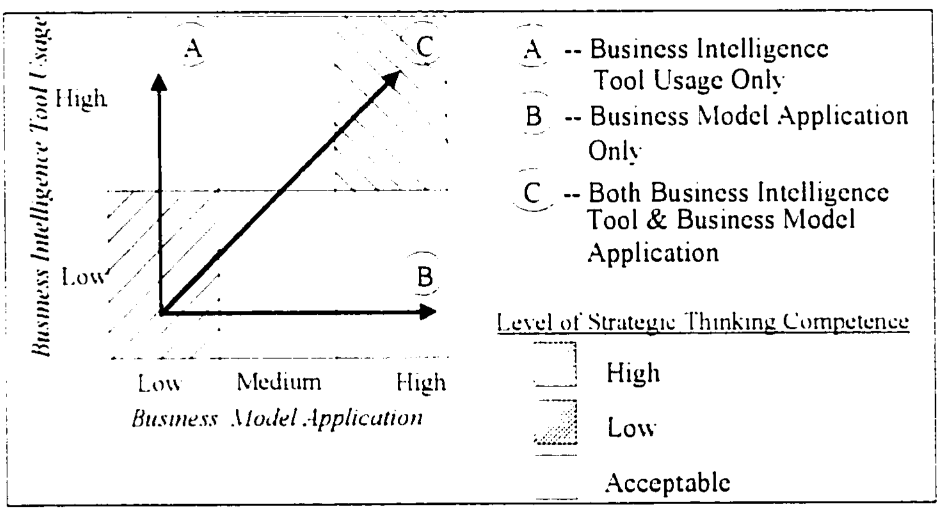

Figure 10: Expected Outcome: Efficiency/Effectiveness

Research Study Hypotheses

The relevant literature for this study was reviewed in Chapter 2. From the concepts, research findings, and detailed information presented in the literature, the research model was developed. The following hypotheses were derived from the application of the research model to the relevant literature. The literature, the research model, and the expected outcomes then provide the basis for the hypotheses that are developed.

As described previously, an interaction effect is expected between the two independent variables. The investigation of this research study examines that interaction effect. The following hypotheses relate to the independent variables of proficiency in business intelligence software tool usage and business model utilization and to the dependent variable of demonstrated strategic thinking competence.

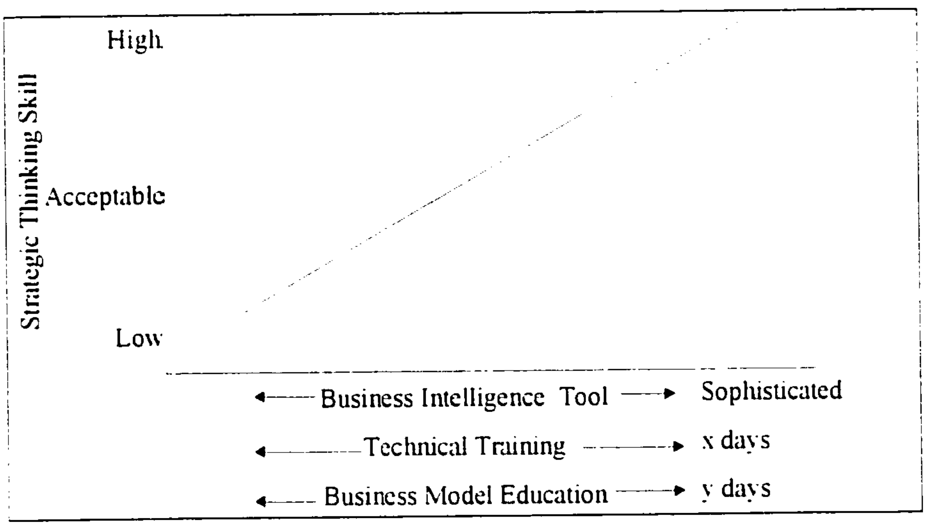

Figure 11: Expected Outcome: Strategic Thinking Skill

Pedhazur and Pedhazur (1991) provide guidelines for hypothesis formulation when investigating multiple categorical independent variables in factorial designs. When the researcher expects interaction, it is suggested that a general statement about the presence of an interaction be followed by specific expectations regarding the simple main effects. The format of the sentence is, "There is an (ordinal) interaction between A and B (where A and B are the main effects or the independent variables) in their effects on Y (where Y is the dependent variable)." The second part of the hypothesis contains, "Although A_1 (where A_1 is a category of the main effect A) is superior to A_2 across all the levels of B, the difference between A_1 and A_2 is greatest under B_2 and smallest under B_1."

The hypotheses for this research study deal with the overall level of the independent variables of the student's perceived business intelligence software tools skill and business model ability rating as they relate to the various dependent variables. Hypothesis 1 deals with the overall nature of the dependent variable as it is affected by the independent variables. Hypothesis 2 deals with the market mix assessment dependent variable as it is affected by the independent variables. Hypothesis 3 deals with the insight generation dependent variable as it is affected by the independent variables. Hypothesis 4 deals with the critical questioning dependent variable as it is affected by the independent variables. Hypothesis 5 deals with the pattern generation dependent variable as it is affected by the independent variables.

For each of these hypotheses, the argument is that a higher level of proficiency in business intelligence tool usage will yield a higher level of demonstrated strategic thinking skill. This argument is based upon the information presentation capability (Vessey, 1994), the multidimensional database structure (Codd, Codd, & Salley, 1994), and the ability to perform complex calculations of the business intelligence tool and the ability to rapidly bring massive volumes of data (Daft, 1998; Dos Santos & Braniff, 1988) to the problem-solving step. The argument is also made that the ability to use proven models and techniques (Gale, 1994; Zeithaml, Parasuraman, & Berry, 1990) to analyze the data will yield demonstrably improved strategic thinking ability. This is based upon the fact that understanding and developing these proven business models create certain mental models for the knowledge worker (Vandenbosch & Higgins, 1995; Vandenbosch & Huff, 1997). The knowledge worker has learned and implicitly knows what data is required to develop various insights that can be generated from the business models (Menon & Varadarajan, 1992). The interesting arguments are made based upon the interaction of these two constructs. It is argued that with the knowledge evocation capability of the business intelligence tools that the difference in strategic thinking skills will be greater for the novice possessing low business model skills than for the knowledge worker with medium level model skills (Browne, Curley, & Benson, 1997; Spence & Brucks, 1997). This may be counter-intuitive. At first discussion, it would appear that the tool level should produce a continuing and greater degree of strategic thinking skills as the business model skill improves. But the knowledge evocation capability of the business intelligence tool aids the novice and the information presentation capability aids the expert (Maltz & Kohli, 1996). These features tend to exaggerate the differences in strategic thinking skills at the extremes.

1 – Impact on Overall Strategic Thinking Skills

There is an interaction effect between the student's perceived rating of their overall business intelligence software tools skill and their overall synthesis of business analytic models ability on the overall strategic thinking skills. It is hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business analytic model factor as it affects overall strategic thinking skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business analytic model category and lowest at the medium business analytic model category for the overall strategic thinking skills.

Hypothesis 1.1 – High business intelligence tool capability will produce a higher level of overall strategic thinking skill than low business intelligence tool capability.

Hypothesis 1.2.1 – High business model utilization capability will produce a higher level of overall strategic thinking skill than medium or low business model utilization capability.

Hypothesis 1.2.2 – Medium business model utilization capability will produce a higher level of overall strategic thinking skill than low business model utilization capability.

Hypothesis 1.3 – There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on overall strategic thinking skill.

2 – Impact on Market Assessment Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business model utilization ability. It is hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor for the dependent variable market assessment skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category.

<u>Hypothesis 2.1</u> – High business intelligence tool capability will produce a higher level of market assessment skills than low business intelligence tool capability.

<u>Hypothesis 2.2.1</u> – High business model utilization capability will produce a higher level of market assessment skills than medium or low business model utilization capability.

<u>Hypothesis 2.2.2</u> – Medium business model utilization capability will produce a higher level of market assessment skills than low business model utilization capability.

<u>Hypothesis 2.3</u> – There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on market assessment skills.

3 – Impact on Insight Generation Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business model utilization ability. It is hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor for the dependent variable insight generation skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category.

Hypothesis 3.1 – High business intelligence tool capability will produce a higher level of insight generation skills than low business intelligence tool capability.

Hypothesis 3.2.1 – High business model utilization capability will produce a higher level of insight generation skills than medium or low business model utilization capability.

Hypothesis 3.2.2 – Medium business model utilization capability will produce a higher level of insight generation skills than low business model utilization capability.

Hypothesis 3.3 – There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on insight generation skills.

4 – Impact on Critical Questioning Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business models ability. It is hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor as it affects the critical questioning skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category.

Hypothesis 4.1 – High business intelligence tool capability will produce a higher level of critical questioning skills than low business intelligence tool capability.

Hypothesis 4.2.1 – Higher business model utilization capability will produce a higher level of critical questioning skills than medium or low business model utilization capability.

Hypothesis 4.2.2 – Medium business model utilization capability will produce a higher level of critical questioning skills than low business model utilization capability.

Hypothesis 4.3 – There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on critical questioning skills.

5 – Impact on Pattern Generation Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business models ability. It is hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor for the pattern generation skills dependent variable. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category.

Hypothesis 5.1 – High business intelligence tool capability will produce a higher level of pattern generation skills than low business intelligence tool capability.

Hypothesis 5.2.1 – High business model utilization capability will produce a higher level of pattern generation skills than medium or low business model utilization capability.

Hypothesis 5.2.2 – Medium business model utilization capability will produce a higher level of pattern generation skills than low business model utilization capability.

Hypothesis 5.3 – There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on pattern generation skills.

Research Design

A factorial design is one in which more than one factor or independent variable is used. When more than one independent variable is included in a research study, a factor design is necessary (Best & Kahn, 1989). A factorial study is then defined as a study in which the effect of two or more independent variables (i.e. factors) are investigated each by itself and also in interaction with each other on the dependent variable. In a factorial design, the goal of the researcher is to estimate the interaction effects and the main effects. The interaction effect may positively or negatively reinforce the main effect or independent variables. A positive interaction effect provides a result that is greater than the effects of each factor separately. A negative interaction effect provides a result that counteracts the effects of each factor.

Before exploring the factorial design concepts, the various factors are labeled with different letters to facilitate discussion. In Figure 12 below, the letters A and B specify the factors or independent variables. The letter A represents the independent variable associated with the business intelligence tool proficiency. The letter B represents the business model utilization. The letter O specifies the dependent variable which is the critical thinking ability. In a factorial design, each of the factors can have two or more categories or levels. The subscripts on each letter refer to the categories or levels within the factors. In Figure 12, factor A has two categories that are labeled A_1 and A_2. The category A_1 represents low business intelligence tool proficiency and the category A_2 represents high business intelligence tool proficiency. Factor B has three levels labeled B_1, B_2, and B_3. The levels represent low, medium, and high business model utilization. The factorial design in Figure 12 is called a two-factor design. The specified two-factor design is referred to as a 2 by 3 (2x3) factor design. The 2 by 3 factor design illustrated in Figure 12 has 6 combinations of the various levels for the two factors. The appropriate factor letter and category number refers to each of the combinations or cells in the matrix. For example, the first combination or cell in Figure 12 is referred to as A_1B_1. This cell represents low business intelligence tool proficiency and low business model utilization.

Previous research studies could not reveal the nature of the expected interaction. Only the existence of the interaction can be hypothesized. Under this circumstance, traditional linear regression approaches may not be appropriate for capturing various types of interaction effects. As a result, this 2 by 3 factorial design was selected as the research design to capture the non-linear nature of the hypothesized interaction.

		B_1	B_2	B_3	
Tool	A_1	O_1	O_2	O_3	$\bar{A}_1$
	A_2	O_4	O_5	O_6	$\bar{A}_2$
		$\bar{B}_1$	$\bar{B}_2$	$\bar{B}_3$	
			Model		

Figure 12: Factorial Design

To estimate the main effect of the independent variable or factor labeled 'A', the researcher examines the difference between the mean of row A_1 (labeled $\bar{A}_1$) and the mean of row A_2 (labeled $\bar{A}_2$). In this research study, the main effect for business intelligence tool proficiency is the difference between the mean for low tool proficiency and the mean for high tool proficiency. When the researcher is examining the main effect of the factor A, all other factors are held constant or treated as if they do not exist. An effect then is specified as the deviation of a level mean (either $\bar{A}_1$ or $\bar{A}_2$) from the grand mean. When the effects do not vary across the categories or levels of the factor under investigation, there is no interaction. When interaction does occur, interaction can be such that one category or level is always superior to another category or level or it can be that the superior category or level changes. The first situation, when one level is always superior to the other level, is referred to as ordinal interaction. The second situation, where the superior level changes, is referred to as disordinal interaction.

The model for two independent categorical variables such as those presented above is expressed in a mathematical equation form of:

$$Y_{ijk} = \bar{Y} + a_i + b_j + (ab)_{ij} + e_{ijk}$$

where Y_{ijk} is the value for individual k in the cell ij, $\bar{Y}$ is the grand mean for the dependent variable, a_i is the effect of level i, b_j is the effect of level j, $(ab)_{ij}$ is the interaction effect, and e_{ijk} is the error for the individual k in the cell ij. (Note: The values for i and j range from 1 to the number of levels for the appropriate category. In Figure 12, i would have a range from 1 to 2 whereas j would have a range from 1 to 3. The range for k is from 1 to the number of individual scores in that particular cell.)

Once the results from the above discussion are determined, it is important to test them for statistical significance. If the interaction component is not significant, the interpretation of the main effects is meaningful. If the interaction component is significant, then the interpretation of the main effect is less meaningful and is usually not done. After testing for statistical significance, other tools can help the researcher in interpreting the results.

Variables

The previous discussion has alluded to the various aspects of variables. Variables can be defined as the conditions that the researcher controls or observes (Best & Kahn, 1989). The variables being examined in the factorial design can be classified as either independent or dependent. A more complete discussion of this classification and confounding variables is in order.

Independent variables are the conditions that the researcher observes or controls to ascertain their relationship to the observed phenomena. These variables may be a type of teaching material, a reward, a period of exposure to a particular condition, or an attribute such as gender, age, alert status, or intelligence. In this research analysis, the investigated independent variables are the “Business Intelligence Tool Proficiency” and “Business Model Utilization”. Related to the definition of independent variables are attribute variables. Attribute variables are those characteristics that cannot be altered by the researcher. Examples of attribute variables include age of the student, gender of the student, and GMAT scores of the student.

Dependent variables are defined as the conditions that appear, disappear, or change based upon the status of the independent variables. Examples of dependent variables include test scores, number of errors on a given assignment, or measures of completion time for a given assignment. In this research study, the dependent variable is the "Critical Thinking Skill".

Confounding variables are aspects of the research study that influence the dependent variable and whose effect may be confused with the effects of the independent variable. There are two types of confounding variables: intervening variables and extraneous variables. Intervening variables are those variables that cannot be controlled or measured directly. Yet, intervening variables may have an important effect upon the outcome of the research project. Intervening variables are simply those variables that intervene between the cause and the effect. Examples of intervening variables include the student's motivation, the student's anxiety level, the student's feeling of fatigue, or perhaps the other courses being taken during the semester. Extraneous variables are those uncontrolled variables that are not manipulated but may have a significant influence upon the results of the research study. Extraneous variables must have a strong correlation with both the independent and dependent variables so that its influence could be mistaken for that of the independent variable. Various methods exist to control extraneous variables. Randomization is a method that provides the most effective way of minimizing the effect of extraneous variables.

Operationalization of Business Model Utilization

Operationalizing this construct was accomplished by asking the respondents their opinion regarding their perceived skills and abilities on several key items. Their opinions were captured via a 7 point Likert scale questionnaire. The rating scale for the questionnaire was from very weak (1) to very strong (7). The respondent's perceptions dealt with their ability to apply and articulate various tactical and strategic analytic models and with their ability to generate forecasts and perform situation assessments. The linkages to the specific questions are detailed in Appendix I-1.

The respondents also were asked to complete several objective, graded exercises to ensure they utilized and were comfortable with the application of business analytic models. The researcher feels that both of these objective graded exercises ensured that the expected skills and abilities were properly demonstrated and internalized.

The personal assessment questionnaire asked the respondents to rate their ability to perform various insight generation capabilities. Their opinions are captured via a 7 point Likert scale questionnaire. The rating scale was from very weak (1) to very strong (7). The various insight generation capabilities that were assessed included the ability to understand issues, develop meaning, and make observations from the data presented using charts and grids, as well as an overall assessment of the ability to utilize charts and grids. The linkages to the specific questions are detailed in Appendix I-1.

Operationalization of Proficiency in Business Intelligence Tool Usage

The respondents were asked to complete ten objective, graded exercises to ensure that they utilized and were comfortable with the guided analysis portion of the business intelligence software tool used in the course. The students also used the guided analysis feature of the business intelligence software tool (Comshare Sales Analysis – CSA) to complete their team case presentation and exercise. The researcher feels that both of these objective graded exercises ensured that the expected skills and abilities were obtained.

The personal assessment questionnaire asked the respondents to rate their ability to perform various technical functions. Their opinions are captured via a 7 point Likert scale questionnaire. The rating scale was from very weak (1) to very strong (7). The various technical capabilities that were assessed included the ability to customize charts, the ability to swap members on and off the grid, the ability to sort data, and the ability to alter presentation scales (these presentation scales included numeric, logarithmic, and percentile). The linkages to the specific questions are detailed in Appendix I-1.

Operationalizing the emergence of multidimensional analytic capabilities construct was accomplished by asking the respondents their opinion regarding their perceived skills and abilities on several items. Their opinions are captured via a 7 point Likert scale questionnaire. The rating scale was from very weak (1) to very strong (7). The respondents' perception deals with their abilities to create calculations and use complex formulas. The linkages to the specific questions are detailed in Appendix I-1. The respondents also were asked to complete several objective, graded exercises to ensure they utilized and were comfortable with the analytic functionality portion of the business intelligence software tool used in the course. The students also used the analytic functionality to generate insights and demonstrate understanding of the problem presented in their team case presentation and exercises. The researcher feels that both of these objective graded exercises ensured that the expected skills and abilities were obtained.

Operationalization of Critical Thinking Skill

Operationalizing this construct was accomplished by asking the students their opinion regarding their perceived skills and abilities on several items. The opinions are captured via a 7 point Likert scale questionnaire. The rating scale was from very weak (1) to very strong (7). The students' perception deals with their ability to assess, compare, describe, develop, observe and relate the current competitive environment with the strengths and weaknesses of the manufacturing organization. The linkages to the specific questions are detailed in Appendix I-1.

The students also had to complete several objective, graded exercises. These graded exercises included the scenario analyses, the presentation of the application exercises, and the presentation of the case problems. The grading criteria for evaluating the scenarios is detailed in Appendix A-1. It follows the Malcolm Baldrige National Quality Award (MBNQA) format and philosophy. The student responses are rated for each of the IMPACT (Issues, Meaning, Possibilities, and Actions) methodology categories. (The rating scale ranges from zero through one hundred points. Its range was based on a continuum from low to high with "observation/opinion-based" comments rated as low through "insightful/fact-based" comments rated as high.) The researcher feels that both of these objective, graded exercises ensured that the expected skills and abilities were obtained.

Measurement Instrument Reliability/Validity

During the design of the research study, the concepts of reliability and validity of the various measurement instruments needs to be examined. Reliability and validity are essential to the effectiveness of any data-gathering procedure.

Reliability is defined as the degree of consistency that the measuring instrument or procedure demonstrates. Reliability shows that the measured items are done so consistently. A high coefficient of reliability is desired so that errors of measurement have been reduced to minimum (Borg & Gall, 1989). If the results on a variable measured by the measuring instrument is material, then a measure of relatively low reliability may be selected and the researcher may still be reasonably sure that the testing instrument will discriminate adequately between the groups under investigation. Coefficient of internal consistency is a method of assessing reliability. It is the most widely used method of estimating internal consistency (Borg & Gall, 1989). One of the statistical procedures for determining the coefficient of internal consistency is accomplished by splitting the measurement questions into two subgroups (i.e. odd/even questions), computing the scores for each individual, and then correlating the scores of these two sets. The various SPSS procedures are used to determine this.

Validity is that quality of a measuring instrument or procedure that enables it to measure what it is supposed to measure. The researcher examines the content validity and construct validity. Content validity is defined as the degree to which the measuring instrument actually measures the traits for which it was designed to measure. It is based upon careful examination of course textbooks, literature, study objectives, and the judgement of subject matter specialists. Construct validity is defined as the degree to which scores on the measuring instrument can be accounted for by the explanatory constructs of a sound theory. Construct validity includes the ideas of predictive validity, criterion-related validity and concurrent validity. Predictive validity is the usefulness of the measuring instrument in predicting some future performance whereas concurrent validity is the usefulness of the measurement instrument in relating to other measures.

The concepts of internal reliability and external reliability are very important when examining the study's results. Reliability of the measurement instruments is necessary but not sufficient for validity. Also, a measurement instrument can be found to be internally valid to the extent that its results are credible, but to be useful the results must be generalizable or externally valid (Cohen & Manion, 1994).

Research Study Procedures

Cohen and Manion (1994) provide a methodology for planning research-based work. Their methodology consists of seven unique steps.

The first step is to identify and define the research problem. The second step is to formulate hypotheses that must be investigated. This step involves making predictions about the relationships between specific variables. The third step is to select the level at which to test the independent variables. The fourth step is to describe the population to which the results will be generalized. The fifth step involves choosing the tests and the appropriate methods for analysis. The sixth step is to pilot the research procedures and measurement instruments. The seventh step is to precisely follow the procedures.

The first step in this methodology has been accomplished and discussed in Chapter 2: Literature Review and Chapter 3: Research Model, Hypotheses, and Procedures. The research model under investigation was developed and presented in Figure 9. The second step in this methodology has been accomplished and presented in Chapter 3 in the Development of Hypotheses section. The hypotheses for the research model were described and discussed. The hypotheses dealt with each of the defined variables and their relationships.

Research Study Sample Size Determination

The third step involves determining the level to test the independent variables. This determination involves setting the sample size and setting an appropriate alpha (α) level and power level. To determine the sample size requirement, the concept of power needs to be examined. According to Hair, Anderson, Tatham and Black (1995) power is the probability that the statistical test will identify an effect if it actually exists. Power is related to the alpha (α) level. Yet it is not solely a function of alpha. It is determined by a combination of the effect size, the alpha, and the sample size. The effect size is defined as the difference of the means between two groups or the correlation between variables. Alpha, or type 1 error, is the probability of rejecting the null hypothesis when it is actually true. If the alpha level is set at 0.05 and the effect size is estimated at a moderate level (.50), then to achieve a power level of 80% a sample size of approximately 64 is required (Cohen, 1977). For an alpha level of .05, a beta level of .10, a power of .90, and a moderate effect size of .50 a sample size of 137 is required (Owen, 1962).

Research Study Characteristics

The fourth step in the research plan is to discuss the population. The term population is defined as the aggregate of all of the cases that conform to some designated set of specifications. The term aggregate is defined as the target population to be generalized. The sample is a subset of the elements from the population selected according to a sample design (Pedhazur & Pedhazur, 1991). The sample for this research study is graduate and undergraduate business students at The University of Toledo. Further, the unit of analysis for this research study is the strategic thinker, that is the individual knowledge worker or student. The results from the research study will be generalized to the population of knowledge workers in manufacturing organizations.

Research Study Measurement Areas

Each area of the empirical research model has measurement instruments associated with it. The construct, proficiency in business intelligence tools usage, is measured using three different instruments. The first instrument is a survey of the student's personal skills and abilities. The survey covers perceived strength and knowledge of business intelligence software tool capabilities. The second instrument is an objective multiple-choice test on business intelligence software tool capabilities. The third instrument consists of ten software application exercises on business tool software capabilities. Those ten exercises include developing various calculations, developing custom charts, performing detailed query functions, transferring data to a statistical analysis software tool, performing exception highlighting, and manipulating and cross-nesting the various dimensions and performance measures.

The construct, business model utilization, is measured by an objective multiple-choice test on business models and concepts and a student's personal skill assessment survey covering perceived strength and knowledge of business concepts and models. The ability to demonstrate strategic thinking and critical questioning competence is measured by various "Scenario Analysis" exercises and by the student's personal skill assessment survey. They are evaluated based upon sensible lines of inquiry, application of appropriate business analytic models to the scenario, and application of the information presentation tools.

Research Study Measurement Locations

Two classes at The University of Toledo were deemed as relevant for investigating business model utilization and business intelligence software tools. These classes are identified as MBA 6120 and Marketing 4130 courses. Students in other business classes also completed the assessment instruments. The instruments were administered and evaluated in MBA 6120 and Marketing 4130 during the Spring 1999 semester, the Summer 1999 semester, the Fall 1999 semester, the Spring 2000 semester and the Summer 2000 semester.

A sample manufacturing organization doing business in the non-durable household goods industry (SIC 2844) was created for this research study. The students applied business concept and model knowledge to issues related to a single manufacturing organization. The manufacturing organization served as a source of data for examples for students to become proficient in the development of business intelligence tool skills. The focus on a single manufacturing organization was to provide a context and build a common knowledge base. This ensured that the problems associated with multiple industries and various leadership styles of executives were not becoming entangled with the focus on the effects of the application of business models and proficiency in business intelligence tool usage.

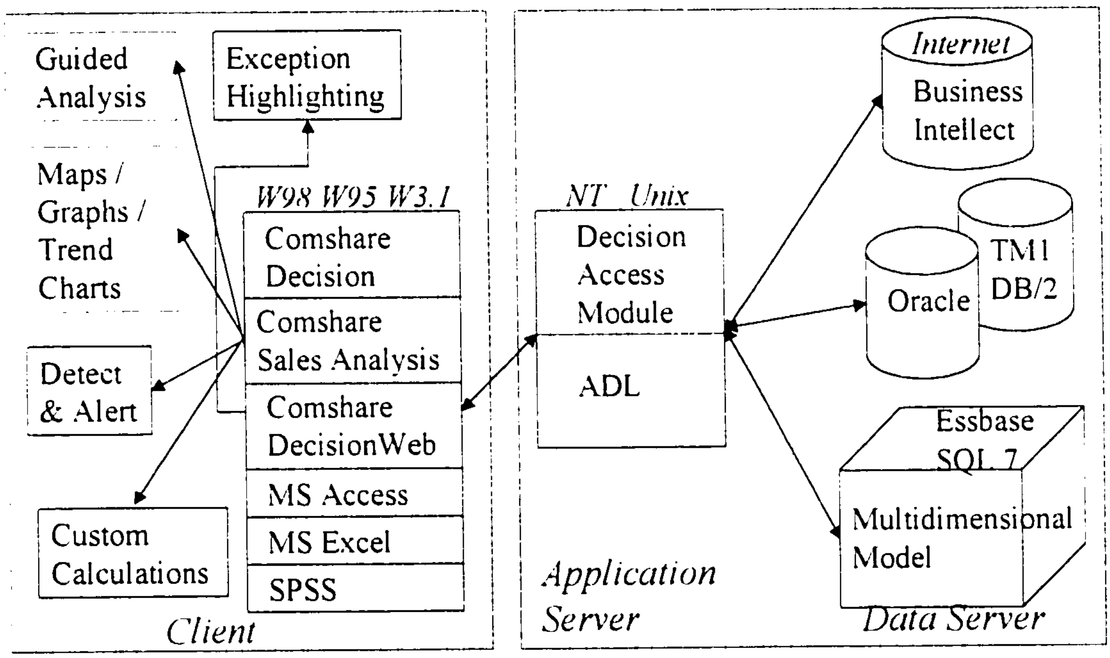

Figure 13: Business Intelligence Tool Model

The business intelligence software tools are illustrated in Figure 13. The figure demonstrates a client/server technical relationship. The student could access the data and the application via the Internet or from various computers situated in the laboratories in the Stranahan Building at The University of Toledo.

Chapter Four
Data Collection Procedures and Study Results

In the first part of this chapter, the various instruments used in the research study are described. Then, the data collection procedures are described and discussed. In the last part of this chapter, the results from this research study are presented and discussed.

Research Study Tools / Instruments

The tools and instruments used in this research study include both the teaching materials and the assessment instruments. The teaching material is used to develop and present the various concepts; whereas, the assessment instruments are used to determine the students' proficiency in the various areas being researched.

Educational Tools

This research study utilizes a leading-edge textbook, business intelligence software tools, and various business videos for the instructional materials. The textbook used for the course and for the research study is "Strategic Marketing Analysis: Business Intelligence

Tools for Knowledge Based Actions" by Lim, Heinrichs, and Hudspeth, 1999. Table 18 provides an overview of the various topics covered in the textbook. The business intelligence software tools used in the course and the research study include the presentation software, the multidimensional database software, and the statistical software. Figure 13 in the previous chapter provides a graphical illustration of the various software components on both the client side and on the server side and illustrates how the various software components interact. A variety of business videos are used to reinforce the key concepts presented in the course, to provide credence to the material and ideas presented in the course, and to highlight the successful business practices of the selected organizations illustrated in the videos.

Software Tools

The business intelligence presentation software includes Comshare Sales Analysis (CSA), Comshare DecisionWeb, and Comshare Decision. These leading-edge business intelligence software products are developed and supported by Comshare Inc. of Ann Arbor, Michigan. The multidimensional analytic databases that are used by the presentation software tools include both Essbase which is developed and marketed by Arbor Software Corporation and Microsoft SQL 7.0 OLAP Services which is developed and marketed by Microsoft Corporation. The statistical software utilized in the course is SPSS 10 from SPSS Inc. of Chicago, Illinois. Each of these software components operates under Microsoft's Windows NT 4.0 operating system on various personal computers (PC) at The University of Toledo in the College of Business Administration computer laboratories located in the Stranahan building.

Business Videos

There are six selected videos used in this study. These videos include "Phillips 66 Company: Executive Information Systems", "Thriving in the 1990's", "The Executive Forum", "The Way We Were", "Growing Your Business", and "The 1990 Malcolm Baldrige National Quality Award Presentations". Each of these videos was selected to reinforce particular concepts presented in the various stages of the course.

In the first video, "Phillips 66 Company: Executive Information Systems", Harvard Case (9-189-006), Linda Applegate interviews Bob Wallace, the CEO of Phillips 66. Bob Wallace described the reasons for the initial failure of the Executive Information System (EIS) at the Phillips 66 Company. He then described the requirements for successful implementation of an EIS. The key success factors he chose to comment on include executive commitment, business focus, and one place for all the corporate data to come together. In addition to discussing the key success factor, he commented on the skills required of his management team. He stated that the individual knowledge worker must sense what the executive needs, that it was just intuitive. He was unable to find knowledge workers that had that unique skill. His comments highlighted the need for the skills and abilities being assess and develop din this research study.

In the second video entitled "Thriving in the 1990's", Tom Peters details six guiding principles for the manufacturing organization. The first principle is to continually reinvent your business. This is a key factor in the learning organization concept. The second principle is that flexibility, responsiveness, and focused resources are required regardless if the manufacturing organization is a large or small. The third principle is to talk to successful people out of your industry. The fourth principle is to meet global changes head on. The fifth principle is to put yourself in a learning mode and the sixth principle is to be innovative and have a long-term focus. Tom Peters illustrated each of these principles with examples of various successful organizations from around the world.

The third video entitled "The Executive Forum" features Dennis Ganster, the Chief Executive Officer (CEO) of Comshare Incorporated. He describes business intelligence software tool usage. The key point of the video was access to information yields a more competitive organization. He argued this point because the organization is better prepared to adapt to the environment quickly.

The fourth video entitled "The Way We Were" describes the behavior and questioning of kindergartners. The video focuses on re-instilling our questioning skills. The fifth video entitled "Growing Your Business" features Stew Leonard. The video describes the actions taken by Stew Leonard to become the world's largest dairy store. Concepts of focus, information, and segmentation are described.

The sixth video entitled "The 1990 Malcolm Baldrige National Quality Award Presentations" features the Wallace Company. It describes the Wallace Company efforts as both a customer and a supplier. It culminates in Bob Wallace accepting the MBNQA. Yet, the inference from the video is that in spite of doing all the right things, the Wallace Company did not survive. Doing all the right things sometimes is not enough.

Assessment Instruments

A variety of assessment instruments are used to assess the performance of the students in this study. These instruments include the survey instructions, the problem-solving style survey, the knowledge-concept test, the business intelligence software tools test, the business intelligence/marketing concept personal assessment survey, and scenario analysis questions. Each of these instruments is presented in the appropriate appendix.

The "Problem-solving Style" survey is a series of eighty yes/no preference questions. This survey is used to describe the student's problem-solving or decision-making profile. This survey is based upon the Herrmann Brain Dominance Indicator© (HBDI) profile (Herrmann, 1996; Lumsdaine & Lumsdaine, 1993). It is presented in Appendix E.

The "Concept Knowledge" test is a fifty-seven question multiple-choice test with the majority of the answers ranging from option "a" through option "d". The questions and answers are designed to test concept knowledge, not to "trick" or confuse the student. The test is based upon Kotler's "Principles of Marketing, 7th Edition" (Hershey, 1996). This test bank was chosen as the prerequisite for this course as the students have completed the "Marketing Principles" course or have obtained equivalent knowledge elsewhere. The test bank focuses on many business analytic models. The test has questions of various difficulty factors ranging from one through three. The difficulty factor is used to weight the points assigned to correct answers. The questions were chosen based upon the concepts and models to be covered in Chapters 7 through 11 of the course textbook (refer to Table 18 for a brief description of Chapters 7 through 11). Pre-treatment and post-treatment multiple choice knowledge concept question tests are administered. The entire test is presented in Appendix C.

The "Business Intelligence Tool" test is an eight question multiple-choice test. It is based upon the Comshare Decision business intelligence software tool tutorial. Pre-treatment and post-treatment business intelligence software tool multiple-choice questions tests are conducted. The business intelligence software tool test is presented in entirety in Appendix B.

The "Business Intelligence/Marketing Concept Personal Assessment" survey is a sixty-four question personal skills and ability assessment survey. It uses a 7-point Likert scale ranging from very weak (1) to very strong (7). The questions describe the subject's ability, knowledge, and understanding of concepts and models. Questions in the survey include personal assessment of marketing concept knowledge and business intelligence software tool skill. The survey also assesses the student's critical questioning skill based upon various analytical categories and the student's ability to identify and understand issues using data presented in charts and grids. The survey is presented in Appendix D.

Various scenarios (refer to Table 11 for a brief description of the scenarios) and exhibits (refer to Table 12 for a brief description of the exhibits) are presented to the students. The students are asked to identify the issues, determine appropriate meaning, discuss possible causes, and then recommend a course of action to the scenario presented. The student has access to various exhibits. The exhibits contain internal financial information for LJL Industries, external industry and competitor information, market research data, and customer satisfaction data that may be useful in completing the scenario. The exhibits are shown in Appendix J. Upon completion of the answer to the posed scenario, the students rate their confidence in their assessment. The scenarios used are presented in Appendix F.

Table 11: Scenario Descriptions

Scenario Analysis	*Scenario Description*
#1	As the new VP of marketing for the Southern region, what are you going to do to reverse the past sales decline?
#2	As the new VP of Oral Care Brands for LJL Industries, what are you going to do to ensure a 10% growth rate?

The first scenario is presented to the students at the beginning of the course. The survey consists of two questions. The second scenario is presented to the student at the middle of the course. The survey consists of one question regarding general insights based upon the use of information presented in the form of charts and grids. The third scenario is presented to the students at the end of the semester. The scenario consists of one case-type question regarding the student's insights. The insights are based upon the application and use of the business analytic models discussed in the class and upon the information presented in charts and grids.

Table 12: Scenario Exhibits

Scenario Exhibit	*Emphasized Dimension*
Exhibit 1: Sales by Customer by Prior Year	Customer
Exhibit 2: Sales by Channel by Prior Year	Channel
Exhibit 3: Sales by Market by Prior Year	Market
Exhibit 4: Sales by Product by Prior Year	Product
Exhibit 5: Ratings by Brand by Prior Year	Product
Exhibit 6: Sales by Competitor by Prior Year	Market
Exhibit 7: Census by State by Prior Year	Market
Exhibit M1: Promotional Dollar Expenditures	Channel
Exhibit M2: Customer Sales Analysis - South	Market
Exhibit M3: Customer Sales Analysis - US	Market
Exhibit M4: Operating Profit by Customer	Customers
Exhibit M5: Sales, Volume & Satisfaction	Customers
Exhibit F1: Sales Concentration by Brand	Product
Exhibit F2: Sales Growth by Competitor	Market
Exhibit F3: Customer Value Report	Customer
Exhibit F4: PowerGrid Report	Product
Exhibit F5: Brand Equity Report	Product
Exhibit F6: Sales Trend for Products	Product
Exhibit F7: Sales Contribution Analysis	Product
Exhibit F8: Sales by Introduction Date	Product
Exhibit F9: Promotional Analysis	Measures
Exhibit F10: Product Comparisons	Product
Exhibit F11: Population Statistics	Market
Exhibit F12: Sales Trend For Customer Types	Customer

The student responses to the scenarios are assessed using the assessment sheet shown in Appendix A. The assessment sheets are based upon the Malcolm Baldrige National Quality Award (MBNQA) assessment philosophy. The categories for assessment are issues, meaning, possible causes, and actions. Each category is rated according to the comments made by the student. If the statements are observation, opinion-based, they are rated low. If the statements are analysis oriented, they receive a medium rating. If the statements are insightful, fact-based ratings, they receive a high rating.

Research Study Procedure

To populate the factorial design matrix, the students are exposed to various business analytic models, leading edge business concepts, and business intelligence software tool concepts. The research study provides students with information in three major phases. The initial phase is conducted during the first half of the semester and consists of providing a context for knowledge-based actions. The discussion in this phase consists of the changing external environment and the competitive global marketplace. The second phase focuses on the usage of the business intelligence tools and on the linkages of data with the analytic dimensions. The business intelligence software tools portion of this phase focuses on providing skills in presentation management and model creation. The data linkage portion of this phase focuses on the methodologies used to create insight and the linkages of the organization's performance measures with their analytic dimensions. The second phase is conducted during the first half of the semester as well. The final phase focuses on the synthesis, understanding and application of business concepts and analytical models. The third phase is conducted during the last part of the semester. The approximate times spent for each of the phases is detailed in Table 16.

Course Administration

The research study begins by welcoming the students to the course. They are informed that this is a different type of course from what they have encountered in their prior academic experience. The students are informed that they are facing situations commonly found in the business world. The first situation that they are informed about is that the tools used in problem investigation may fail. Microsoft Windows NT 4.0 is not always a stable, reliable product. The second situation relates to the fact that the data used in the various exercises and cases may be incomplete or inaccurate. The third situation that is encountered is that there may be errors in the formulas and calculations used in analysis. Finally, the students are informed that regardless of the above situations, they are ultimately responsible for the timely completion of their assignments and they are responsible for the accuracy of their recommendations regardless of the above situations. The students are informed that during the course they will work with just one manufacturing organization for the entire semester. The students are provided with the Standard & Poor's Industry Reports for the beauty and health care industry. The students are assigned to one of five teams. The teams are responsible for presenting the application exercises listed in Table 21. The students are informed that they will be treated like business professionals and that attendance in the course is at their prerogative.

The manufacturing organization the students will work with is labeled "LJL Industries". LJL Industries is a manufacturer of beauty and health care products. The organization is classified in SIC 2844 category. SIC 2844 includes businesses that manufacture perfumes, cosmetics, shampoos, body powder, colognes, denture cleaners, lipstick, mouthwash, soap, suntan lotion, toothpaste, shaving products, and other toilet preparations (Lim, Heinrichs, & Hudspeth, 1999). LJL Industries has five product lines with thirteen major brands. They do business throughout the world although the majority of their sales come from the United States. The organization has five major channels for the distribution of its products. In 1996, the organization had gross sales of over $680 million.

The students are informed that they have access to three years of financial data for LJL Industries. They also have access to external data consisting of population demographics obtained from the US Census Bureau, customer satisfaction survey data for both products and services, market research data on customer perceptions of LJL Industries brands, US industry sales data, and publicly traded competitor financial information. The students are provided with a listing of all major competitors and their web sites. Simply, the students have access to the same kind and same volume of information as a manager in an actual business would have. LJL Industries multidimensional analytical database that the students will manipulate contains approximately 500MB of integrated internal and external information.

All questions the students have regarding the course, the organization and the industry are answered as truthfully and completely as possible. After all questions have been answered, the students begin the initial data gathering step.

Initial Data-Gathering Phase

Before the course begins, the initial data-gathering step is conducted. The students are told that the various surveys and measurement instruments are the entrance exam for the course. The students are asked to answer each question as honestly and completely as possible. They are told that if they complete the entrance exam as completely and honestly as they can, they will receive the full ten bonus points assigned to the entrance exam. The students are told that the instructor will use the information they are providing.

The initial data gathering instruments consists of the Knowledge Concepts test, the Personal Skills Assessment survey, the Business Intelligence Tool test, the Thinking Styles survey and the Scenario essay. To complete the tests, measurement instruments and surveys, two hours have been allocated.

Introductory Phase

The first phase of the course focuses on why this course is relevant and important. Elements of the strategic marketing process are examined and discussed. The three major elements that are discussed include the environmental context, knowledge-based decision-making, and managing complexity and information. The impact of the turbulent and competitive environment on the organizational processes is reviewed. Problem identification and problem-solving approaches as they affect knowledge-based decision-making are explored. A framework and methodology for managing complexity and information is presented. These topics are supplemented with three relevant videos. The videos are shown and the discussion on these videos is facilitated. The videos shown and discussed in this treatment were previously described. They are "Phillips 66 Company: Executive Information Systems", "Thriving in the 1990's", and "The Executive Forum". These videos provide independent justification for the arguments being presented and provide examples of organizations experiencing the competitive pressures of the turbulent, global environment.

Table 13: Introductory Phase – Time Allocation & Topics

Time (in hours)	*Topic*

7 hrs	**Introductory Phase – Understanding & Questioning Skills**
	➢ *Show and facilitate discussion of videos*
	    ➢ "Thriving in the 1990s"
	    ➢ "The Executive Forum"
	    ➢ "Phillips 66 Company: Executive Information System"
	    ➢ "The Way We Were"
	➢ *Facilitate discussion of the creative thinking profile*
	➢ *Strategic Marketing in the Information Age*
	    ➢ Facilitate discussion of the turbulent and competitive environment and its impact on the organization's planning processes
	    ➢ Facilitate discussion of decision-making, problem identification, and problem-solving approaches
	    ➢ Facilitate discussion of managing complexity and information and discuss a framework that incorporates these tools

Business Intelligence Tool Phase

The second phase focuses on providing the students with the skills and capabilities to utilize a leading business intelligence tool application. The concept of dimensions or categories of analysis, performance measures, and the linkages of these to business processes are discussed and described. The students receive a primer on the utilization of business intelligence software tools used in strategic marketing analysis. They are shown the various features required for the exercises previously described. The business intelligence software tool application that the students have access to is Comshare Decision Web with the Essbase multidimensional analytic database and/or Microsoft SQL Server 7.0. To perform statistical routines, the students are provided with access to SPSS statistical software. The methodology that the students have to perform competitive and strategic marketing analysis is labeled IMPACT.

Table 14: Business Intelligence Phase – Time Allocation & Topics

10 hrs	**Business Intelligence Phase – Business Intelligence Tools** ➢ Demonstrate Business Intelligence Tools and assist in solving exercises ➢ Discuss the linkages between analysis categories, performance measurements and the integration of organizational processes ➢ Demonstrate the application of the IMPACT methodology

Business Models Phase

The third phase focuses on ensuring that the students understand and can use various leading edge business analytic models. The various models include the brand management model called Powergrid described by Keller, the business portfolio model labeled the Boston Consulting Group (BCG) model described by Kotler, the Customer Value Matrix model advocated by Gale, the product life cycle model, the ServQual model presented by Zeithaml, and various financial, promotional and pricing models for strategic planning. The students use these models with the data provided in the multidimensional database during their presentation of application exercise and case issues. The business intelligence software tools, the internal and external data, and these models provide the student with an opportunity to uncover insight into various scenarios (Refer to Table 21 for a description and review of the various cases and application exercises completed by the student teams.).

Table 15: Business Models Phase – Time Allocation & Topics

18 hrs	**Business Models Phase - Business Analytic Models**
	➢ Show and facilitate discussion of videos
	  ➢ "Growing Your Business"
	  ➢ "1990 MBNQA Ceremony"
	➢ *Marketing Decisions Using Guided Analysis*
	  ➢ Facilitate discussion and demonstrate strategic marketing planning tools like the BCG model and customer value matrix
	  ➢ Facilitate discussion and demonstrate situation assessment tools like forecasting and competitive analysis
	  ➢ Facilitate discussion and demonstrate product performance tools like the product life cycle and PowerGrid
	  ➢ Facilitate discussion and demonstrate the value chain management tools like ServQual
	  ➢ Facilitate discussion and demonstrate pricing and promotion tools

Final Data-Gathering Phase

After the phases in the course conclude, the final data-gathering phase is conducted. The students are asked to answer each question as honestly and completely as possible. By placing only fifteen points on the exam, it is felt that the students will not feel anxious and provide honest answers. The students are told that the instructor will use the information they are providing. The final data-gathering phase consists of the Knowledge Concepts test, the Personal Skills Assessment survey, the Business Intelligence Tool test, the Thinking Styles survey and the Scenario essay. To complete the tests and surveys, three hours have been allocated.

Research Study Timeline

Figure 14 displays the timeframe for when each instrument is administered to the students. Tables 13, 14, and 15 provide an estimate of the amount of in classroom time devoted to each part of the course. The course is conducted over a 15-week semester timeframe.

Table 16: Assessment Times

Time (in hours)	*Topic*
2 hrs	*Assessment # 1 – Entrance Exam* ➢ Provide Survey Instructions ➢ Provide HBDI Survey ➢ Provide Personal Assessment Survey ➢ Provide Concept Knowledge Test ➢ Provide Business Intelligence Test ➢ Provide Scenario Analysis Form
3 hrs	*Assessment # 2 – Midterm Exam*
3 hrs	*Assessment # 3 – Final Exam* ➢ Provide HBDI Survey ➢ Provide Personal Assessment Survey ➢ Provide Concept Knowledge Test ➢ Provide Business Intelligence Test ➢ Provide Scenario Analysis Form

Table 17: Course Administration Times

Time (in hours)	*Topic*
2 hrs	Course Administration ➢ Random teams assignment ➢ Provide course syllabus ➢ Provide S&P report ➢ Complete course introduction
8 hrs	Total Assessment
35 hrs	Total Treatment

Table 18: Course Textbook Chapter Headings

Part / Chapter	Topic
Part 1:	*Strategic Marketing in the Information Age*
➢ Chapter 1	➢ The Environmental Context for Strategic Marketing Analysis
➢ Chapter 2	➢ Knowledge Based Decision-making
➢ Chapter 3	➢ Managing Complexity and Information
Part 2	*Understanding the Guided Marketing Analysis Approach*
➢ Chapter 4	➢ Categories, Measurements, and Linkages to Business Processes
➢ Chapter 5	➢ Business Intelligence Tools
➢ Chapter 6	➢ IMPACT Process
Part 3	*Marketing Decisions Using Guided Analysis*
➢ Chapter 7	➢ Strategic Marketing Planning
➢ Chapter 8	➢ Situation Assessment for Market-Driven Strategies
➢ Chapter 9	➢ Product Performance and Strategy
➢ Chapter 10	➢ Value Chain Management
➢ Chapter 11	➢ Strategic Impacts of Pricing and Promotion Strategies
Appendices	
➢ Appendix 1	➢ LJL Industries -- A Case Study
➢ Appendix 2	➢ Analytical Categories and Dimensions
➢ Appendix 3	➢ Performance Measures
➢ Appendix 4	➢ Statistical Procedures
➢ Appendix 5	➢ Terms and Definitions
➢ Appendix 6	➢ Income Statement and Balance Sheet
➢ Appendix 7	➢ 1990 Census: Population by State
➢ Appendix 8	➢ Customer Satisfaction Survey Form
➢ Appendix 9	➢ List of Comshare Sales Analysis Questions
➢ Appendix 10	➢ Website Directory

Table 19: Business Intelligence Tool Proficiency Exercises

Exercise	*Exercise Topic*	*Purpose*
#1	Tutorial	➢ To review all the capabilities of the business intelligence tool ➢ To see a complete demonstration of the tool functionality
#2	Account Review	➢ To understand the presentation capabilities ➢ To gain insight into contribution analysis for product and geographic dimensions
#3	Calculations	➢ To practice the various mathematical and statistical calculation function capabilities ➢ To gain insight into contribution analysis for channel and geographic location dimensions
#4	Graphs / Charts	➢ To develop skill in dynamically creating and modifying various charts ➢ To gain insight into contribution analysis for customer and product dimensions
#5	Query Functions	➢ To develop skill in performing the query functions of variance, growth, trend, and percentile/number functions ➢ To gain insight into pareto analysis for the geographic and channel dimensions
#6	Transfer Data	➢ To develop skill in transferring/exporting data between various applications ➢ To gain insight into the relationship between the various internal and external measures
#7	Exception Highlighting	➢ To develop skill in dynamically creating and updating detect & alert capability ➢ To gain insight into the market dimensions and its sales performance
#8	Market Review	➢ To develop skill in utilizing the guided analysis features ➢ To gain insight into the product and channel dimensions
#9	Customer Performance	➢ To develop skill in utilizing the guided analysis features ➢ To gain insight into the customer and product dimensions
#10	Brand & Products	➢ To develop skill in drill down capabilities available on the grid ➢ To gain insight into the product and market dimensions

First-Half of the Course

Students are required to complete the ten business intelligence tool exercises described in the course textbook. The focus of the exercises is on developing the student's business intelligence tool proficiency and insight capability. During the first half of the course, the first six chapters of the textbook are covered. In addition, the business intelligence tool training is facilitated.

Table 20: Application Exercises Analysis

Application Exercises	*Topic*	*Purpose*
Exercise #1	➢ BCG Matrix ➢ Customer Value Matrix	➢ To gain insight into utilizing and applying various models to perform business portfolio analysis (especially the BCG Matrix), the customer value matrix, and articulate business growth strategies
Exercise #2	➢ Market Analysis	➢ To gain insight into utilizing and applying models and concepts regarding situations assessment, market analysis, segmentation analysis, forecasting and trend analysis, competitive analysis, and strategic performance analysis
Exercise #3	➢ PowerGrid Model ➢ Product Life Cycle	➢ To gain insight into utilizing and applying models and tools to understand existing and new product strategy and to assess performance
Exercise #4	➢ Channel Management	➢ To gain insight into utilizing and applying channel management functions and evaluation models, customer service management functions and measurements tools
Exercise #5	➢ Promotional Effects	➢ To gain insight into utilizing and applying various pricing models, breakeven analysis, promotional mix models, advertising models, and sales force assessment models

Half-Way Point of the Course

At the halfway point in the course, a midterm exam is conducted. This is a two-question test with one of the questions based upon a scenario analysis.

Table 21: Application Case Study Analysis

Cases	*Topic*	*Purpose*
Case #1	➢ Business Portfolio Analysis ➢ Growth Strategy	➢ To gain insight into utilizing and applying various models to perform business portfolio analysis (especially the BCG Matrix), the customer value matrix, and articulate business growth strategies
Case #2	➢ Forecasting & Trend Analysis ➢ Situation Assessment	➢ To gain insight into utilizing and applying models and concepts regarding situations assessment, market analysis, segmentation analysis, forecasting and trend analysis, competitive analysis, and strategic performance analysis
Case #3	➢ Brand Equity Assessment	➢ To gain insight into utilizing and applying models and tools to understand existing and new product strategy and to assess performance
Case #4	➢ Channel Management ➢ ServQual Model	➢ To gain insight into utilizing and applying channel management functions and evaluation models, customer service management functions and measurements tools
Case #5	➢ Promotional Allocation	➢ To gain insight into utilizing and applying various pricing model, breakeven analysis, promotional mix models, advertising models, and sales force assessment models

Second-Half of the Course

During the second half of the course, the last five chapters of the textbook are covered. The students are provided insight into the key concepts, analytical models, and focal points for each chapter via facilitated discussion. The students are required to complete a case or application exercise, present their findings to the class and discuss the relationship to the previously presented cases or application exercises.

Completion of the Course

The day before the end of the course, the following surveys will be administered: the "Concept Knowledge" test, the "Business Intelligence Tool" test, and the "Personal Skills Assessment" test. In addition, the student course assessment form is administered. On the final day of the course, a scenario analysis is distributed.

Timeframe / *Instrument*	Start of Semester	Mid-Point of Semester	End of Semester
Actual Ability Assessment Instrument			
• Business Intelligence Tools	X		X
• Business Concept / Models	X		X
• Scenario Assessment	X	X	X
• Business Intelligence Tool Exercises		X	
Perceived Ability Assessment Instrument			
• Business Intelligence Tools	X		X
• Business Concept / Models	X		X

X -- The point in time that the assessment instrument is administered

Figure 14: Assessment Logistics Grid

Research Study Summary

The information provided by the students was collected and the data were captured in a Microsoft Excel spreadsheet. Initial totals, averages, and simple statistical analysis were then performed on the collected data in preparation for detailed analysis. This simple analysis aided in developing reasonableness checks to ensure that the data were entered correctly.

Statistical Analyses

To gain insight into the outcome of the research study and to enable generalization of the results, statistical analysis is performed. The purpose of the statistical analysis is to determine the effect of the various described factors on the actual outcome and to investigate the potential interaction of the various identified factors (Cook & Campbell, 1979). A variety of statistical analyses are required to be performed (Best & Kahn, 1989; Borg & Gall, 1989; Cohen & Manion, 1994; Cook & Campbell, 1979; Haas & Kraft, 1984; Jones, 1996). The statistical analysis routines that are performed in this research study include sample characteristics, descriptive statistics, instrument reliability analysis, factor analysis, and multivariate analysis of variance.

Sample Characteristics

The variables that describe the participants used in this research study include gender, age, day or night person, time when most alert, perceived business intelligence software tools ability, perceived computer ability, and job satisfaction rating. These data are listed in Table 22.

Table 22: Sample Characteristics

Category	Level	Frequency	Percent	Study Group	Comparison Group	Sig.
Gender	Female	80	39	58	22	
	Male	127	61	100	27	
	Total	207	100	158	49	.306
Age	21 Yr	14	7	2	12	
	22 Yr	20	10	15	5	
	23 Yr	38	19	36	2	
	24 Yr	39	19	37	2	
	25 Yr	20	10	18	2	
	26 Yr	14	7	11	3	
	27 Yr	11	5	4	7	
	28 Yr	11	5	8	3	
	29 Yr	11	5	8	3	
	30-35	10	5	6	4	
	36 +	14	7	9	5	
	Total	202	100	154	48	.301
Day / Night	Day	95	47	69	26	
	Night	107	53	85	22	
	Total	202	100	154	48	.259
Time When Most Alert	6pm-Mid	84	42	64	20	
	6am-Noon	35	17	25	10	
	Mid-6am	10	5	10	0	
	Noon-6pm	72	36	55	17	
	Total	201	100	154	47	.323
Business Intelligence Software Ability	Very Skilled	1	1	1	0	
	Skilled	17	8	12	5	
	Neither	28	17	30	4	
	Minimal	28	14	24	4	
	Novice	121	60	86	35	
	Total	201	100	153	48	.153
Computer Ability	Very Skilled	23	11	18	8	
	Skilled	117	58	90	27	
	Neither	51	25	40	11	
	Minimal	10	5	8	2	
	Novice	1	1	1	0	
	Total	202	100	154	48	.254
Job Satisfaction	Very Sat.	44	24	36	8	
	Satisfied	83	45	60	23	
	Neither	36	19	25	11	
	Dissatisfied	19	10	15	4	
	Very Dissat.	4	2	4	0	
	Total	186	100	140	46	.917

In Table 22, the participants in the study group were contrasted with participants in a comparison group. The study group and the comparison group were analyzed to determine if the two groups possessed similar characteristics. The study group was composed of 158 participants. The comparison group was composed of 49 participants. The total number of participants in the study group or the comparison group differs based upon whether the participant chose to answer the particular question. The SPSS Independent-Samples T Test procedure was used. It compares the means of two groups of cases. The significance-rating statistic details that there is not sufficient evidence to show that there is a difference between the two groups on any of the captured categorical variables.

Descriptive Statistics

The assessment survey instrument was composed of multiple questions. Table 23 provides an overview of the responses for the various questions. The questions highlighted in the table relate to the various factors detailed later in this chapter. Table 23 provides the mean, skewness, kurtosis, and Kolmogorov-Smirnov (K-S) statistic. Hair, Anderson, Tatham, and Black (1995) define skewness as a measure of the symmetry of a particular distribution. Skewness values outside the range of −1 to +1 indicate a substantially skewed distribution. None of the questions exhibited skewness. According to Hair, Anderson, Tatham,

Table 23: Assessment Instrument Descriptive Statistics

Questions	Statistics			
	Mean	Skewness	Kurtosis	K-S Z
#2 Contribution Model	2.78	.578	-.804	2.584
#3 Customer Value Map	2.95	.423	-.834	2.315
#4 Perform Breakeven Analysis	2.49	.797	-.177	2.839
#5 Strategic Profit Model	2.93	.393	-.929	2.555
#6 Pricing Methods	4.16	-.243	-.554	2.327
#7 Promotional Budget Methods	3.88	-.163	-.763	2.178
#8 Critical Questioning Ability	4.65	-.363	-.487	1.957
#9 Assess Channel Performance	3.51	-.135	-.770	2.543
#10 Assess Customer Performance	4.26	-.353	-.670	2.274
#12 Assess Price Elasticity	4.06	-.181	-.797	2.094
#13 Assess Product Performance	4.45	-.518	-.438	2.750
#14 Assess Promotional Performance	4.33	-.422	-.445	2.457
#16 Assess Supplier Performance	3.97	-.265	-.531	2.475
#17 Assess Advertising Effects	4.52	-.396	-.545	2.197
#20 Create Exceptions	2.94	.276	-.796	2.147
#21 Create Formulas	2.77	.657	-.326	2.626
#22 Competitive Environment	3.76	-.005	-.381	2.507
#23 Develop Market Niches	3.63	.051	-.634	2.204
#24 Develop Meaning from Charts	4.50	.-290	-.449	2.098
#25 Develop Meaning from Grids	4.03	-.158	-.557	2.194
#26 Develop Forecasts	3.52	.100	-.867	1.933
#27 Observation from Charts	4.72	-.335	-.483	2.621
#28 Observations from Grids	4.33	-.331	-.368	2.388
#29 Perform Analysis	3.68	.018	-.823	1.944
#31 Perform Breakeven Analysis	4.49	-.229	-.516	2.205
#33 Perform Problem Solving with Pareto	2.82	.670	-.443	2.404
#34 Perform Problem Solving with Fishbone	2.80	.602	-.515	2.502
#35 Perform Situation Assessment	3.62	.118	-.381	2.125
#36 Perform Trend Analysis	3.33	.173	-.817	1.926
#39 Understand Issues Using Charts	4.65	-.267	-.079	2.123
#40 Understand Issues Using Grids	4.24	-.277	-.121	2.376
#41 Understanding Exception Highlighting	3.22	.183	-.779	1.955
#45 Overall Ask Critical Questions	4.59	-.373	-.138	2.549
#46 Overall Perform Strategic Analysis	3.87	-.063	-.388	2.064
#47 Overall Use Problem Solving Methodology	4.13	-.020	-.258	2.373
#49 Overall Use Business Models	3.70	-.055	-.478	2.301
#50 Overall Use Performance Metrics	3.71	-.156	-.459	2.463
#51 Add Members	3.09	.214	-.998	2.100
#52 Change Style	3.05	.368	-.822	2.208
#53 Create Detailed Calculations	3.55	.041	-.934	1.987
#54 Create Calculations	3.05	.320	-.936	2.134
#55 Create Charts	4.23	-.422	-.760	2.297
#56 Create Charts	3.07	.317	-.936	2.252
#57 Create Forecasts	3.34	.144	-.908	1.906
#58 Create Queries	3.09	.256	-.882	1.982
#59 Customize Charts	4.07	-.293	-.909	2.190
#64 Swap Members	3.19	.185	-1.076	2.143

and Black (1995) kurtosis is a measure of the peakedness or flatness of a distribution when compared to a normal distribution. A positive value indicates a relatively peaked distribution and a negative value indicates a relatively flat distribution. Only question 64 exhibited a value outside of the +1/-1 range. Hair, Anderson, Tatham, and Black (1995) state that the statistical test of normality uses the z value. The critical z value of +/- 1.96 corresponds to a .05 alpha error level. The Kolmogorov-Smirnov (K-S) statistic test is one of the most common tests to ensure that the distribution is normal. The value of the Kolmogorov-Smirnov Z is based on the largest absolute difference between the observed and the theoretical cumulative distributions.

The K-S statistic is looking at the Type 1 error. The probability of this error is labeled alpha (α). This refers to the probability of rejecting the null hypothesis when it should not be rejected. Meyers and Wilemon (1989) provide a series of questions to be asked including "What is the value of the mean of a population?". A normal distribution is a requirement for many of the statistical tests. For example, if a variable is normally distributed the researcher can use the t-test. If the variable is not normally distributed, then the researcher uses the Wilcoxon Signed-Rank (WSR) test. The logic of the WSR test is that if the population of difference scores is symmetric about zero, then all patterns of signed ranks is equally likely (Myers and Well, 1995). The test does not rest on the assumption that the population from different sources is normally distributed or that the distribution should be symmetric. If the

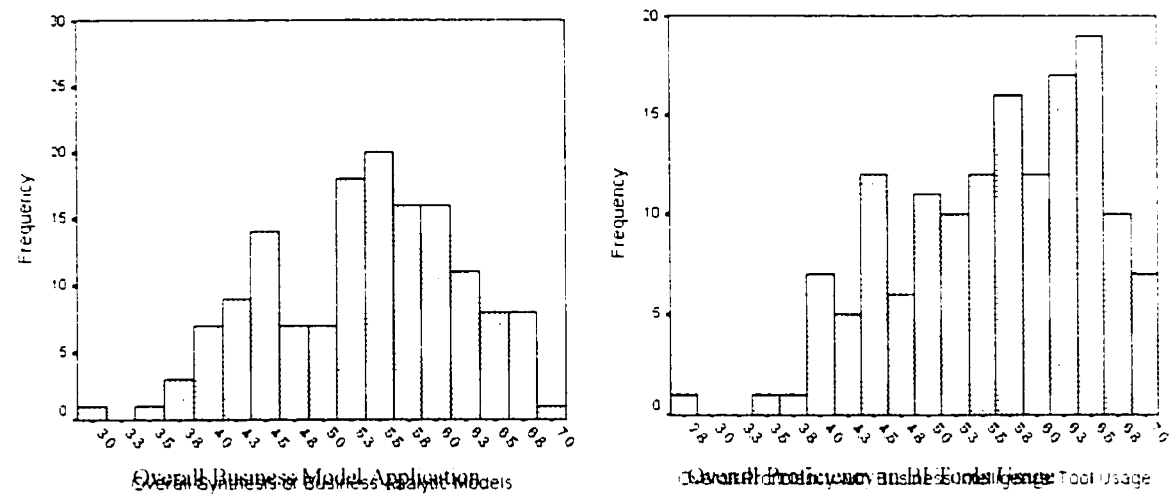

Figure 15: Distribution Responses for the Independent Variables

researcher uses the WSR test, it is important to check to ensure that the variable is not skewed.

Figure 15 provides a graphical view of the distribution of the two independent variables. The detailed description of the questions that comprise these variables is presented in Tables 29 and Table 30 in the Factor Analysis section.

<u>Instrument Reliability Analysis</u>

Reliability analysis allows the researcher to study the properties of the measurement instruments and the various items that make up those measurement instruments. Reliability of the measurement instrument is defined as the ratio of the true-score variance to the observed-score variance (SPSS, 1997). The concept of reliability then refers to how accurate the estimate of the true score is. The reliability analysis procedure in SPSS calculates a number of measures of the measurement instrument and provides information about the relationships between individual items in the measurement instrument. Using reliability analysis, the researcher can determine the extent to which the items in the questionnaire are related to each other, get an overall index of the repeatability or internal consistency of the measurement instrument, and identify problem questionnaire or survey items that should be excluded from the measurement instrument.

A variety of models for reliability analysis are available in SPSS Professional Statistics 7.5. They include the alpha, the split-half, Guttman, parallel, and strict parallel models. The alpha or Cronbach model is a model of internal consistency based upon the average inter-item correlation. The split-half model splits the test into two parts (for example, even and odd questions) and examines the correlation between the two parts. The Guttman model computes Guttman's lower bounds for true reliability. The parallel model assumes that all items have equal variances and equal error variances across replications. The strict parallel model makes the assumptions of the parallel model and assumes equal means across items. The assumptions used for reliability analysis are that the observations are independent and each pair of items should have a normal distribution. Survey scales should be additive so that each item is linearly related to the total score.

Table 24 provides a summary of the reliability of the assessment instrument. The table shows the reliability of the overall instrument and the reliability of the various sub-groups. It is important to ensure that these sub-groups have a high reliability as these are used in the factor analysis section.

Table 24: Reliability of the Assessment Instrument at Various Iterative Stages

Description	Number of Variables	Number of Cases	Alpha
Overall Assessment Instrument	64	415	.9887
Strategic Thinking	23	420	.9683
1. Market Mix Assessment	7	333	.9448
2. Insight Generation	4	333	.9397
3. Critical Questioning	3	333	.8689
4. Pattern Generation	4	334	.8699
Business Models Application	20	424	.9714
1. Assessment Models	9	332	.9542
2. Tactical Models	7	333	.9122
3. Strategic Models	4	335	.9384
Business Intelligence Tools	21	425	.9801
1. Forecasting Tools	6	331	.9434
2. Presentation Tools	4	334	.9401
3. Insight Tools	4	334	.9311

All questions on the measurement instrument were used in determining the instrument reliability. There were 64 statements in the survey. The participants rated their perceived skill on various areas using a Likert one (1) to seven (7) scale rating. A rating of one (1) is defined as being very weak whereas a rating of seven (7) is defined as being very strong. The responses of the participants from both the comparison group and the study group were used to determine the overall reliability of the assessment instrument. The number of cases reported varies as some of the participants chose not to answer certain questions. The reliability of the assessment instrument was checked in an iterative fashion. Once the overall instrument was show to have a high reliability rating, the reliability of the instrument for each of the key factors in the study was tested. These were shown to have high reliability. Factor analysis was again performed for the various constructs. The reliability for each of the constructs of each of the key factors was assessed utilizing only the study group. Hence, the number of cases reported decreased. This was deemed important to ensure that the assessment instrument demonstrated reliability for just the study group participants. As can be seen in Table 24, the assessment instrument demonstrated a high degree of reliability for all participants and for the study group participants.

Factor Analysis of the Assessment Instrument Items

Factor analysis is used to determine if more than one construct is required to account for the pattern of item scores. The researcher should look at each of the factors that come from the measurement instrument's answers. Hair, Anderson, Tatham, and Black (1995) provide a methodology for developing factors from the various measurement instruments. The first step in their methodology is to visually examine the correlation matrix. The researcher is looking for statistical significance of at least 50% of the items in the correlation matrix. The correlation matrix significance can be quantitatively assessed using the Bartlett test. The Bartlett test identifies a pattern of nonzero correlations. The Barlett's test for significance is presented in Table 25.

Table 25: Factor Scores Summary

Factors	MSA	Bartlett's Test – sig.	Variance Explained (%)	Number of Components
Proficiency in Business Intelligence Software Tools Usage	.924	.000	66.95	3
Synthesis of Business Analytic Models	.924	.000	66.36	3
Demonstrate Strategic Thinking	.924	.000	73.11	4

The second step in this methodology is to assess the measure of sampling adequacy (MSA). The researcher wants an MSA of greater than .500. The researcher eliminates variables that are less than .500 and would pull down the overall MSA. In the statistical factor analysis routines, anti-image matrices are produced. The anti-image correlation matrix contains the negatives of the partial correlation coefficients. In a good factor model, most of the off-diagonal elements of the anti-image correlation matrix are small. The measure of sampling adequacy (MSA) for a variable is displayed on the diagonal of the anti-image correlation matrix. For the factor "Proficiency in Business Intelligence Tool Usage", the MSAs ranged from a high of .960 to a low of .878 with only three MSAs below .900. For the factor "Business Model Application", the MSAs ranged from a high of .965 to a low of .886 with only three MSAs below .900. For the factor "Strategic Thinking Competence", the MSAs ranged from a high of .968 to a low of .882 with only four MSAs below .900. Kim and Mueller (1978) refer to Kaiser (1974) to detail the interpretation of the various MSA rating scores as follows:

○ greater than .900	marvelous
○ greater than .800	meritorious
○ greater than .700	meddling
○ greater than .600	mediocre
○ greater than .500	miserable
○ less than .500	unacceptable

This classification scheme enable the MSA rating scores to be classified as meritorious.

In the third step of the methodology, the component analysis is examined. The researcher is looking for eigenvalues that are greater than 1.0. The researcher can also utilize the scree test to graphically locate where the slope of the graph changes. The researcher looks at the communalities, which is the amount of variance in a variable that is accounted for by the identified factors. The extraction method used is Principal Component Analysis (PCA).

In the fourth step of the methodology, the identified factors are rotated. Hair, Anderson, Tatham, and Black (1995) indicate that the researcher can use varimax rotation or can use oblique (direct oblimin) rotation. The rotation method used is the Varimax with Kaiser Normalization.

Table 26: Total Variance Explained for Business Intelligence Tools

Component	*Initial Eigenvalues*			*Rotation Sums of Squared Loadings*		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.81	56.250	56.250	4.95	23.586	23.586
2	1.24	5.909	62.159	4.75	22.621	46.207
3	1.00	4.797	66.956	4.35	20.749	66.956
4	.90	4.291	71.247			

Table 27: Total Variance Explained for Business Model Application

Component	*Initial Eigenvalues*			*Rotation Sums of Squared Loadings*		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.67	53.384	53.384	4.98	24.898	24.898
2	1.38	6.928	60.312	4.32	21.632	46.530
3	1.21	6.056	66.368	3.96	19.838	66.368
4	.99	4.975	71.343			

Table 28: Total Variance Explained for Strategic Thinking

Component	*Initial Eigenvalues*			*Rotation Sums of Squared Loadings*		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.10	56.967	56.967	5.20	22.625	22.625
2	1.53	6.687	63.654	4.06	17.674	40.299
3	1.12	4.890	68.543	3.95	17.178	57.477
4	1.05	4.567	73.111	3.59	15.634	73.111
5	.77	3.351	76.462			

The final step in the methodology is to name the various identified factors. When naming the factors, items that have significance greater than .500 are usually included with factors having the greater significance receiving greater emphasis in the naming of the factor. The items are sorted based upon the highest significance level. In addition, items that had a significance of .500 or greater and a cross loading of .440 or greater were identified in the following tables but were not used in the factor. They are identified by the strikethrough (~~This is an example of a strikethrough~~). The rotated component matrix converged in 17 iterations for the Strategic Thinking factor. The rotated component matrix converged in 9 iterations for the Business Model Application factor. The rotated component matrix converged in 8 iteration for the Business Intelligence Tools factor.

The construct of Proficiency in Business Intelligence Software Tool Usage had three components identified. The items were sorted by the highest significance in each component. The first component was named Forecasting Tools as the items indicated ability to create forecasts and to perform trend analysis with the presented data. The second component was named Presentation Tools as the items indicated the participant's ability to create charts/graphs, add members to the chart and to change the style of the presentation graph. The third component was named

Insight tools as the items indicated the ability of the participant to create detailed formulas, calculation, and exception highlighting to gain insight into the presented data.

The construct of Business Models Application had three components identified. The items were sorted by the highest significance in each component. The first component was named Assessment Models as the items indicated the perceived ability of the respondents to develop and uncover market niches and to assess the competitive environment with performance metrics and situation analysis tools. The second component was named Tactical Models. This name was chosen as the items focused on various tactical tools such as pricing and promotion methods and breakeven analysis. The third component was named Strategic Models. This name was chosen as the items focused on strategic issues of strategic profit, quality, and contribution by various dimensions.

Table 29: Proficiency in Business Intelligence Software Tools Usage Factor Analysis

Factors	Questions	Component		
		1	2	3
Factor 1 Forecasting Tools	#57 Create Forecasts	.763	.291	.247
	#36 Perform Trend Analysis	.725		.303
	#26 Develop Forecasts	.667		.387
	#59 Customize Charts	.664	.426	
	#58 Create Queries	.650	.307	.366
	#56 Create Charts	.533	.342	.274
	~~#62 BI Use Help~~	~~.512~~	~~.449~~	——
Factor 2 Presentation Tools	#55 Create Charts	.286	.799	.304
	#64 Swap Members		.753	
	#52 Change Style	.336	.716	.277
	#51 Add Members		.696	.399
	~~#61 BI Find Members~~	~~.511~~	~~.667~~	——
	~~#63 BI Sort Data~~	~~.474~~	~~.560~~	——
	~~#44 Use External Data~~	~~.431~~	~~.496~~	~~.380~~
Factor 3 Insight Tools	#21 Create Formulas	.203		.884
	#53 Create Detailed Calculations	.305	.391	.724
	#20 Create Exceptions	.277	.282	.704
	#54 Create Summary Calculations	.368	.392	.643
	~~#42 Use Statistical Tools~~	~~.499~~	~~.202~~	~~.613~~
	~~#60 BI Edit Formulas~~	~~.510~~	~~.370~~	~~.559~~
	~~#48 Overall Use BI Tools~~	~~.455~~	~~.466~~	~~.502~~

The construct of Strategic Thinking Skills had four components identified. The items were sorted by the highest significance in each component. The components were named Market Assessment Skills, Insight Generation Skills, Critical Questioning Skills, and Pattern Generation Skills respectively.

Table 30: Business Models Application Factor Analysis

Factors	Questions	Component 1	Component 2	Component 3
Factor 1 Assessment Models	#23 Develop Market Niches	.777	.328	
	~~#38 Relate Performance Measures~~	~~.722~~	——	~~.476~~
	#22 Competitive Environment	.719	.351	
	~~#30 Perform Brand Equity Assessment~~	~~.670~~	——	~~.470~~
	~~#37 Relate Cust Sat with Financial Metrics~~	~~.661~~	——	~~.483~~
	#50 Overall Use Performance Metrics	.643	.430	.295
	#29 Perform Analysis	.641	.396	.360
	#35 Perform Situation Assessment	.596		.452
	~~#32 Perform Competitive Analysis~~	~~.509~~	~~.480~~	~~.410~~
Factor 2 Tactical Models	#6 Pricing Methods		.794	.268
	#7 Promotional Budget Methods		.749	
	#46 Overall Perform Strategic Analysis	.400	.706	.212
	#49 Overall Use Business Models	.410	.618	.278
	~~#1 BCG Growth Share Matrix~~	——	~~.604~~	~~.454~~
	~~#19 Compare Performance~~	~~.461~~	~~.602~~	——
	#31 Perform Breakeven Analysis	.347	.562	.417
Factor 3 Strategic Models	#5 Strategic Profit Model		.341	.782
	#2 Contribution Model		.331	.744
	#3 Customer Value Map	.300	.230	.703
	#4 Perform Breakeven Analysis	.360		.637

The Market Assessment Skills factor was labeled as such because the items focused on assessment skills of the current market mix. The market mix included advertising effects, promotional performance and the performance of the customer, channel and product dimensions. The Insight Generation Skills factor was named as such because of the skill and required ability to observe and develop meaning from charts/graphs and tables/grids. The Critical Questioning Skills factor was named as such because the items focused on the ability to ask critical questions and use an appropriate problem solving methodology. The Pattern

Generation Skill was named as such because of the respondents required skill to identify and perform techniques to create and identify patterns. These include the fishbone methodology and the Pareto methodology.

Table 31: Strategic Thinking Skills Factor Analysis

Factors	Questions	Component			
		1	2	3	4
Factor 1 Market Mix Assessment Skills	#17 Assess Advertising Effects	.754	.	.371	
	#10 Assess Customer Performance	.749	.448		.244
	#9 Assess Channel Performance	.694	.448		.250
	~~#11 Assess Market Performance~~	~~.673~~	~~.582~~	——	——
	#13 Assess Product Performance	.671	.362	.266	.308
	#14 Assess Promotional Performance	.669	.237	.454	.262
	#16 Assess Supplier Performance	.638	.207	.328	.338
	#39 Understand Issues Using Charts	.547	.373	.420	.300
Factor 2 Insight Generation Skills	#27 Observation from Charts	.218	.797	.305	
	#24 Develop Meaning from Charts	.236	.715	.354	.253
	#28 Observations from Grids	.376	.710	.265	
	#25 Develop Meaning from Grids	.342	.685		.282
Factor 3 Critical Questioning Skills	#45 Overall Ask Critical Questions		.384	.746	.263
	#8 Critical Questioning Ability	.342	.238	.694	
	~~#15 Assess Sales Force Performance~~	~~.561~~	——	~~.630~~	~~.269~~
	#47 Overall Use Problem Solving Methodology		.399	.615	.461
	~~#43 Use Decision Making Methodology~~	——	~~.248~~	~~.541~~	~~.531~~
	~~#18 Assess Product Life Cycle~~	~~.504~~	~~.210~~	~~.528~~	——
	#40 Understand Issues Using Grids	.431	.425	.514	.363
Factor 4 Pattern Generation Skills	#34 Perform Problem Solving with Fishbone				.858
	#33 Perform Problem Solving with Pareto		.215		.783
	#12 Assess Price Elasticity	.322		.299	.641
	#41 Understanding Exception Highlighting	.204	.286	.354	.561

MANOVA for Strategic Thinking Skills

Many statistical methods are available to aid in separating the main or interaction effects from the effect of selection differences.

Multivariate Analysis of Variance (MANOVA) is one of those statistical procedures.

Before beginning the MANOVA procedure the variables must be classified. Operationalizing the two independent variables of business model application and business intelligence tools was accomplished by classifying the respondents into various levels in the 2 x 3 matrix based upon the subjective measures of the achieved skills and capabilities. The 7-point Likert scale items were used to measure the achieved level of the business model application and business intelligence tools proficiency. The summated score of the multi-item measures were used to classify the respondents into various groups.

The respondents were placed in the high business intelligence tool group if their summated score was above the group mean and in the low business intelligence tool group if their score was below the mean. The respondents were placed in the low business model application group if their summated score was in the lower third, in the medium business model application group if they were in the middle third, and in the high business model application group if they were in the top third.

For the business model application construct, the multi-item measures capture the respondent's achieved ability to apply and articulate various tactical and strategic analytic models and with their ability to generate forecasts and perform situation assessments into market conditions. For the business intelligence tool construct, various technical capabilities were assessed including the ability to customize charts, swap members on and off the grid, sort data, alter presentation scales, create calculations, and use complex formulas. The knowledge creation and utilization construct measured the respondent's ability to assess, compare, describe, develop, observe and relate the current competitive environment with the strengths and weaknesses of the sample manufacturing organization.

MANOVA specifies three major components. The first component is the grand mean of the measurement instrument scores across all individuals in the factorial design. This value locates the average response of all individuals on the measurement scale. The second component corresponds to the main effect of the various factors. The third component is the error that represents the effects of all other factors that contribute to differences between the scores or ratings. In this procedure, the factor under discussion is assumed to be the whole cause of any expected difference in the performance between the groups. The MANOVA procedure does not allow for the possibility that the magnitude of the main factor effect might differ across characteristics of the individual participants. The MANOVA procedure only explains the portion of the variation of the scores that result from the effect. All other variation is relegated to the error term.

Table 32: Cell Means for Overall Strategic Thinking Skills

Overall – Business Intelligence Tools	Overall – Business Models Application			
	Low	Medium	High	Total
Low	4.75	5.58	5.13	5.02
High	5.43	5.89	6.52	6.22
Total	4.79	5.76	6.49	***5.66***

Table 33: Cell Means for Market Mix Assessment Skills

Overall – Business Intelligence Tools	Overall – Business Models Application			
	Low	Medium	High	Total
Low	4.96	5.61	4.57	5.16
High	5.09	6.02	6.61	6.31
Total	4.97	5.86	6.56	***5.77***

Table 34: Cell Means for Insight Generation Skills

Overall – Business Intelligence Tools	Overall – Business Models Application			
	Low	Medium	High	Total
Low	5.04	5.81	4.50	5.27
High	6.00	6.18	6.66	6.44
Total	5.10	6.03	6.61	***5.89***

Table 35: Cell Means for Critical Questioning Skills

Overall – Business Intelligence Tools	Overall – Business Models Application			
	Low	Medium	High	Total
Low	4.85	5.66	5.33	5.11
High	6.00	5.90	6.58	6.28
Total	4.92	5.80	6.55	***5.73***

Table 36: Cell Means for Pattern Generation Skills

Overall – Business Intelligence Tools	Overall – Business Models Application			
	Low	Medium	High	Total
Low	3.85	4.97	6.50	4.24
High	5.33	5.21	6.05	5.68
Total	3.94	5.11	6.06	***5.01***

Table 37: Cell Size for Strategic Thinking Factors

Overall – Business Intelligence Tools	Overall – Business Models Application			
	Low	Medium	High	Total
Low	45	21	1	67
High	3	31	42	76
Total	48	52	43	***143***

The first major component in the MANOVA procedure is creation of the grand mean. The grand mean, or overall average response, for the Overall Strategic Thinking Skills is 5.66. The four factors that comprise the dependent variable are Market Mix Assessment Skills, Insight Generation Skills, Critical Questioning Skills, and Pattern Generation Skills. The grand means for the four factors that comprise the overall strategic thinking skills are 5.77, 5.89, 5.73, and 5.01 respectively. The second component is the main effect. In this research study, the main effects are related to the Business Intelligence Tools and to the Business Models Application. For each of the dependent variables, the category mean of the main effects increases. So, as the business intelligence tools moves from low to high, the category means increase. As the business model application moves from low to medium to high, the category means increase.

As can be seen in Table 38, only two of the main effects were not significant at the .100 level. The first was for the Business Models main effect on the dependent variable Critical Questioning Skills at .205. The second was for the Business Intelligence Tools main effect on the dependent variable Pattern Generation Skills at .119. More importantly, all the interaction effects were significant.

Table 38: MANOVA Results

Source	Dependent Variable	Mean Square	F	Sig.	R^2
Corrected Model	Overall – Strategic Thinking	14.13	69.9	.000	.719
	Market Mix Assmnt Skills	12.79	37.2	.000	.560
	Insight Generation Skills	12.38	27.4	.000	.483
	Critical Questioning Skills	13.39	30.7	.000	.512
	Pattern Generation Skills	21.90	49.2	.000	.629
Intercept	Overall – Strategic Thinking	760.09	3764.9	.000	
	Market Mix Assmnt Skills	740.98	2155.2	.000	
	Insight Generation Skills	801.55	1778.3	.000	
	Critical Questioning Skills	808.23	1855.3	.000	
	Pattern Generation Skills	698.59	1571.0	.000	
Main Effect: Overall – Models	Overall – Strategic Thinking	1.96	9.7	.000	
	Market Mix Assmnt Skills	2.88	8.3	.000	
	Insight Generation Skills	1.23	2.7	.068	
	Critical Questioning Skills	.69	1.6	.205	
	Pattern Generation Skills	4.12	9.2	.000	
Main Effect: Overall – Tools	Overall – Strategic Thinking	3.90	19.3	.000	
	Market Mix Assmnt Skills	4.53	13.1	.000	
	Insight Generation Skills	8.35	18.5	.000	
	Critical Questioning Skills	4.77	10.9	.001	
	Pattern Generation Skills	1.09	2.4	.119	
Interaction Effect: Overall Models by Overall Tools	Overall – Strategic Thinking	.63	3.1	.047	
	Market Mix Assmnt Skills	1.38	4.0	.020	
	Insight Generation Skills	1.67	3.7	.027	
	Critical Questioning Skills	1.28	2.9	.056	
	Pattern Generation Skills	2.15	4.8	.009	
Error/Residual	Overall – Strategic Thinking	.20			
	Market Mix Assmnt Skills	.34			
	Insight Generation Skills	.45			
	Critical Questioning Skills	.43			
	Pattern Generation Skills	.44			

ANOVA for Overall Strategic Thinking

Analysis of variance (ANOVA) was performed to find out which independent variables contributed to the MANOVA results. ANOVA is a statistical procedure or method of testing the null hypothesis that several group means are equal in the population by comparing the sample variance estimated from the group means to that estimated within the groups. The SPSS General Linear Model (GLM) Multivariate statistical procedure provides multivariate analysis of variance (MANOVA) for multiple dependent variables by one or more factor variables. The factor variables, as previously stated, divide the population into groups. Using this general linear model statistical procedure, the researcher can test the null hypotheses regarding the effects of the factor variables on the means of various groupings of a joint distribution of dependent variables. The researcher can investigate interactions between the various factors as well as the effects of the individual factors.

An ANOVA table was reproduced using the data from Table 38. The table highlights that the interaction effect and the main effect for the independent variables Overall Business Model Application and Overall Business Intelligence Tools is significant for the dependent variable Overall Strategic Thinking Skills.

Table 39: ANOVA for Overall Strategic Thinking

		Sum of Squares	df	Mean Square	F	Sig.
Main Effects	Combined	69.386	3	23.129	114.561	.000
	Overall Model	17.661	2	8.830	43.738	.000
	Overall Tool	3.149	1	3.149	15.600	.000
2-Way Interaction	Overall Model by Overall Tool	1.264	2	.632	3.131	.047
Model		70.651	5	14.130	69.989	.000
Residual		27.659	137	.202		
Total		98.310	142	.692		

The simple factorial ANOVA statistical procedure performs analysis of variance for factorial designs. It tests the hypothesis that the group or cell means of the dependent variable are equal. The researcher can control the order of entry of the factor main effects and can test both balanced and unbalanced models. A design is balanced if each cell in the model contains the same number of cases. If more than one dependent variable is specified, the multivariate analysis of variance (MANOVA) using Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root criterion can be used as well as the univariate analysis of variance for each of the dependent variable. In addition to testing the hypotheses, the SPSS GLM Multivariate statistical method produces estimates of the various parameters.

One of the statistical assumptions important to the ANOVA procedure is the homogeneity of the variance of the dependent variable between the groups. The Levene statistic is used to assess this situation.

The unequal cell sizes should not impact the sensitivity of the statistical tests of group difference (Hair, Anderson, Tatham, & Black, 1995). The Levene statistic tests the null hypothesis that the error variance of the dependent variable is equal across groups. The null hypothesis is that the two population variances are equal. Table 40 highlights that three of the equations do not violate this assumption.

Table 40: Levene's Test of Equality of Error Variance

Independent Variables		Dependent Variable	Sig.
Overall BI Tools	Overall Business Models	Overall Strategic Thinking	.002
Overall BI Tools	Overall Business Models	Market Mix Assessment Skills	.184
Overall BI Tools	Overall Business Models	Insight Generation Skills	.056
Overall BI Tools	Overall Business Models	Critical Questioning Skills	.000
Overall BI Tools	Overall Business Models	Pattern Generation Skills	.281

If the groups are not of equal size the Type III method of the GLM procedure is used. Table 37 provides a breakdown of the cell sizes. It is apparent from this table that the Type III method must be used. In the SPSS GLM procedure, the Type III method calculates the sums of squares of an effect in the design as the sums of squares adjusted for any other effects that do not contain it and orthogonal to any effects (if any) that contains it. The Type III sums of squares have one major advantage in that they are invariant with respect to the cell frequencies as long as the general form of estimating remains constant. Hence, this type of sums of squares is often considered useful for an unbalanced model with no missing cells, which is the case in this research study. The Type III sum-of-squares method is commonly used for any unbalanced model with no empty cells. Table 37 indicates that all cells are populated. Again, because of the unequal cell sizes, this is an unbalance model and the Type III method is appropriate for this analysis.

Interaction of Tools and Models

Graphs are another method of determining whether an interaction has occurred. According to Pedhazor and Pedhazor (1991) there are three results from the graphs or charts that can be used to aid in determining interaction effect. The three results are no interaction, disordinal interaction, and ordinal interaction. To generate these charts the dependent and independent variables are located on the chart. The dependent variable is placed on the Y-axis of the chart, one of the factors is placed on the X-axis of the chart, and the other factor is placed on the line segments. If the lines segments in the line chart are parallel, no interaction has occurred. If the line segments are not parallel, interaction has occurred. If the rank order of the effects does not change then the interaction is referred to as an ordinal interaction. If the rank order of the effects changes then the interaction is referred to as disordinal interaction. The independent variables and the dependent variables are graphed in Figure 16.1 through Figure 16.5.

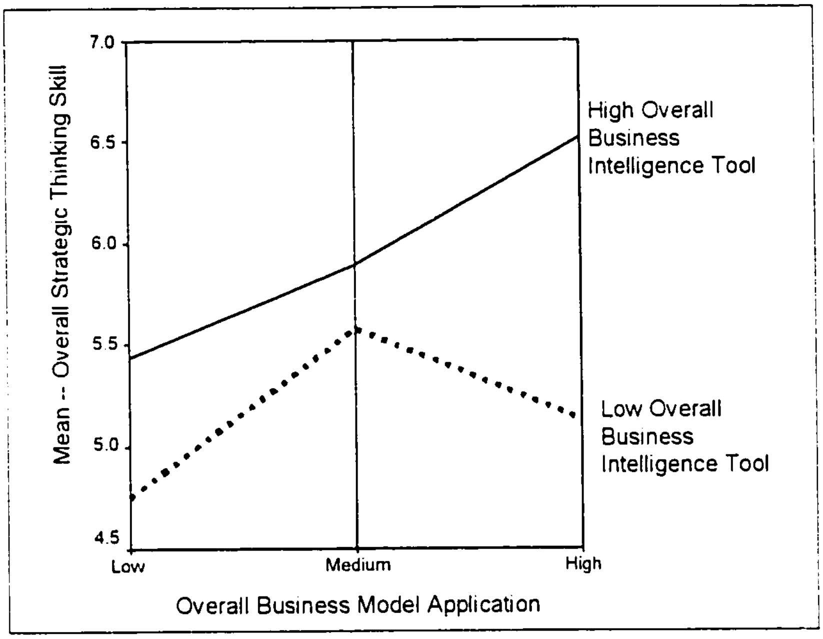

Figure 16.1: Interaction of Overall Models and Overall Tools for Overall Strategic Thinking Skills

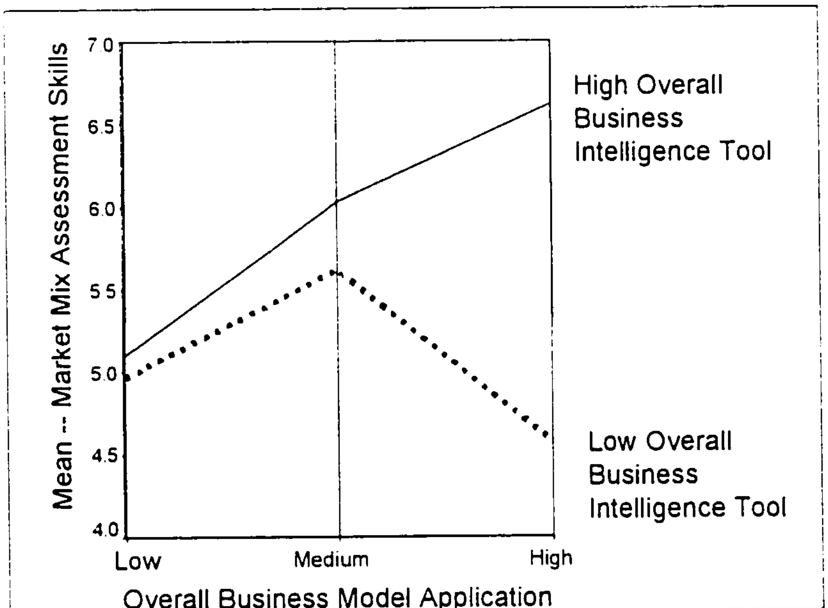

Figure 16.2: Interaction of Overall Model and Overall Tools for Market Assessment Skills

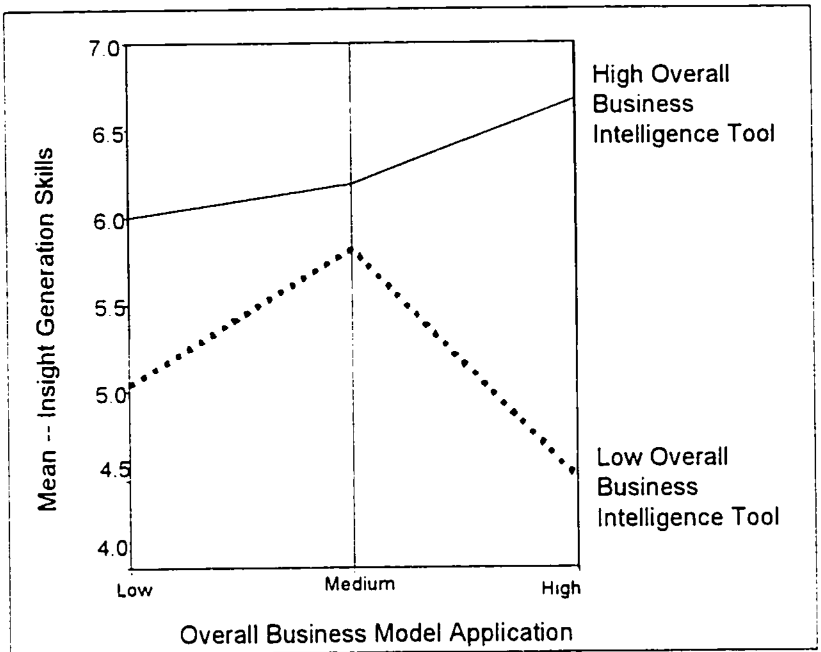

Figure 16.3: Interaction of Overall Model and Overall Tools for Insight Generation Skills

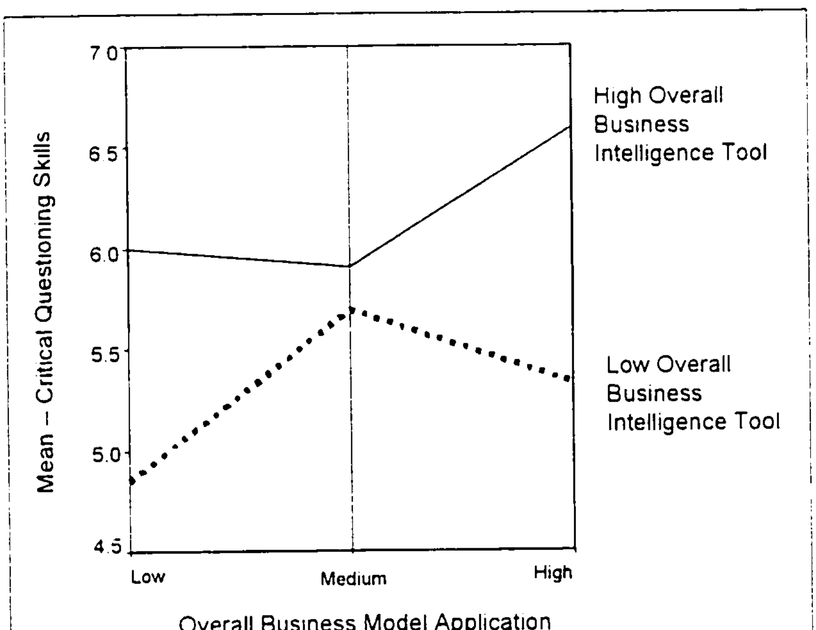

Figure 16.4: Interaction of Overall Model and Overall Tools for Critical Questioning Skills

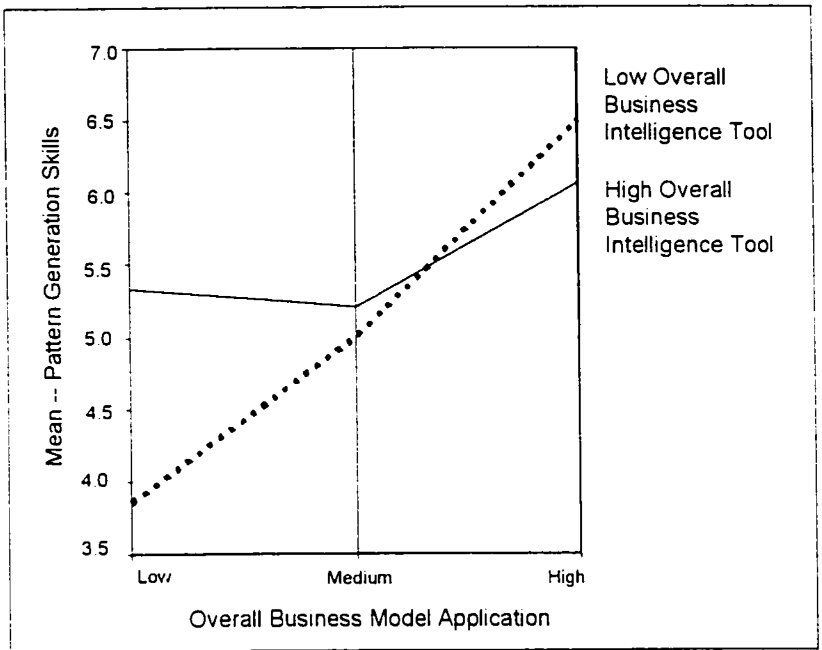

Figure 16.5: Interaction of Overall Model and Overall Tools for Pattern Generation Skills

Based upon a visual review of these graphs, it appears obvious that interaction is occurring because the lines representing high and low overall business intelligence tool are not parallel in any of the graphs. In addition, the interaction figures for the dependent variables Overall Strategic Thinking Skills, Market Assessment Skills, Insight Generation Skills, and Pattern Generation Skills can be referred to as ordinal interaction. The interaction figure for the dependent variable Critical Questioning Skill is disordinal because the rank order of the Overall Business Intelligence Tool factor has changed.

Factorial Design Summary

For the various independent and dependent variables under investigation, the cell means were calculated. The row and column means, referred to as the marginal means, were also calculated. The marginal means were calculated as if this was a single factor design. Therefore, the row means were calculated as if there were no columns and the column means were calculated as if there were no rows. The effect is the deviation of the category mean from the grand mean. The effects for the independent variables are referred to as the main effects. Since the effects are calculated as deviations from the grand mean, their sum must equal zero. For the Overall Strategic Thinking Skills matrix in Table 41, the grand mean was calculated as 5.65. The mean for the overall low Business Intelligence Tool was 5.01 and the mean for the overall high Business Intelligence Tool was 6.22. The effect was then calculated as -.392 for the low Tools and .392 for the high Tools. The mean for the overall low Business Models Application was calculated as 4.79, the mean for the overall medium Business Models Application was calculated as 5.76, and the mean for the overall high Business Models Application was calculated as 6.49. The effect was then calculated as -.452, .170, and .282 respectively.

The potential interaction between the two independent variables needs to be examined. By definition, the interaction for any row or any column must sum to zero. Previously, the discussion addressed the significance of the interaction. It was shown that the interaction was significant. The interaction between Tools and Models is relatively low for the low Models but increases and is relatively high for the high Models. Thus, the effect of the Tools factor varies depending on the level of the Model factor. The effect is most pronounced at the high level of the Models factor.

Since it has been determined that differences exist among the means, pairwise multiple comparisons can determine which means differ. Pairwise multiple comparisons test the difference between each pair of means. Scheffé is a multiple comparison test. The Scheffé test is the most conservative with respect to Type 1 errors (Hair, Anderson, Tatham, & Black, 1995). The multiple comparison tests follows each table to determine the significance of the means from low to medium and medium to high.

Table 41: Data for the 2x3 Factorial Design for Overall Strategic Thinking

		Business Models Application			
		Low	*Medium*	*High*	
Proficiency in Business Intelligence Software Tool Usage	*Low*	Mean: 4.7507 Interaction: .0497	Mean: 5.5776 Interaction: .2550	Mean: 5.1304 Interaction: -.3047	Mean: 5.015 Effect: -.392
	High	Mean: 5.4348 Interaction: -.0497	Mean: 5.8878 Interaction: -.2550	Mean: 6.5228 Interaction: .3047	Mean: 6.2208 Effect: .392
		Mean: 4.7935 Effect: -.452	Mean: 5.7625 Effect: .170	Mean: 6.4904 Effect: .282	**Grand Mean: 5.6561**

Multiple Comparisons

Dependent Variable: Overall Strategic Thinking
Scheffe

(I) Overall Model -- High / Medium / Low	(J) Overall Model -- High / Medium / Low	Mean Difference (I-J)	Std. Error	Sig.
Low	Medium	-1.0553*	.086	.000
	High	-1.7852*	.094	.000
Medium	Low	1.0553*	.086	.000
	High	-.7299*	.102	.000
High	Low	1.7852*	.094	.000
	Medium	.7299*	.102	.000

*. The mean difference is significant at the .05 level.

Table 42: Data for the 2x3 Factorial Design for Market Mix Assessment Skills

		Business Models Application			
		Low	*Medium*	*High*	
Proficiency in Business Intelligence Software Tool Usage	*Low*	Mean: 4.9651 Interaction: .345	Mean: 5.6190 Interaction: .264	Mean: 4.5714 Interaction: -.609	Mean: 5.1642 Effect: -.410
	High	Mean: 5.0952 Interaction: -.345	Mean: 6.0230 Interaction: -.264	Mean: 6.6088 Interaction: .609	Mean: 6.3102 Effect: .410
		Mean: 4.9732 Effect: -.446	Mean: 5.8599 Effect: .333	Mean: 6.5615 Effect: .113	**Grand Mean: 5.7732**

Multiple Comparisons

Dependent Variable: Market Mix Assessment Skills
Scheffe

(I) Overall Model -- High / Medium / Low	(J) Overall Model -- High / Medium / Low	Mean Difference (I-J)	Std. Error	Sig.
Low	Medium	-1.0766*	.116	.000
	High	-1.8058*	.125	.000
Medium	Low	1.0766*	.116	.000
	High	-.7292*	.135	.000
High	Low	1.8058*	.125	.000
	Medium	.7292*	.135	.000

*. The mean difference is significant at the .05 level.

Table 43: Data for the 2x3 Factorial Design for Insight Generation Skills

		Business Models Application: *Low*	Business Models Application: *Medium*	Business Models Application: *High*	
Proficiency in Business Intelligence Software Tool Usage	*Low*	Mean: 5.0444 Interaction: .101	Mean: 5.8095 Interaction: .401	Mean: 4.5000 Interaction: -.502	Mean: 5.2761 Effect: -.579
	High	Mean: 6.000 Interaction: -.101	Mean: 6.1855 Interaction: -.401	Mean: 6.6607 Interaction: .502	Mean: 6.4408 Effect: .579
		Mean: 5.1042 Effect: -.169	Mean: 6.0337 Effect: .281	Mean: 6.6105 Effect: -.112	**Grand Mean: 5.8951**

Multiple Comparisons

Dependent Variable: Insight Generation Skills
Scheffe

(I) Overall Model -- High / Medium / Low	(J) Overall Model -- High / Medium / Low	Mean Difference (I-J)	Std Error	Sig
Low	Medium	- 9635*	136	000
	High	-1 5676*	148	000
Medium	Low	9635*	136	000
	High	-.6042*	159	.001
High	Low	1 5676*	148	.000
	Medium	6042*	159	001

* The mean difference is significant at the .05 level.

Table 44: Data for the 2x3 Factorial Design for Critical Questioning Skills

		Business Models Application: *Low*	Business Models Application: *Medium*	Business Models Application: *High*	
Proficiency in Business Intelligence Software Tool Usage	*Low*	Mean: 4.8519 Interaction: -.149	Mean: 5.6667 Interaction: .350	Mean: 5.3333 Interaction: -.151	Mean: 5.1144 Effect: -.426
	High	Mean: 6.000 Interaction: .149	Mean: 5.9032 Interaction: -.350	Mean: 6.5873 Interaction: .151	Mean: 6.2851 Effect: .426
		Mean: 4.9236 Effect: -.297	Mean: 5.8077 Effect: .059	Mean: 6.5581 Effect: .238	**Grand Mean: 5.7366**

Multiple Comparisons

Dependent Variable: Critical Questioning Skills

Scheffe

(I) Overall Model -- High / Medium / Low	(J) Overall Model -- High / Medium / Low	Mean Difference (I-J)	Std. Error	Sig.
Low	Medium	-.8655*	.121	.000
	High	-1.6325*	.131	.000
Medium	Low	.8655*	.121	.000
	High	-.7670*	.141	.000
High	Low	1.6325*	.131	.000
	Medium	.7670*	.141	.000

*. The mean difference is significant at the .05 level.

Table 45: Data for the 2x3 Factorial Design for Pattern Generation Skills

		Business Models Application			
		Low	*Medium*	*High*	
Proficiency in Business Intelligence Software Tool Usage	*Low*	Mean: 3.8556 Interaction: -.495	Mean: 4.9762 Interaction: .027	Mean: 6.5000 Interaction: -.468	Mean: 4.2463 Effect: -.244
	High	Mean: 5.3333 Interaction: .495	Mean: 5.2097 Interaction: -.027	Mean: 6.0536 Interaction: .468	Mean: 5.6809 Effect: .244
		Mean: 3.9479 Effect: -.709	Mean: 5.1154 Effect: -.264	Mean: 6.0640 Effect: .973	**Grand Mean: 5.0087**

Multiple Comparisons

Dependent Variable: Pattern Generation Skills

Scheffe

(I) Overall Model -- High / Medium / Low	(J) Overall Model -- High / Medium / Low	Mean Difference (I-J)	Std. Error	Sig.
Low	Medium	-1.2672*	.120	.000
	High	-2.1588*	.131	.000
Medium	Low	1.2672*	.120	.000
	High	-.8917*	.140	.000
High	Low	2.1588*	.131	.000
	Medium	.8917*	.140	.000

*. The mean difference is significant at the .05 level.

Table 46: Hypotheses Summary

1. Impact on Overall Strategic Thinking Skills		
	Hypothesis 1.1 – Business Intelligence Tool Main Effect	Supported
	Hypothesis 1.2.1 – Business Model Application Main Effect	Supported
	Hypothesis 1.2.2 – Business Model Application Main Effect	Supported
	Hypothesis 1.3 – BI Tool & Business Model Interaction Effect	Supported
2. Impact on Market Assessment Skills		
	Hypothesis 2.1 – Business Intelligence Tool Main Effect	Supported
	Hypothesis 2.2.1 – Business Model Application Main Effect	Supported
	Hypothesis 2.2.2 – Business Model Application Main Effect	Rejected
	Hypothesis 2.3 – BI Tool & Business Model Interaction Effect	Supported
3. Impact on Insight Generation Skills		
	Hypothesis 3.1 – Business Intelligence Tool Main Effect	Supported
	Hypothesis 3.2.1 – Business Model Application Main Effect	Supported
	Hypothesis 3.2.2 – Business Model Application Main Effect	Supported
	Hypothesis 3.3 – BI Tool & Business Model Interaction Effect	Supported
4. Impact on Critical Questioning Skills		
	Hypothesis 4.1 – Business Intelligence Tool Main Effect	Supported
	Hypothesis 4.2.1 – Business Model Application Main Effect	Supported
	Hypothesis 4.2.2 – Business Model Application Main Effect	Supported
	Hypothesis 4.3 – BI Tool & Business Model Interaction Effect	Supported
5. Impact on Pattern Generation Skills		
	Hypothesis 5.1 – Business Intelligence Tool Main Effect	Rejected
	Hypothesis 5.2.1 – Business Model Application Main Effect	Rejected
	Hypothesis 5.2.2 – Business Model Application Main Effect	Supported
	Hypothesis 5.3 – BI Tool & Business Model Interaction Effect	Supported

Hypotheses Summary

Various hypotheses were developed regarding the impact of business intelligence tools and business model application on overall strategic thinking skills, market assessment skills, insight generation skills, critical questioning skills, and pattern generation skills. The data collected and reported on generally supports those hypotheses.

Chapter Five
Summary / Conclusion / Discussion

Summary

Multiple statistical procedures and methods were used to analyze the data. Each of the statistical procedure used was designed to provide a different view into the data enabling the researcher to gain detailed insight and greater understanding.

Sample Characteristics

Data were collected from the participants. The categorical data provided a view or picture of the individual participants. The data demonstrated that there was no statistical difference between these individual participants in the study group and those individual participants in the comparison group population. This begins to provide the basis for arguing for generalization to the target population. The composite view of the participant was an individual considered skilled at computer usage (69% rated their computer capabilities as either very skilled or skilled) and were mostly under 26 years old (65% of the participants indicated that their age was less than 26 years old). These individuals were satisfied with their current job (69% rated their satisfaction with their current job as very satisfied or satisfied). The group involved in the study was approximately evenly split by gender (female or male) and by perceived time of day that they were most alert (day or night).

The descriptive statistics from the assessment instrument were listed. The skewness of the listed survey questions was between +1 and -1. This leads to the conclusion that the variables are not skewed. The kurtosis of the variables is mostly negative. This leads to the conclusion that the distributions of the variables are relatively flat. The K-S statistic shows that the variables are to be defined as normal. This permits usage of various statistical procedures requiring normal data.

The alpha scores of the various assessment instruments were detailed. For the overall assessment instrument the alpha score was .9714. The assessment for business models, business intelligence software tools, and strategic thinking and critical questioning alpha scores were .9714, .9801, and .9675 respectively. It is up to the researcher to determine what amount of error to tolerate given the specific circumstance of the study (Pedhazur & Pedhazur, 1991). In the early stages of research on the hypothesized measures of a particular construct, the researcher can save time by working with instruments that have only modest reliability. Modest reliability can be thought of as being in the .60 to .50 range (Pedhazur & Pedhazur, 1991; Nunnally, 1967). All the instruments in this research study far exceeded the .60 threshold specified by Nunnally. After factor analysis of the measurement instrument, the unique items or variables associated with each of the identified factor were summed. This created a summated scale for each of the factors. These new summated variables were tested for reliability as well.

Strategic Thinking Factor Analysis

Factor analysis was performed on all of the measurement instruments. Hair, Anderson, Tatham, and Black (1995) stated that the researcher could use either the summated scale or the factor scores. In this research study, the summated scale is used. The survey questions that are used for each of the factors is listed in the previous tables (refer to Tables 31, 32, and 33). Hair, Anderson, Tatham, and Black (1995) stated that for a sample size of approximately 120 a factor loading of .500 or greater was required. This research study follows that recommendation. In addition, for each of the components listed (refer to Tables 29, 30, and 31) the factor loading on the other components is listed to identify cross-loading situations. Child (1990) states that the requirement is for at least three variables or questions for each of the identified factors. The questions or variables that comprise the factors are listed in the appropriate table. It is noted that Child's recommendation is adhered to in identifying factors. In general, researchers seem to agree that one should have at least twice as many variables as factors. For the various factors that were identified, a summated scale was developed and then appropriately named.

The Bartlett test rating for each factor was performed. Each factor showed a significance level of .000. The assessment instrument for Business Models Application had a measure of sampling adequacy (MSA) for each item greater than .900. The assessment instrument for Proficiency in Business Intelligence Tools had a MSA for each item greater than .899. The assessment instrument for Strategic Thinking Skills had a MSA for each item greater than .851. The factors for this research study are labeled meritorious according to Kim and Mueller (1978) classification scheme.

Communality is the proportion of the variance of that variable that can be explained by the common factors (SPSS, 1997). Communalities range from zero (0) to one (1). A score of zero (0) indicates that the common factors explain none of the variance of the variable whereas a score of one (1) indicates that the common factors explain all the variance.

The "Business Analytic Model" factor analysis had a MSA of .924. All variables had a MSA of greater than .864. Three factors explaining over 66% of the variance were identified. Factors that loaded greater than .50 on one factor and less than .40 on the others were kept. The reliability as measured by alpha coefficient (refer to Table 24 in the instrument reliability section) was greater than .90 for all three factors. The "Proficiency in Business Intelligence Tool" factor analysis had a MSA of .920. All variables had a MSA of greater than .888. Three factors explaining over 66% of the variance were identified. The reliability as measured by alpha coefficient was greater than .95 for all factors. The "Demonstrate Strategic Thinking" factor analysis had a MSA of .920. All variables had a MSA of greater than .890. Four factors explaining over 72% of the variance were identified. The reliability as measured by alpha coefficient was greater than .87 for all four factors.

The matrix was then rotated using varimax rotation as specified by Hair, Anderson, Tatham, and Black (1995) in preparation for the naming of the factors. Three factors were identified for Proficiency in Business Intelligence Tools. Based upon the identified variables, the factors were named. The first factor was named forecasting tools, the second factor was named presentation tools, and the third factor was named insight tools. Three factors were obtained for Business Models Application. The first factor was named assessment models, the second factor was named tactical models, and the third factor was named strategic models.

Multivariate Analysis of Variance

When the interaction effects are significant, the interpretation of the main effects is not as important. The investigation of the interaction effect is to ascertain whether the effects of a given factor vary depending on the level of the other factors. As such, it is important to discuss the effects of the various combinations.

The interaction of Overall Models and Overall Tools for Overall Strategic Thinking was displayed graphically. According to the previous discussion on graphing means, this would be classified as an ordinal interaction. The interaction values, the cell means, the marginal means, the grand mean, and the effect values were calculated for this combination. The interaction value for low model and low/high tool is +/- .05. The interaction value for the medium model and low/high tool is +/- .26. The interaction value for the high model and low/high tool is +/- .31.

Conclusion

This research study began with a review of the literature involved with the successful implementation of business intelligence software tools. A research model was created from the review of the literature to address an area requiring additional study. Data were collected to gain insight into the research study situation. The data were analyzed. The data previously detailed is now used to determine if the proposed hypotheses are supported.

Hypotheses Results

The research study provided a variety of hypotheses regarding the interaction of the proficiency of business intelligence software tool usage and the business models application on the perceived strategic thinking skills and abilities of the future leaders in manufacturing organizations. The hypotheses involved the main and interaction effects of the independent variables on the dependent variables related to strategic thinking skills.

1 – Impact on Overall Strategic Thinking Skills

It was hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business models application factor as it affects overall strategic thinking skills. This was indeed the case. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business models application category and lowest at the medium business models application category for the overall strategic thinking skills. The hypotheses presented in this study and their status are summarized in Table 47.

Table 47: Hypotheses Summary for Impact of Overall Strategic Thinking Skills

Hypotheses	Description	Status
1.1	A high business intelligence tool capability will produce a higher level of overall strategic thinking skill than low business intelligence tool capability.	Supported
1.2.1	High business model utilization capability will produce a higher level of overall strategic thinking skill than medium or low business model utilization capability.	Supported
1.2.2	Medium business model utilization capability will produce a higher level of overall strategic thinking skill than low business model utilization capability.	Supported
1.3	There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on overall strategic thinking skill.	Supported

This research study supports all three of these hypotheses. The high level of overall business intelligence tool capability produced a higher overall level of strategic thinking skill for the knowledge worker. It was also shown that the overall performance of the high business intelligence software tool category was superior to the low business intelligence software tool category across all levels of business models application. In addition, the study supports the statement that greatest difference occurred at the high business model category and the lowest difference occurred at the medium business model category.

2 – Impact on Market Assessment Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business model utilization ability. It was hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor for the dependent variable market assessment skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category. It was lowest at the low business model category. This was different that was expected. The hypotheses presented in this study and their status are summarized in Table 48.

This research study supports three of these hypotheses. It was shown that the overall performance of the high business intelligence software tool category was superior to the low business intelligence software tool category across all levels of business models. In addition, the study supports the statement that greatest difference occurred at the high business model category and the lowest difference occurred at the medium business model category.

Table 48: Hypotheses Summary for Impact of Market Assessment Skills

Hypotheses	Description	Status
2.1	A higher business intelligence tool capability will produce a higher level of market assessment skills than lower business intelligence tool capability.	Supported
2.2.1	High business model utilization capability will produce a higher level of market assessment skills than medium or low business model utilization capability.	Supported
2.2.2	Medium business model utilization capability will produce a higher level of market assessment skills than low business model utilization capability.	Rejected
2.3	There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on market assessment skills.	Supported

3 – Impact on Insight Generation Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business model utilization ability. It was hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor for the dependent variable insight generation skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category. The hypotheses presented in this study and their status are summarized in Table 49.

Table 49: Hypotheses Summary for Impact of Insight Generation Skills

Hypotheses	Description	Status
3.1	A higher business intelligence tool capability will produce a higher level of insight generation skills than lower business intelligence tool capability.	Supported
3.2.1	High business model utilization capability will produce a higher level of insight generation skills than medium or low business model utilization capability.	Supported
3.2.2	Medium business model utilization capability will produce a higher level of insight generation skills than low business model utilization capability.	Supported
3.3	There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on insight generation skills.	Supported

This research study supports all four of these hypotheses. It was shown that the overall performance of the high business intelligence software tool category was superior to the low business intelligence software tool category across all levels of business models. In addition, the study supports the statement that greatest difference occurred at the high business model category and the lowest difference occurred at the medium business model category.

4 – Impact on Critical Questioning Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business models ability. It was hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor as it affects the critical questioning skills. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category. The hypotheses presented in this study and their status are summarized in Table 50.

Table 50: Hypotheses Summary for Impact of Critical Questioning Skills

Hypotheses	Description	Status
4.1	A higher business intelligence tool capability will produce a higher level of critical questioning skills than lower business intelligence tool capability.	Supported
4.2.1	High business model utilization capability will produce a higher level of critical questioning skills than medium or low business model utilization capability.	Supported
4.2.2	Medium business model utilization capability will produce a higher level of critical questioning skills than low business model utilization capability.	Supported
4.3	There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on critical questioning skills.	Supported

This research study supports all four hypotheses. It was shown that the overall performance of the high business intelligence software tool category was superior to the low business intelligence software tool category across all levels of business models. In addition, the study supports the statement that greatest difference occurred at the high business model category and the lowest difference occurred at the medium business model category.

5 - Impact on Pattern Generation Skills

There is an interaction between the student's perceived rating of their overall business intelligence software tools skill and their overall business models ability. It is hypothesized that the high business intelligence tool category is superior to the low business intelligence tool category across all levels of the business model factor for the pattern generation skills dependent variable. The difference between the high business intelligence tool category and the low business intelligence tool category is greatest at the high business model category and lowest at the medium business model category. The hypotheses presented in this study and their status are summarized in Table 51.

Table 51: Hypotheses Summary for Impact of Pattern Generation Skills

Hypotheses	Description	Status
5.1	A higher business intelligence tool capability will produce a higher level of pattern generation skills than lower business intelligence tool capability	Rejected
5.2.1	High business model utilization capability will produce a higher level of pattern generation skills than medium or low business model utilization capability.	Rejected
5.2.1	Medium business model utilization capability will produce a higher level of pattern generation skills than low business model utilization capability.	Supported
5.3	There will be a significant interaction effect between business intelligence tool capability and business model utilization capability on pattern generation skills.	Supported

This research study supports hypothesis 5.2.2 and hypothesis 5.3 but doesn't support hypothesis 5.1 and hypothesis 5.2.1. It was shown that the overall performance of the high business intelligence software tool category was superior to the low business intelligence software tool category for the low and medium levels of business models application. The study doesn't support the statement that greatest difference occurred at the high business analytic model category. In fact, the low tool category outperformed the high tool category at the high model level.

Overall, the results are as expected. At the low model level, the business intelligence tool with the guided analysis functionality enable the novice knowledge worker to achieve insight and success with relatively little investment in effort. At the high model level, the business intelligence tool with the presentation management functionality enables the knowledge worker to generate more options and to evaluate more alternatives. At the medium model level, the business intelligence tool provides the knowledge worker with the functionality required to perform in depth analysis to gain insights, yet the knowledge worker doesn't have the capability to utilize the results.

Discussion

Various researchers have called for research studies to "open the black box" and investigate the various aspects associated with making decisions with business intelligence software tools. The research studies by Vandenbosch and Higgins (1995) focused on "opening the black box" by examining the manager's mental models and the process to acquire and update information. They found a twenty-five percent failure rate of installed business intelligence software systems. As a result, they focused their research on the need to understand what would cause organizations to abandon their invested research and development dollars. Subsequent research highlighted that managers identified knowledge management as a critical requirement. In his research study Li (1995) stated that 66% of surveyed managers were unsatisfied with the information they received. This dissatisfaction was attributed to the lack of research skills of existing knowledge workers and their inability to locate qualified personnel. CIOs in various organizations identified business intelligence software tool implementation as the number one issue they are facing. The executive board in these organizations view business intelligence software tools as a path to competitive advantage.

This research study sought to demonstrate that the reasons for the manufacturing organization's implementation failure could be attributed to conditions other than the business intelligence software tool functionality. It sought to "open the black box" and demonstrate that competitive advantage for manufacturing organizations is achieved through knowledge workers. Those knowledge workers require more than just leading-edge tools to support their work. To achieve insights and understanding in the marketplace, the knowledge workers must ensure that their mental models of existing competitive conditions are in sync with the leading-edge business development analytic models. These models provide the focus for insight. The business intelligence software tools provide the speed for insight generation.

This study examined the sample characteristics on various categories. These categories included age, gender, job satisfaction, number of years of job experience, and perceived computer capability. No difference was detected on the sample based upon these categories. This provides additional support and justification to the arguments that any knowledge worker in any manufacturing organization can enhance their critical insight generation skills utilizing business analytic models and business intelligence software tools.

All assessment instruments demonstrated a Cronbach alpha reliability rating greater than .86. In addition, the statistical tests indicate that the data being analyzed has normal characteristics. The graphs presented in Figure 15 provide additional visual support for this conclusion. Factor analysis statistical routines provided the ability to gain greater insight into the three primary constructs. The factors that were identified match those that were developed in the research model displayed in Figure 9. The five graphs displayed in Figure 16 visually depict the interaction effect of the business models and business intelligence tools. These figures detail the importance of the research study. This interaction is statistically significant for all of the dependent variables.

This research study has demonstrated that business intelligence software tools can provide knowledge workers with speed in analysis, that business analytic models can provide the organization with focus and that the critical thinking skills of the organization's knowledge workers can provide the organization with competitive advantage. These tools and skills enable the knowledge worker to produce detailed insights into the global competitive landscape. Yet, this study demonstrated that it is more that just business analytic models and leading-edge business intelligence software tools. It is the strategic thinking and critical questioning skills of knowledge workers that support the integration of valid business analytic models and leading edge business intelligence software support tools.

The concern addressed in various studies referenced in the literature focused on the lack of skill of the knowledge workers. However, these organizations must also include the tools and the willingness of the manufacturing organizations to invest in the tools for the knowledge workers and invest in the training to increase the skills of the knowledge workers. This research study sought to demonstrate that it requires more than just business intelligence software tool skill and ability to generate strategic thinking. It is more than just the knowledge and application of analytic business models. Manufacturing organizations require knowledge workers focused on critical questioning, supported by leading-edge business intelligence software tools and utilizing proven business analytic models to achieve lasting competitive advantage.

In Figure 10 it was illustrated that business intelligence software tools would provide the speed and business analytical models would provide the manufacturing organization with focus. The data from this study supports this figure. It was shown that the highest level of demonstrated strategic thinking was related to both high business intelligence software tools and high business analytic models. The data also showed that a low level of demonstrated strategic thinking was related to low levels of business intelligence software tools and low levels of business analytic models.

Research Implications

In addition to highlighting statistical significance, this study demonstrated practical significance as well. Figure 17 utilizes the data from this study. This figure details the three potential strategies facing senior managers in manufacturing organizations. The first strategy that the managers can follow is to begin by investing in business intelligence software tools and follow a "Tools Strategy". The second strategy that the managers can follow is to invest in business analytic model training and follow a "Models Strategy". The third strategy that the managers can follow is a hybrid strategy where the manager invests in both model training and business intelligence tools and is appropriately labeled "Hybrid Strategy". The improvement in demonstrated strategic thinking is seen in the figure. Depending upon the chosen strategy, the increase in the demonstrated strategy thinking ability is shown. Based upon the resources available to be deployed by the management team, the appropriate strategy can be chosen. Ultimately if the strategy is followed completely, the overall improvement in demonstrated strategic thinking ability will be the same.

In conclusion, this study has shown more than the importance of the business models or the importance of the business intelligence software tools alone. It has demonstrated the interaction of these constructs. This study has addressed the concern raised by previous studies regarding the skills of knowledge workers. This study has shown that knowledge workers can gain additional insights and produce greater competitive advantage for the manufacturing organization when they have leading-edge business intelligence software tools coupled with business models application. This study has shown that the concern addressed by managers regarding the lack of skills must also include the tools and willingness of the manufacturing organization to invest in technology. Ultimately competitive advantage will rest with the knowledge workers locating and defining niches of opportunity. It is the responsibility of the organization to ensure that the knowledge workers have the necessary technological tools and the proper training. It is the combination of these tools and the training in the application of the business analytic models that yields competitive advantage.

What aids in Strategic Thinking and Critical Questioning skills and abilities in a manufacturing organization? Many categorical variables have been examined. It has been shown not to be gender, age, or even job satisfaction. It has been demonstrated that business analytic models and proficiency in business intelligence tools should be included. Yet these account for about 75% of the explained variance relegating the remaining 25% to error or unexplained variance. Learning can be seen as the acquisition of information. But before learning can take place, there must be interest. Interest permeates all endeavors and precedes learning. In order to acquire and remember new knowledge, it must stimulate your curiosity in some way. So, what are the other factors that contribute to the unexplained variance in Strategic Thinking and Critical Questioning skills and abilities? Maybe it is curiosity.

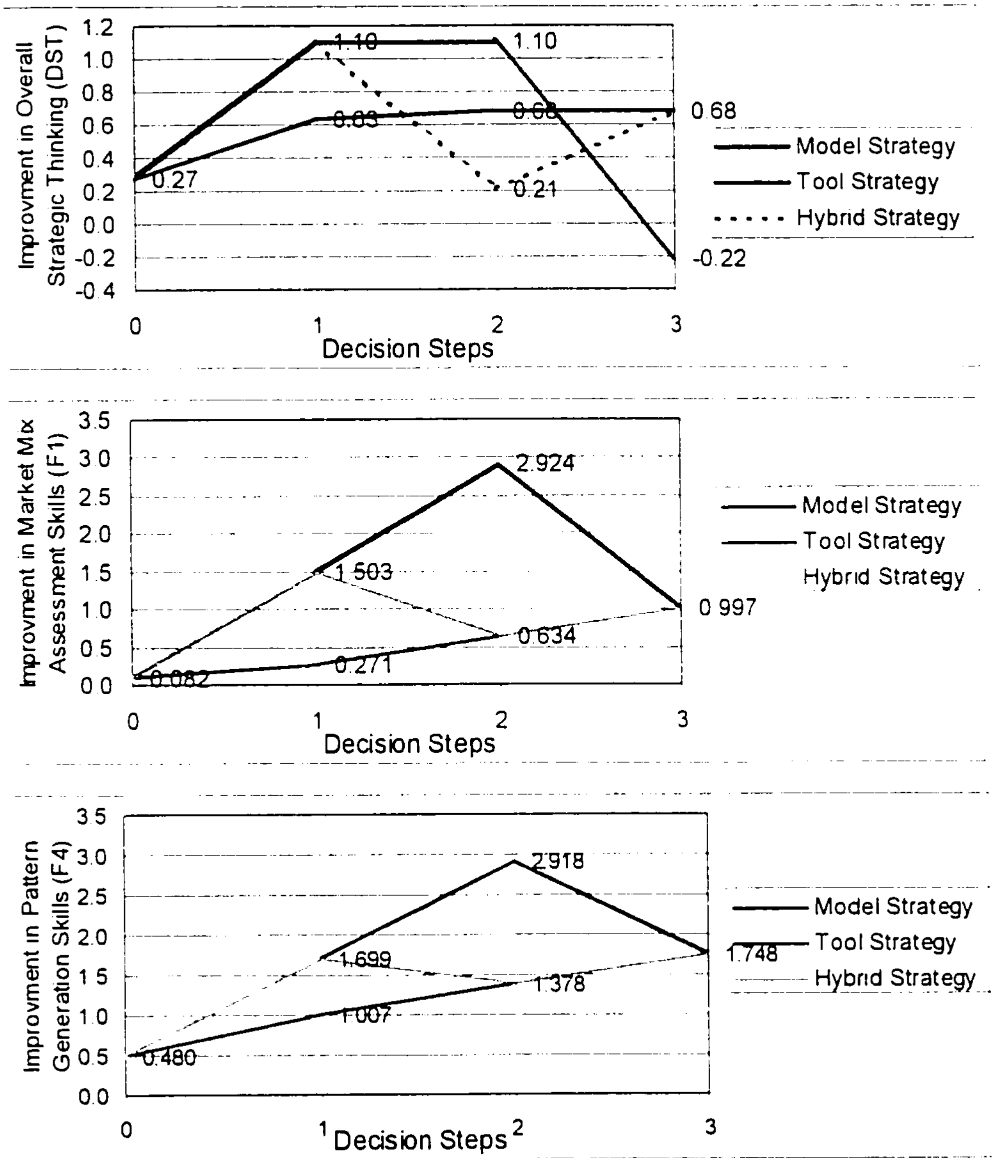

Figure 17: Application Strategies

Limitations

Each research study has limitations based upon what can be accomplished given the constraints of the environment. Three limitations to be addressed include issues related to the time chosen for the analysis routines, the classroom setting and the sample size. Each of these limitations was understood at the beginning of the study.

The time was chosen to be static during the research study. During the academic exercises, the date used in the analysis situations was frozen at April 5, 1997. Given the constraints of the academic computer environment and the requirement to have a static environment in the classroom to facilitate discussion of business analytic models and concepts, it is not possible to update the multidimensional database dynamically and achieve the objectives required by the course.

Since the date was frozen at April 5, 1997, it was not realistic to capture organizational learning and it was not possible to test or gain insight into the student's mental model creation or mental model update processes. Knowledge management dealt with the manufacturing organization's ability to scan and acquire information as well as the manufacturing organization's ability to generate and disseminate information. Again, given the academic constraints, there was no way for the students to scan for information and then to react to the acquired information in a real-time manner. Given that the date for the study was April 5, 1997, the students would have perfect forecasting ability as all classes were conducted after that date. Also, the students would have had unlimited time to discuss and understand the global competitive environment.

During the research study, the date was frozen in time at April 5, 1997. Therefore, the students cannot react to any market intelligence in a meaningful manner. The students could not receive any market feedback based upon their recommendations and suggested courses of action, as time does not progress forward. Given these constraints, market orientation could not be measured.

The respondents were undergraduate and graduate students. While various studies have shown that it is acceptable to use students as surrogates for business managers, it would be appropriate to confirm these results with business managers. The classroom setting provided the opportunity to develop and refine the assessment instruments. Utilizing business managers would provide external validity to the findings. This issue is addressed in the future research section.

The classroom setting also placed constraints on the sample size. To ensure an adequate sample size for this study, the research was conducted over several semesters. This required a close focus on the requirements for the statistical tests to ensure that the proper number responses from the participants were obtained.

Future Research

This is a very dynamic field. The business intelligence software industry is growing at 40% compounded annually. The computer manufacturers have just recently provided sufficient storage and processing power to ensure that business intelligence software performs as expected. Given that this is a rapidly growing field that is still in its infancy, the future research direction is almost unlimited.

There are many areas for future research directions. Future research directions can expand in four key areas. Those directions include surveying businesses to corroborate the findings obtained from the academic setting, correlating the problem solving style of the knowledge worker, investigating the customers of the various business intelligence tool manufacturers to determine if a difference exists between tools, and changing the static time requirement in the study.

This study was conducted in an academic environment. Many of the insights obtained could be verified by actual organizations. This study could provide insight into usage by organization size and organizational complexity. This research would be confirmatory in nature.

The customers of the various business intelligence software firms could be analyzed to detect if certain functionality in the software provides additional competitive advantage. The firms could be analyzed to determine the impact of their training and educational offerings. This research work would focus primarily on the business tool construct.

The problem solving style of the knowledge worker may be a moderating factor of strategic thinking skills. Investigating the performance of the knowledge worker based upon their problem solving style may provide additional information for how organizations could allocated their training resources. This research would focus primarily on the critical thinking abilities of the knowledge worker.

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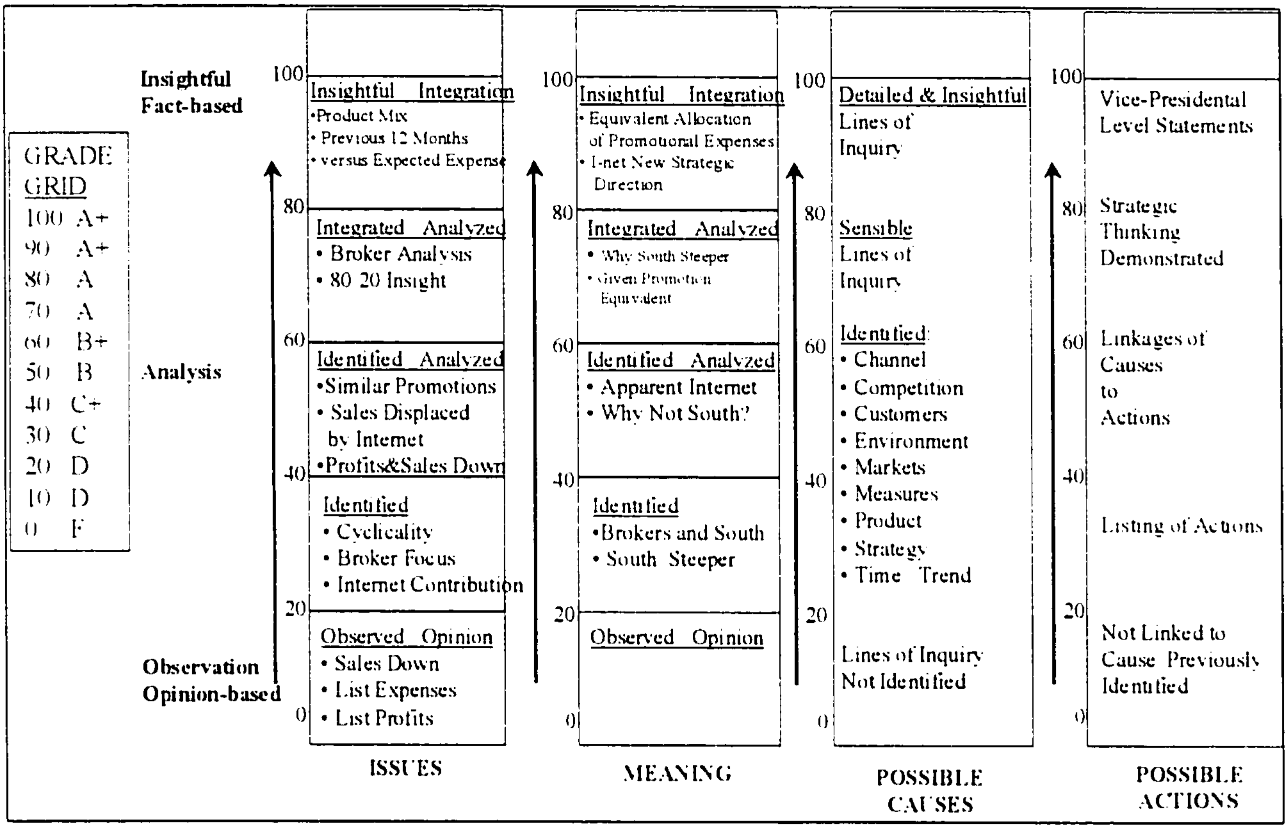
Appendix A

Assessment Tools

Evaluation Criteria for Examinations / Presentations



Appendix A-1: Grading Criteria Worksheet

Appendix B

Business Intelligence Tool Test

Instructions: Please read each questions carefully and select the answer that you believe most accurately answers the question. After each question, please answer the "ability" question using a 1 to 7 scale with 1 meaning not well at all through 7 meaning can perform very easily. Good Luck!!

---

1. Using the chart function in business intelligence tools, I can:

   a) Plot on Multiple Y-axis
   b) Perform Regression / Trending
   c) Select a Variety of Chart Shapes (Bar Chart, Pie Chart, etc.)
   d) A and C
   e) All of the Above
   f) None of the Above
   g) I don't know

I can easily perform the charting function.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

2. With business intelligence exception capabilities, I can:

   a) Apply Exception rules to numbers, text, and maps
   b) Set Background and Foreground Colors
   c) Associate Symbols with Exceptions
   d) B and C
   e) All of the Above
   f) None of the Above
   g) I Don't Know

I can easily create exception conditions.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

3. With business intelligence software, what can't you do:

   a) Rotate and Nest Various Dimensions
   b) Sort Defined Members
   c) Perform Calculations
   d) Play Video and Sound Files
   e) All of the Above
   f) None of the Above
   g) I Don't Know

I can easily perform these functions.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

4. With business intelligence tools, I can drill into my data by:

a) By Adding Levels to the Displayed Dimension
b) By Replacing Levels of the Displayed Dimension
c) By Selecting Levels for the Displayed Dimension
d) All of the Above
e) None of the Above
f) I Don't Know

I can easily perform the selection function.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

5. Using business intelligence tools, I have the ability to create formulas and calculations. Which formula(s) is (are) invalid?

a) Share of Parent ("Gross Sales")
b) 100*"F00000000070" / "F00000000157"
c) ("Prior Year" - "1995") * 100 / "1995"
d) A and C
e) All Are Invalid
f) None Are Invalid
g) I Don't Know

I can easily perform the calculation function.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

6. Which chart types are invalid in business intelligence tools?

a) Pictograph
b) XY(Scatter)
c) Radar
d) Polar
e) A and D
f) All Are Valid Chart Types
g) None Are Valid Chart Types
h) I Don't Know

I can easily perform the charting function.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

7. With business intelligence tools, I can display data in which form?

a) Linear Scale
b) Logarithmic Scale
c) Percent Scale
d) All of the Above are Possible
e) None of the Above are Possible
f) I Don't Know

I can easily perform the display data function.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

8. With business intelligence tools, I can create unique queries that allow me to

a) Rank the top 10 members by gross sales
b) Rank the bottom 10 members by variance from forecast
c) Rank the top 15% of the members according to sales growth over the 4 time periods
d) Rank the top 15% of the members according to the trend of 2 time periods based upon the last 3 time periods
e) All of the Above are Possible
f) None of the Above are Possible
g) I Don't Know

I can easily perform the query function.

No, I have no ability to do this.	I have very limited ability with this.	I have limited ability with this.	Maybe	I can accomplish this in time	I have some ability to do this.	Yes, I am very skilled at this.
1	2	3	4	5	6	7

Appendix C

Knowledge Concept Test

Instructions: Please read each questions carefully and select the answer that you believe most accurately answers the question.
Good Luck!!

---

1. When the producer directs its marketing activities toward the final consumers to induce them to buy the product, they are using which type of strategy?

   a) Pull Strategy
   b) Induction Strategy
   c) Deduction Strategy
   d) Push Strategy

2. Asking customers what benefits they value and how they rate the company versus competitors on important attributes is called:

   a) Competitive Positioning Analysis
   b) Strategic Value Analysis
   c) Market-Driven Analysis
   d) Customer Value Analysis

3. Cheryl Creditworthy knew that her company made the best notebook computers for the money. I can match anybody's features for less price and still make $500 above our costs, thought Cheryl. Cheryl's $500 margin refers to which of the following?

   a) Total Customer Cost
   b) Total Delivered Value
   c) Total Customer Value
   d) Total Added Value

4. If Honda uses its company name to cover such different products as its automobiles, lawn mowers, and motorcycles, it is practicing which of the following:

   a) Brand Extension Strategy
   b) Line Extension Strategy
   c) Private Brand Strategy
   d) New Brand Strategy

5. The percentage change in the quantity of demand divided by the percentage change in price yields the:

   a) Price Sensitivity of Demand
   b) Price Comparison with Demand
   c) Price Elasticity of Demand
   d) Price Profit by Demand

6. Which tool of the promotion mix consists of short-term incentives to encourage the purchase or sales of a product or service?

   a) Advertising
   b) Personal Selling
   c) Sales Promotion
   d) Public Relations

7. The redesign of existing brands to offer more quality at a given price or the same quality at a lower price is typical of which of the following?

   a) Product Form Pricing
   b) Cash Discount Pricing
   c) Seasonal Discount Pricing
   d) Value Pricing

8. When a coffee shop in an airport and a fine restaurant in a luxury hotel charge different prices for the same meal to customers who find the atmosphere in the hotel worth the difference, we can say that which type of pricing method is being used?

   a) Cost-Plus Pricing
   b) Perceived-Value Pricing
   c) Target Profit Pricing
   d) Value Based Pricing
   e) Going-Rate Pricing

9. The use of such methods as comparison-shopping, customer surveys, and suggestions and complaint forms are all ways of implementing which characteristic of well-managed service companies?

   a) Customer -Obsession
   b) Top Management Commitment to Quality
   c) Setting Appropriately High Service Quality Standards
   d) Monitoring Service Performance Closely

10. Building selective demand is the objective of which type of advertising?

   a) Informative Advertising
   b) Persuasive Advertising
   c) Reminder Advertising
   d) Demand Driven Advertising

11. A __________ has no intermediary levels between the producer and the consumer.

a) Direct-Marketing Channel
b) Primary-Marketing Channel
c) Secondary-Marketing Channel
d) Peripheral-Marketing Channel

12. Companies that are good prospects for a relationship marketing program have all the following characteristics except:

a) That they prefer suppliers who can sell and deliver a coordinated set of products and services to many locations.
b) That they want suppliers who can quickly solve problems.
c) That they want suppliers who can work closely with customer teams to improve products and processes.
d) That they want suppliers who emphasize service over technical support.

13. Under the value-chain concept, the company examines its costs and performance in each value-creating activity. To the extent that the firm can perform certain activities better than its competitors, it can:

a) Create Total Customer Satisfaction
b) Reduce Total Customer Costs
c) Achieve a Competitive Advantage
d) Realize a Low Cost Leadership Advantage

14. Considerations for discounts, trade-in allowances, and varying terms of credit are all part of which element of the marketing mix?

a) Product
b) Price
c) Place
d) Promotion

15. The ________ for a product or service is the volume that would be bought by a defined consumer group in a defined geographic area in a defined time period in a defined marketing environment under a defined level and mix of industry marketing effort.

a) Demand
b) Total Market Demand
c) Area Market Demand
d) Time Period Market Demand
e) Actual Sales
f) Market Share

16. Timing the use of promotion tools to enhance a particular response such as increasing awareness or building product knowledge emphasizes which factor in setting the promotion mix.

a) The Type of the Product / Market
b) Push versus Pull Strategy
c) Buyer Readiness State
d) Product Life Cycle Stage

17. Which type of promotion uses buying allowance, push money, and free goods?

a) Consumer Promotion
b) Trade Promotion
c) Salesforce Promotion
d) Product Promotion
e) Place Promotion

18. The process of dividing a market into distinct groups of buyers with different needs, characteristics, or behaviors is called:

a) Demand Forecasting
b) Market Segmentation
c) Market Targeting
d) Market Positioning

19. The process of computing how much a customer spends per purchase, how often s/he buys from the company, and how long the company can expect the customer to continue to buy is used to estimate the:

a) Customer Attractiveness Index
b) Customer Lifetime Value
c) Customer Preference Quotient
d) Customer Marketability Value

20. All of the following are sales forecasting techniques based upon what people say except:

a) Leading Indicators
b) Survey of Buyers Intentions
c) Composite Salesforce Opinions
d) Expert Opinions

21. Choosing a product difference that competitors cannot easily copy would be which kind of differentiation?

a) Important
b) Distinctive
c) Superior
d) Preemptive

22. Doug Dobbins liked his subcompact minicar, the Micro. The micro didn't have much pick up and wasn't very attractive but it was easy to park and got great gas mileage. That's all I want in a car, thought Doug. From Doug's response, we can infer that the makers of the Micro have:

a) Maximized Customer Satisfaction
b) Offered the Lowest Total Customer Cost
c) Achieved an Acceptable Level of Customer Satisfaction
d) All of the Above
e) None of the Above

23. The concept under which a company carefully coordinates its many communications channels to deliver a clear, consistent, and compelling message about the organization and its products is called:

a) Integrated Direct Marketing
b) The Marketing Mix
c) Direct Marketing Communications
d) Integrated Marketing Communications

24. Providing employee incentives for quality service and checking customer satisfaction through suggestion boxes and complaint departments in an effort to standardize customer experiences are all steps that address which aspect of services?

a) Intangibility
b) Inseparability
c) Variability
d) Perishability

25. In terms of indicators of market potential for global marketing, the size of the population and the rate of population growth, refer to which of the following:

a) Demographic Characteristics
b) Geographic Characteristics
c) Economic Factors
d) Socio-Cultural Factors
e) Psycho-Graphic Characteristics

26. The process of identifying key competitors; assessing their objectives, strengths and weaknesses, strategies, and reaction patterns; and selecting which competitors to attack or avoid is called:

a) Strategic Management
b) Marketing Analysis
c) Competitor Analysis
d) Strategic Positioning
e) Law of the Jungle

27. An expensive set of golf clubs promises to hit the ball farther. An inexpensive set of clubs promises to hold up well. Both sets of clubs deliver on their promises and are free from defects. We can say that:

a) They have equivalent levels of performance quality.
b) They are produced by similar total quality management programs.
c) They have equivalent levels of conformance quality.
d) All of the above
e) None of the above

28. Recognizing that new products typically need large advertising budgets to build awareness while mature brands usually require lower budgets as a ratio to sales focuses on which factor to consider when setting an advertising budget?

a) Stage in the Product Life Cycle
b) Product Differentiation
c) Advertising Frequency
d) Competition and Clutter

29. Regarding the key functions of marketing channels, all of the following statements are true except:

a) That all functions use up scarce resources.
b) That many functions can be performed better through specialization.
c) That not all functions need to be performed for all products.
d) That they can be shifted among channel members.

30. The decision to serve a few markets well rather than going after the whole market is typical of which competitive strategy?

a) Overall Cost Leadership
b) Differentiation
c) Focus
d) Middle of the Road
e) Limited Market
f) Premium Market

31. Cash Discounts are a form of:

a) Discriminatory Pricing
b) Psychological Pricing
c) Discount Pricing and Allowances
d) Promotional Pricing

32. Common mistakes that companies make when it comes to pricing include:

a) Pricing that is too cost oriented.
b) Prices that are not revised often enough to reflect market changes.
c) Pricing that does not take the rest of the marketing mix into account.
d) A and B
e) All of the Above
f) None of the Above

33. Comparing the company's products and processes to those of competitors or leading firms in other industries to find new ways to improve quality and performance is called:

a) Customer-Value Analysis
b) Benchmarking
c) Consumer-Competitor Matrix
d) Value-Added Competition

34. Choosing a price based upon its effect on immediate profit, cash flow, or return on investment reflects which of the following pricing objectives?

a) Survival
b) Current Profit Maximization
c) Market-Share Leadership
d) Product-Quality Leadership

35. Psychographic segmentation is typically done by dividing markets according to some combination of which of the following?

a) Nations, States, Regions
b) Products, Brands, SKU
c) Social Class, Behavior, Personality characteristics
d) Social Class, Lifestyle, Personality Characteristics
e) Personality, Lifestyle, Income Distribution
f) Manufacturer, Brokers, Consumer

36. When a firm such as General Motors sets its prices to achieve a 15 percent to 20 percent profit on its investment, it is using which type of pricing method?

a) Cost-Plus Pricing
b) Perceived-Value Pricing
c) Target Profit Pricing
d) Going-Rate Pricing

37. The __________ holds that achieving organizational goals depends on determining the needs and wants of target markets and delivering the desired satisfactions more effectively and efficiently than the competition.

a) Production Concept
b) Product Concept
c) Selling Concept
d) Marketing Concept

38. The process of developing and maintaining a strategic fit between the organization's goals and capabilities and its changing marketing opportunities is called:

a) Annual Planning
b) Long-Range Planning
c) Strategic Planning
d) Market Auditing

39. Under the BCG growth-share matrix, the market growth rate provides:

a) A measure of the company's strength in the market.
b) The primary information for investment / divestiture decisions.
c) A measure of market attractiveness.
d) A measure of profitability for all products.

40. The identification of the best businesses for a company to enter as those located in highly attractive industries where the company has high business strength is characteristic of which portfolio planning tools?

a) The BCG Growth-Share Matrix
b) The GE Strategic Business-Planning Grid
c) The JLH Executive Judgement Planning Model
d) The Shell Risk Assessment Model
e) The TQM Product Planning Process

41. The stage in the new product development process in which the anticipated sales, market share, and profit goals for the first few years are described is called:

a) Idea Generation
b) Marketing Strategy Development
c) Business Analysis
d) Product Development

42. Cost-Plus Pricing involves:

a) Setting Prices to Reach a Specific Rate of Return
b) Adding a Standard Markup to the Cost of the Product
c) Pricing Products with the Buyer's Sense of Value in Mind
d) Basing the Prices on What the Competition Charges

43. Firms such as Pepsi aggressively seek to gain market share at the expense of their competition. Firms like these might attack firms with more share, about the same share, or smaller share than their own. This type of competitive marketing strategy is typical of which of the following:

a) Market Leaders
b) Market Challengers
c) Market Followers
d) Market Nichers

44. A company should determine what characteristics distinguish better middlemen and analyze their years in business growth and profit records, cooperativeness and reputation as part of which channel management decision?

a) Selecting Channel Members
b) Motivating Channel Members
c) Evaluating Channel Members
d) All of the Above
e) None of the Above

45. The process by which people select, organize, and interpret information to form a meaningful picture of the world is called:

a) Marketing
b) Consumption
c) Perception
d) Cognition

46. The type of trade-promotion discount in which manufacturers agree to reduce the price to the retailer in exchange for the retailer's agreement to feature the manufacturer's products in some way is called a(n):

a) Discount
b) Allowance
c) Premium
d) Advertising Specialty
e) Rebate
f) Patronage Reward

47. Assuming that brand equity constitutes the major enduring asset of a company, the marketing strategy should focus on:

a) Building Brand Awareness
b) Building Brand Preference
c) Marketing Company Brand Strength
d) Extending Loyal Customer Lifetime Value

48. In the introduction stage of the product life cycle, which of the following statements are true?

a) Promotion spending is relatively high.
b) Firms focus on those buyers who are the most ready to purchase – usually the higher income groups.
c) Firms must adopt one of several marketing strategies appropriate for introduction.
d) A and C
e) All of the Above are True
f) None of the Above are True

49. The commonly used three-stage procedure companies use to arrive at a sales forecast includes:

a) A national forecast, a regional forecast, and a local forecast
b) An organizational forecast, an interpersonal forecast, and a personal forecast
c) An environmental forecast, and industry forecast, and a company forecast
d) An economic forecast, a political forecast, and a social forecast

50. Setting the promotion budget on the basis of taking some predetermined portion of the actual or forecasted sales is characteristic of which method?

a) Affordable Method
b) Percentage of Sales Method
c) Competitive Parity Method
d) Objective and Task Method

51. Technological advances, shifts in consumer tastes, and increased competition, all of which reduce demand for a product are typical of which stage in the product life cycle.

a) Decline
b) Introduction
c) Growth
d) Maturity

52. The formula, Q=n*q*p, where n = the number of buyers in the market, q = the quantity purchased and p = price of an average unit, is a common way to estimate:

a) Total Market Demand
b) Market Potential
c) Selective Demand
d) Area Market Demand
e) Market Share

53. The relation between the price charged and the resulting demand level achieved is known as the :

a) Price Curve
b) Cost Curve
c) Need Curve
d) Demand Curve

54. In terms of time-series analysis, the element that captures the medium-term, wave–like movement of sales resulting from changes in general economic and competitive activity is called the :

a) Trend
b) Cycle
c) Season
d) Erratic Components

55. Determining each competitor's resources and capabilities is part of which step in competitor analysis?

a) Identifying the Company's Objectives
b) Determining Competitors' Objectives
c) Identifying Competitors' Strategies
d) Assessing Competitor's Strengths and Weaknesses

56. A period of rapid market acceptance and increasing profits characterizes which stage in the product life cycle?

a) Decline
b) Maturity
c) Introduction
d) Growth

57. The dividing of the market into different units based upon such criteria as nations, states, regions, or even neighborhoods is called:

a) Geographic Segmentation
b) Demographic Segmentation
c) Psychographic Segmentation
d) Behavioral Segmentation

Appendix D

Personal Assessment Survey: Business Intelligence / Marketing Concepts

Strategic Marketing Analysis and Decision Making
Personal Skills Assessment Questionnaire

Name: ____________________________
Student Number: ______-_______-_________

Instructions: Please respond to each of the following questions with the rating that most appropriately expresses your ability (Very Weak (1) to Very Strong (7)). This questionnaire has no bearing on your grade (i.e. No bonus points). Your answers will help improve the course. Your honest feedback is appreciated. ***Thank you!!***

Question	**Very Weak**			**Acceptable**			**Very Strong**
1. My ability to apply the BCG Growth Share matrix to gain understanding and insight is ...	1	2	3	4	5	6	7
2. My ability to apply the contribution model to gain understanding and insight is ...	1	2	3	4	5	6	7
3. My ability to apply the customer value map to gain understanding and insight is ...	1	2	3	4	5	6	7
4. My ability to apply the PowerGrid model to gain understanding and insight is ...	1	2	3	4	5	6	7
5. My ability to apply the strategic profit model to gain understanding and insight is ...	1	2	3	4	5	6	7
6. My ability to articulate the advantages and disadvantages of various pricing methods is ...	1	2	3	4	5	6	7
7. My ability to articulate the advantages and disadvantages of various promotional budget methods is ...	1	2	3	4	5	6	7
8. My ability to ask prompting questions to gain understanding and insight into the data is ...	1	2	3	4	5	6	7
9. My ability to assess channel performance is ...	1	2	3	4	5	6	7
10. My ability to assess customer performance is ...	1	2	3	4	5	6	7
11. My ability to assess geographic performance is ...	1	2	3	4	5	6	7
12. My ability to assess price elasticity is ...	1	2	3	4	5	6	7
13. My ability to assess product performance is ...	1	2	3	4	5	6	7
14. My ability to assess promotional performance is ...	1	2	3	4	5	6	7
15. My ability to assess sales force performance is ...	1	2	3	4	5	6	7
16. My ability to assess supplier performance is ...	1	2	3	4	5	6	7
17. My ability to assess the effects of advertising is ...	1	2	3	4	5	6	7

18. My ability to assess the position of a product / brand in the stages of the product life cycle is ...	1	2	3	4	5	6	7
19. My ability to compare company performance to industry and competitor performance is ...	1	2	3	4	5	6	7
20. My ability to create exception conditions using a business intelligence software tool is ...	1	2	3	4	5	6	7
21. My ability to create new formulas / calculations using business intelligence tools is ...	1	2	3	4	5	6	7
22. My ability to describe the various dimensions of the competitive environment is ...	1	2	3	4	5	6	7
23. My ability to develop market niches from the data is ...	1	2	3	4	5	6	7
24. My ability to develop meaning using charts is ...	1	2	3	4	5	6	7
25. My ability to develop meaning using grids is ...	1	2	3	4	5	6	7
26. My ability to generate forecasts / trends using business intelligence tools is ...	1	2	3	4	5	6	7
27. My ability to make observations from data presented in charts is ...	1	2	3	4	5	6	7
28. My ability to make observations from data presented in grids is ...	1	2	3	4	5	6	7
29. My ability to perform analysis using multidimensional data is ...	1	2	3	4	5	6	7
30. My ability to perform brand equity assessment is ...	1	2	3	4	5	6	7
31. My ability to perform break even analysis is ...	1	2	3	4	5	6	7
32. My ability to perform competitive analysis is ...	1	2	3	4	5	6	7
33. My ability to perform pareto analysis is ...	1	2	3	4	5	6	7
34. My ability to perform problem solving using the fishbone diagram is ...	1	2	3	4	5	6	7
35. My ability to perform situation assessment is ...	1	2	3	4	5	6	7
36. My ability to perform trend analysis using business intelligence tools is ...	1	2	3	4	5	6	7
37. My ability to relate customer satisfaction data to financial metrics is ...	1	2	3	4	5	6	7
38. My ability to relate performance measures to dimensional analysis is ...	1	2	3	4	5	6	7
39. My ability to understand issues by using charts is ...	1	2	3	4	5	6	7
40. My ability to understand issues by using grids is ...	1	2	3	4	5	6	7
41. My ability to understand the significance of exception highlighting is ...	1	2	3	4	5	6	7
42. My ability to use statistical tools for insight is ...	1	2	3	4	5	6	7
43. My ability to utilize a problem solving / decision making methodology is ...	1	2	3	4	5	6	7

44. My ability to utilize external data in developing understanding and insight is ...	1	2	3	4	5	6	7
45. Overall, my ability to ask critical questions to gain understanding and insight is ...	1	2	3	4	5	6	7
46. Overall, my ability to perform strategic marketing analysis is ...	1	2	3	4	5	6	7
47. Overall, my ability to utilize a problem solving methodology to gain understanding and insight is ...	1	2	3	4	5	6	7
48. Overall, my ability to utilize business intelligence tools to gain understanding and insight is ...	1	2	3	4	5	6	7
49. Overall, my ability to utilize various business models to gain understanding and insight is ...	1	2	3	4	5	6	7
50. Overall, my ability to utilize various dimensions and performance measures to gain understanding and insight is ...	1	2	3	4	5	6	7
51. Using business intelligence tools, my ability to add new members to the grid is ...	1	2	3	4	5	6	7
52. Using business intelligence tools, my ability to change the drill down style (add, select, replace) is	1	2	3	4	5	6	7
53. Using business intelligence tools, my ability to create calculations (average, ratio, multiply, variance) is ...	1	2	3	4	5	6	7
54. Using business intelligence tools, my ability to create calculations (share of dimension, share of member, share of parent, total) is ...	1	2	3	4	5	6	7
55. Using business intelligence tools, my ability to create charts (pie, line, horizontal bar, stacked bar, bubble) is	1	2	3	4	5	6	7
56. Using business intelligence tools, my ability to create charts using 2 Y axis is ...	1	2	3	4	5	6	7
57. Using business intelligence tools, my ability to create charts with trend lines is ...	1	2	3	4	5	6	7
58. Using business intelligence tools, my ability to create queries (trend, growth, variance) is ...	1	2	3	4	5	6	7
59. Using business intelligence tools, my ability to customize charts (labeling, formatting) is ...	1	2	3	4	5	6	7
60. Using business intelligence tools, my ability to edit / revise existing formulas is ...	1	2	3	4	5	6	7
61. Using business intelligence tools, my ability to find members (name, description, attributes) is ...	1	2	3	4	5	6	7
62. Using business intelligence tools, my ability to get additional information using the help function is ...	1	2	3	4	5	6	7
63. Using business intelligence tools, my ability to sort data is ...	1	2	3	4	5	6	7
64. Using business intelligence tools, my ability to swap members on and off the grid is ...	1	2	3	4	5	6	7

Appendix E

Problem Solving Style Survey

Instructions:

This is an 80-question survey form. This is *not* a test. There are no right or wrong answers. The goal of the survey is to gain a greater appreciation for individual learning styles, decision-making approaches and problem solving skills. We ask for your support by answering each question honestly and sincerely. Please answer each question by checking (✓) the appropriate box. In a future class, we will provide you with your results. The results help develop a profile of your preferred thinking style.

Statement	Agree	Disagree
1. I collect data and information about a particular subject.		
2. I organize the collected information logically into categories.		
3. I do library searches on a special topic of interest.		
4. I listen to informational lectures.		
5. I read textbooks.		
6. I study example problems and solutions – those in textbooks or those done by the instructor).		
7. I think through abstract ideas.		
8. I judge ideas based on facts, criteria, and logical reasoning.		
9. I do technical or financial case studies.		
10. I do research using the scientific method.		
11. I find out how a frequently used machine actually works by reading about it.		
12. I take old, broken-down, small appliances apart; find out about the function of each part.		
13. I take a current problem situation and analyze it into its main parts.		
14. I review a recent impulse decision and identify its rational, logical aspects.		
15. I play "devil's advocate" in a group decision process.		
16. I do an analysis of politicians running for office; where do they stand on the issues.		
17. I have joined an investment club.		
18. I engage in logic games or puzzles, play chess, and play "Trivial Pursuit."		
19. I have learned how to use a personal computer or a new software package or program.		
20. I have written a critical review of my favorite movie / TV program, based on logical reasons.		
21. I learn a new habit through planning and self-discipline.		
22. I have learned time management skills — read a book and then did what it says.		
23. I cook a new dish by following the instructions in a complicated recipe.		
24. I have used a "programmed learning" software package to learn something new.		
25. I do step-by-step lab work; write a sequential report; do detailed homework problems.		
26. I listen to a detailed lecture; take detailed notes.		
27. I plan a project by writing down each step in detail; then do it.		

Statement	Agree	Disagree
28. I identify the causes of a problem; collect "consumer" data; prepare a Pareto diagram.		
29. I assemble a model kit by instruction (or a piece of modular furniture).		
30. I write or improve an instruction manual for a project or piece of equipment.		
31. I develop a personal budget, then keep it for at least two weeks.		
32. I have prepared a personal property list (then put it in a safe-deposit box).		
33. I set up a filing system for my paperwork and correspondence.		
34. I organize my desk drawer or clothes closet.		
35. I organize my records, disks, photographs, and / or collection.		
36. I prepare a family tree.		
37. I find a mistake in my bank statement or monthly bills.		
38. I am exactly on time all day.		
39. I visit a hands-on science museum. I follow the directions for all the activities.		
40. I play "scrabble."		
41. I get together with friends and share my feelings on a topic or issue.		
42. When in a conversation, I spend most of the time listening to the other person.		
43. I motivate myself by asking "why" — look for personal meaning and values.		
44. I keep a journal to record feelings, not detailed activities.		
45. I use people-oriented case studies; I have written a motivational story.		
46. I respect other people's rights and views. People are important, not things.		
47. I enjoy a walk in nature. I pay attention to sounds, smells, and other sensory output.		
48. I grow fragrant herbs, raise flowers, make artistic bouquets, and then give them away.		
49. I study in a group; learn by teaching others; done a group project.		
50. I learn by touching and using a tool or machinery.		
51. I get involved in a new sport or exercise activity.		
52. I get involved in a play, or do charades at work.		
53. I have composed a song to celebrate a special occasion. I do some creative writing.		
54. I learned to play a musical instrument or have investigated a different style of music.		
55. I play with a small child the way he or she wants to play. I make time for family meals.		
56. I allow tears to come to my eyes without feeling guilt or shame. I express my spirituality.		
57. I think about what other people have done for me and find a way to thank them.		
58. I am a volunteer in my community. I help people, animals, and the environment.		
59. I travel to other places to see the culture and interact with people, or host a foreign student.		

Statement	Agree	Disagree
60. I take seminars on how to become a better teacher and / or communicator.		
61. I look at the big picture and the context, not just the details, of a problem or issue.		
62. I make a study of a trend then predict at least three different future developments.		
63. I ask "what if" questions. I solve open-ended problem.		
64. I make sketches to help memorize material I am learning.		
65. When solving problems, I find two or three different ways to do them.		
66. I do problems that require brainstorming. I find at least ten possible answers.		
67. I appreciate the "beauty" of a design. (a building, an appliance, an object)		
68. I play with "tinkertoys," "skill sticks," "legos," and / or "pictionary."		
69. I have learned to paint, sketch, and draw. I play with modeling clay. I have taken an art class.		
70. I attend a "story-telling" sessions. I read a book of folk tales.		
71. I participate in role-playing games where I can express my imagination.		
72. I have designed and built a kite. I fly the kite the way it is meant to be flown.		
73. I invent a gourmet dish and then prepare it.		
74. I identify the time of day when I am the most creative. I take these fifteen minutes to get ideas.		
75. I take a drive (or walk) to nowhere in particular without feeling guilty.		
76. I take 200 photos without worrying about the cost. I experiment with unusual shots.		
77. I created a personal logo.		
78. I allow myself to daydream; to explore hidden possibilities.		
79. I imagine myself in the year 2000, 2020, 2040. I think about trends as they apply to me.		
80. I investigate how a particular subject can be connected to other things I know.		

How do you see yourself? Please distribute a total of 100 points ***between*** these categories.

Rational _________ Visionary ________
Organized _________ Interpersonal ________

How do you see yourself? Please distribute from 0 to 100 points ***for each*** categories.

Rational _________ Visionary ________
Organized _________ Interpersonal ________

Appendix F

Scenario Analysis Situations

Scenario # 1

Several weeks ago, you were recruited for a marketing assignment at LJL Industries. You have spent several weeks at LJL Industries headquarters prior to your recent announcement as VP of Marketing for the Southern region.

It is the morning of April 5th and you are headed to Atlanta for your first staff meeting. You have brought 5 charts and grids with you to share with your new team. (All data represents the last 6 months – August through January) The president, John Landers, has made it clear to you that the Southern region is performing below expectations. He believes that with your insight and skills that you can quickly assess the situation and develop an action plan to turn the situation around.

Questions

Issues:
- What observations can you make from the charts / grids?
- What insights can you derive from the charts / grids?

(Describe the dimensions and measures that you are considering in this situation.)

Meaning:
- What understanding do you have of each of the individual charts and grids?
- Collectively, what might the charts and grids suggest?

Possible Causes:
- What questions (lines of inquiry) would you pose about the causes of the current situation?

(Consider how are those questions linked to the charts / grids.)

Possible Actions:
- Given the possible causes that you have developed, what possible actions would you recommend that should be taken?
- What are you going to tell your staff?
- What are your focus items?

Make your assumptions explicit. You are not required to write in essay format. Consider bullets or brief statement.

Scenario #2

Several weeks ago, you were recruited for a marketing assignment at LJL Industries. You have spent the last several weeks at LJL Industry's headquarter location in Toledo learning the various information systems. You were just recently announced as the VP of Marketing in charge of all product lines.

The president of LJL Industries, John Landers, has made it clear to you that he expects you to put in place an *action plan* in place to address the product line / brand deficiencies. He has heard from various consultants over the last several weeks that his 10% growth objective is realistic. He has stated that your actions must be clearly supported by facts.

Mr. Landers believes that with your insight and skills that you can quickly assess the situation and develop an insightful, fact-based action plan. He can't wait to see how you incorporate your business intelligence tools, your questioning skills, and your *application of various business models*.

It is the morning of April 5th and you are headed to your first staff meeting. You have brought several grids and charts with you to share with your new team. You have decided to start your action plan development by focusing on the Oral Care Product Line.

Make your assumptions explicit.
You are not required to write in essay format.
Consider bullets or brief statements.
REFERENCE *which chart / grid / exhibit you use in your answer!!!*

Questions:

Issues:
- What observations can you make from the charts, grids and tables?
- What insights can you derive from the data available to you?
  (Describe the dimensions and measures that you need to consider in this situation?)

Meaning:
- What understanding do you have from the charts and grids?
- Collectively, what might they suggest?

Possible Causes:
- What questions (i.e. lines of inquiry) would you pose about the causes of the current situation? How are these questions are linked to the charts/grids.

Possible Actions:
- Given the causes that seem plausible, what actions would you recommend?
- What are you going to tell the president? Why?
- What are your focus items? Why?

Appendix G

Background Information

Background Information

1. Name: ____
2. Student Number: _______ - _____ - _________
3. Date of Birth: ____ / ____ / ______
4. Gender:
   - ➢ __ Male
   - ➢ __ Female
5. I consider myself a:
   - ➢ __ Day person
   - ➢ __ Night person
6. I am most alert around:
   - ➢ __ Midnight – 6 AM
   - ➢ __ 6 AM -- Noon
   - ➢ __ Noon – 6 PM
   - ➢ __ 6 PM -- Midnight
7. The highest academic degree I have received is:
   - ➢ __ High School
   - ➢ __ Associates
   - ➢ __ Bachelor
   - ➢ __ Masters
   - ➢ __ Other ______________
8. The college / university where I received my degree is:
   - ➢ College: __________________ University: ________________________
9. The major area of concentration for the highest degree I received is:
   - ➢ Area _________________________
10. I expect to graduation on:
    - ➢ Semester / Year _____________ / _______
11. The number of years of work experience I have is: _______
12. The number of years at my current job is: _______
13. How would you classify your job: (examples include managerial, engineer, analyst)
    - ➢ __ Classification _________________________
14. What is your job title: ______________________________

15. What is your job satisfaction:
    - ☐ Very Satisfied
    - ☐ Satisfied
    - ☐ Neither Satisfied nor Dissatisfied
    - ☐ Dissatisfied
    - ☐ Very Dissatisfied

16. What is your ethnicity:
    - ☐ African-American
    - ☐ Arab
    - ☐ Asian
    - ☐ Caucasian
    - ☐ Chinese
    - ☐ Hispanic
    - ☐ Indian
    - ☐ Japanese
    - ☐ Native American Indian
    - ☐ Other __________

17. How would you assess your computer capability.
    - ☐ Very Skilled
    - ☐ Skilled
    - ☐ Neither Skilled nor Unskilled
    - ☐ Minimal
    - ☐ Novice
    - ☐ Other __________

18. Based upon your training, assess your skill level with the Comshare decision support tool.
    - ☐ Very Skilled
    - ☐ Skilled
    - ☐ Neither Skilled nor Unskilled
    - ☐ Minimal
    - ☐ Novice
    - ☐ Other __________

Appendix H

Survey Instructions

THANK YOU!!!

As part of this course, we are asking that you complete several questionnaires and answer several scenario-based questions.

This study investigates strategic decision making and analysis and the role of business intelligence tools coupled with business concepts.

We appreciate you taking the time to participate in this survey. Your honest feedback is critical to the success of this study.

Many Thanks,

John Heinrichs

Part 1

Questionnaires

Thank you for your honest answers. Your answers will help us improve this course and gain insight into important concepts.

The results from the survey will not be used in assessing your performance in this course. This is not a test.

You will be given three surveys.

The first survey is used to assess your problem solving style. There is no right or wrong answer. After the results are tabulated, you will have an opportunity to see your answer and the overall class decision making style. Again, there are no right or wrong answers – just your problem solving preferences.

The second survey is used to assess your business concept knowledge. It is not a test. It will help us understand the overall business concept knowledge of the class.

The third survey is used to assess your business intelligence tool knowledge. It is not a test. It will help us understand the overall business intelligence tool knowledge of the class.

THANK YOU for your time and support. Your honest answers are greatly appreciated!!

Part 2

Scenario Assessment

Thank you for your honest answers. Your answers will help us improve this course and gain insight into important concepts.

The results from the survey will not be used in assessing your performance in this course. This is not a test.

The survey starts with an introduction memo.

There are ten specific scenarios and one general scenario for you to consider.

To support the scenarios, there are seven exhibits that you can use.

Please answer in bullet format.
Please do not spend more than 4 minutes per question.
Please answer the "Confidence Table" question on each page.

THANK YOU for your time and support. Your honest answers are greatly appreciated!!

Appendix I

Linkages

Appendix I-1: Research Model / Instrument Question Linkages

	Multiple Choice Questions	Personal Assessments Questions
Business Intelligence Tool Proficiency		Overall – 48
1. Information Presentation Management		24 / 25 / 51 / 55 / 56 / 57 / 59 / 64 / BI1 / BI6 / BI7
2. Knowledge Evocation		
3. Multidimensional Analytic Database		20 / 21 / 52 / 53 / 54 / 58 / 60 / 61 / 62 / 63 / BI2 / BI3 / BI4 / BI5 / BI8
Business Models Application		Overall – 47 / 49 / 50
1. Knowledge Management		
2. Organizational Learning		
3. Insight Generation Models		1 / 2 / 3 / 4 / 5 / 6 / 7 / 26 / 30 / 31 / 32 / 33 / 34 / 35 / 36 / 42 / 43
Strategic Thinking Competence		Overall – 45 / 46
1. Market Orientation		
2. Strategic Thinking / Critical Questioning Orientation		8 / 9 / 10 / 11 / 12 / 13 / 14 / 15 / 16 / 17 / 18 / 19 / 22 / 23 / 27 / 28 / 37 / 38 / 39 / 40 / 41 / 44

Appendix I-2: Overall Ability Assessment

	Questions from the Multiple Choice Tests	Questions from the Personal Assessments
Overall Ability		
• Business Intelligence Tools		48
• Business Models		49
• Critical Questioning		45
• Dimensions / Metrics		50
• Strategic Marketing Analysis		46
• Problem Solving		47

Appendix I-3: Instrument Questions by Category

	Multiple Choice Questions	Personal Assessments Questions
Analytical Tools		
• Charts, Queries & Grids (Create / Use)	BI 1 / BI 4 / BI 6 / BI 7 / BI 8	51 / 52 / 55 / 56 / 57 / 58 / 59 / 61 / 62 / 63 / 64 -- BI 1 / BI 4 / BI 6 / BI 7 / BI 8
• Exception Conditions	BI 2	20 / 41 -- BI 2
• Formulas / Calculations	BI 3 / BI 5	21 / 26 / 36 / 53 / 54 / 60 -- BI 3 / BI 5
• Statistical Tools		41
• Methodologies – Pareto / Fishbone / Trend / Impact Situation Assessment		33 / 34 / 35 / 43
Critical Questioning / Assessment		
• Ask Questions		8 / 45
• External Data – Use / Identify		44
• Charts – Use / Identify		24 / 27 / 39
• Grids -- Use / Identify		25 / 28 / 40
• Dimensional Analysis • Channels / Customer • Geographic / Product / Supplier		9 / 10 / 11 / 13 / 15 / 16 / 29 / 38
• Metric Analysis • Promotion / Advertising / Satisfaction		14 / 17 / 37 / 38
Business Knowledge / Concepts		
• Brands	Q4	30
• Channels	Q11 / Q23 / Q29 / Q44	
• Competitors / Competitive Environment	Q26 / Q30 / Q55	19 / 22 / 32
• Customer Satisfaction	Q9 / Q19 / Q22 / Q24 / Q27	37
• Demand	Q15 / Q52	
• Forecasting / Trend Analysis	Q20 / Q49 / Q54	
• Pricing	Q7 / Q8 / Q32 / Q34 / Q36 / Q42	6 /
• Product	Q21 / Q28 / Q33 / Q41 / Q47 / Q48 / Q51 / Q56	18
• Promotion Mix / Advertising	Q6 / Q10 / Q12 / Q14 / Q16 / Q17 / Q28 / Q31 / Q46 / Q50	7
• Segmentation -- Market Niches	Q18 / Q25 / Q35 / Q37 / Q57	23
• Strategy	Q1 / Q38 / Q43 / Q45	
• Value Chain	Q13	
Business Models		
• BCG / GE Model	Q39 / Q40	1
• Contribution Model		2
• Customer Value Model	Q2 / Q3	3
• PowerGrid Model		4 /
• Pricing Models	Q5 / Q53	12 / 31
• Product Life Cycle Model		18
• Strategic Profit Model		5

Appendix I-4: Instrument Questions Associated with Course Textbook

SMA Text Book	**Questions from the Multiple Choice Tests**	**Questions from the Personal Assessments**
Chapter 7 -- *Strategic Marketing Planning* • BCG / GE • Pull / Push Strategy • Perception • Segmentation • Customer Value Map	1 / 2 / 7 / 37/ /39/ /40 / 45	1 / 3 / 10
Chapter 8 -- *Situation Assessment* • SWOT • Competitive Analysis • Demographics • Psychographics • Strategy • Forecasting / Trend • Segmentation	15 / 18 / 20 / 25 / 26 / 30 / 35 / 38 / 43 / 49 / 52 / 54 / 55 / 57	10 / 11 / 19 / 22 / 23 / 26 / 32 / 35 / 36
Chapter 9 -- *Product Performance and Strategy* • Brands • Product • Features / Attributes • Product Life Cycle • Powergrid Model • Quality	4 / 7 / 21 / 22 / 27 / 28 / 33 / 41 / 47 / 48 / 51 / 56	4 / 10 / 13 / 18 / 30
Chapter 10 -- *Value Chain Management* • Value Chain • Customer Satisfaction • Channel Performance • Contribution Model • Strategic Profit Model	9 / 11 / 13 / 19 / 23 / 24 / 29 / 44	2 / 5 / 16 / 37

Chapter 11 -- *Pricing and Promotion Strategy*
• Promotion Mix
    • Methods
    • Sales Concepts
• Pricing
    • Elasticity / Methods
    • Value Added/Target
• Allowance
• Discounting
• Advertising
• Trade Promotion
	3 / 5 / 6 / 8 / 10 / 12 / 14 / 16 / 17 / 31 / 32 / 34 / 36 / 42 / 46 / 50 / 53	6 / 7 / 12 / 14 / 15 / 17 / 31

Appendix J

Exhibits for All Scenarios

Exhibit #1 -- Sales by Customer #1

LJL Industries

	All Customers	Brokers	Direct	Distributors	Internet
Prior Year Sales	$663,391,139	$431,908,187	$139,937,320	$91,545,633	N/A
Quarter 1 1996	$156,099,338	$100,818,839	$33,080,026	$22,200,473	N/A
Jan 1996	$38,937,002	$25,557,968	$8,037,028	$5,342,006	N/A
Feb 1996	$50,971,210	$33,798,699	$9,631,730	$7,540,782	N/A
Mar 1996	$66,191,126	$41,462,172	$15,411,269	$9,317,686	N/A
Quarter 2 1996	$171,353,353	$110,047,143	$38,757,292	$22,548,918	N/A
Apr 1996	$48,464,672	$31,452,468	$11,816,411	$5,195,794	N/A
May 1996	$53,615,854	$36,120,689	$9,797,431	$7,697,734	N/A
Jun 1996	$69,272,826	$42,473,987	$17,143,449	$9,655,390	N/A
Quarter 3 1996	$167,307,772	$109,841,176	$34,190,789	$23,275,807	N/A
Jul 1996	$42,531,716	$28,962,656	$7,953,882	$5,615,178	N/A
Aug 1996	$54,647,235	$36,603,415	$10,085,257	$7,958,563	N/A
Sep 1996	$70,128,820	$44,275,104	$16,151,649	$9,702,067	N/A
Quarter 4 1996	$168,630,676	$111,201,029	$33,909,213	$23,520,435	N/A
Oct 1996	$42,705,459	$29,418,737	$7,551,651	$5,735,070	N/A
Nov 1996	$54,169,144	$36,923,647	$9,219,349	$8,026,148	N/A
Dec 1996	$71,756,073	$44,858,644	$17,138,212	$9,759,216	N/A

Exhibit #1 -- Sales by Customer #2

LJL Industries

	All Customers	Brokers	Direct	Distributors	Internet
Advertising	$11,075,085	$7,204,336	$2,338,669	$1,532,080	N/A
Cash Discounts	$9,894,382	$6,443,783	$2,090,137	$1,360,462	N/A
Consumer Promotions	$54,877,867	$35,769,749	$11,514,752	$7,593,366	N/A
Damages/Returns	$3,335,156	$2,164,858	$719,413	$450,884	N/A
Deductions	$13,176,412	$8,524,174	$2,840,976	$1,811,261	N/A
Distribution Costs	$21,963,530	$14,220,158	$4,678,351	$3,065,021	N/A
Free Goods	$1,596,454	$1,037,314	$337,279	$221,862	N/A
Misc. Discounts	$6,667,904	$4,321,982	$1,419,054	$926,868	N/A
Promotional Allowances	$37,936,906	$24,648,503	$8,015,778	$5,272,625	N/A
Sales Expenses	$33,101,550	$21,561,151	$6,918,637	$4,621,761	N/A
Trade Expenses	$73,005,700	$47,399,570	$15,506,799	$10,099,331	N/A
Transportation	$22,019,314	$14,327,570	$4,646,895	$3,044,849	N/A

Exhibit #2 -- Sales by Channel #1

LJL Industries	All Channels	Convenience Stores	Drug Stores	Internet	Mass Merchandisers	Supermarkets
Prior Year Sales	$663,391,139	$6,269,278	$44,733,854	N/A	$24,358,987	$588,029,021
Quarter 1 1996	$156,099,338	$1,514,177	$10,538,897	N/A	$5,843,004	$138,203,261
Jan 1996	$38,937,002	$420,617	$2,072,212	N/A	$1,694,487	$34,749,686
Feb 1996	$50,971,210	$526,398	$3,385,780	N/A	$1,841,020	$45,218,011
Mar 1996	$66,191,126	$567,161	$5,080,905	N/A	$2,307,496	$58,235,564
Quarter 2 1996	$171,353,353	$1,584,011	$11,536,163	N/A	$6,217,451	$152,015,727
Apr 1996	$48,464,672	$458,771	$2,440,046	N/A	$1,902,068	$43,663,787
May 1996	$53,615,854	$560,638	$3,498,399	N/A	$1,994,294	$47,562,523
Jun 1996	$69,272,826	$564,602	$5,597,718	N/A	$2,321,089	$60,789,417
Quarter 3 1996	$167,307,772	$1,568,953	$11,130,948	N/A	$6,133,949	$148,473,922
Jul 1996	$42,531,716	$415,124	$2,107,239	N/A	$1,734,193	$38,275,161
Aug 1996	$54,647,235	$542,647	$3,480,292	N/A	$1,968,270	$48,656,027
Sep 1996	$70,128,820	$611,182	$5,543,418	N/A	$2,431,486	$61,542,735
Quarter 4 1996	$168,630,676	$1,602,137	$11,527,845	N/A	$6,164,584	$149,336,111
Oct 1996	$42,705,459	$445,159	$2,241,272	N/A	$1,775,010	$38,244,019
Nov 1996	$54,169,144	$555,202	$3,512,032	N/A	$1,950,700	$48,151,210
Dec 1996	$71,756,073	$601,776	$5,774,542	N/A	$2,438,874	$62,940,882
Overall Satisfaction	3.71	4.47	3.02	4.92	4.79	3.18
Assurance	3.63	4.84	3.20	4.00	5.73	3.30
Delivery	3.69	4.58	3.41	4.43	5.19	3.30
Empathy	4.28	5.51	3.67	5.79	3.97	3.67
Price	1.82	1.84	1.60	2.36	1.47	1.69
Reliable	3.92	5.02	3.51	5.44	4.85	3.19
Responsive	3.89	4.54	3.63	5.14	4.61	3.40
Service	3.63	4.97	3.65	4.15	4.84	3.22
Tangible	4.48	5.30	2.24	6.89	6.89	3.58
Variety	2.97	2.84	2.11	4.07	3.00	2.61

Exhibit #2 -- Sales by Channel #2

LJL Industries **1996**	**All Channels**	**Convenience Stores**	**Drug Stores**	**Internet**	**Mass Merchandisers**	**Supermarkets**
Advertising	$11,075,085	$103,618	$742,430	N/A	$407,402	$9,821,635
Cash Discounts	$9,894,382	$91,559	$678,919	N/A	$349,924	$8,773,981
Consumer Promotions	$54,877,867	$505,813	$3,685,267	N/A	$1,974,861	$48,711,926
Damages/Returns	$3,335,156	$32,082	$226,403	N/A	$125,013	$2,951,658
Deductions	$13,176,412	$121,251	$888,963	N/A	$489,593	$11,676,605
Distribution Costs	$21,963,530	$203,158	$1,488,031	N/A	$819,458	$19,452,883
Free Goods	$1,596,454	$14,423	$108,121	N/A	$57,205	$1,416,706
Misc. Discounts	$6,667,904	$63,842	$451,400	N/A	$248,199	$5,904,464
Promotional Allowances	$37,936,906	$342,806	$2,569,713	N/A	$1,359,374	$33,665,013
Sales Expenses	$33,101,550	$320,737	$2,245,517	N/A	$1,215,965	$29,319,331
Trade Expenses	$73,005,700	$669,559	$4,950,497	N/A	$2,643,587	$64,742,057
Transportation	$22,019,314	$211,412	$1,487,283	N/A	$821,896	$19,498,723

Exhibit #3 -- Sales by Market #1

	Total U.S.	East	Midwest	South	West	Key Accounts	Colgate Palmolive	US Industry
Prior Year Sales	$660,314,908	$61,761,272	$212,594,949	$167,597,673	$119,176,296	$99,184,718	$8,740,251,000	$35,551,000,000
Quarter 1 1996	$155,442,672	$14,791,165	$47,700,187	$41,067,281	$28,641,542	$23,242,498	$2,051,646,300	$8,074,620,148
Jan 1996	$38,779,511	$4,066,448	$11,487,733	$9,906,914	$8,546,828	$4,771,587	N/A	N/A
Feb 1996	$50,762,410	$4,676,226	$15,470,713	$14,962,360	$8,601,647	$7,051,465	N/A	N/A
Mar 1996	$65,900,752	$6,048,491	$20,741,741	$16,198,007	$11,493,067	$11,419,446	N/A	N/A
Quarter 2 1996	$170,588,855	$15,402,614	$54,625,863	$42,239,024	$31,649,835	$26,671,519	$2,165,132,700	$8,562,054,887
Apr 1996	$48,278,138	$4,928,440	$15,262,495	$10,738,846	$10,360,133	$6,988,223	N/A	N/A
May 1996	$53,358,906	$4,603,483	$17,257,892	$15,165,284	$9,347,677	$6,984,569	N/A	N/A
Jun 1996	$68,951,812	$5,870,690	$22,105,475	$16,334,895	$11,942,025	$12,698,727	N/A	N/A
Quarter 3 1996	$166,467,245	$15,786,656	$54,571,429	$42,027,527	$29,968,424	$24,113,209	$2,228,369,400	$9,090,023,478
Jul 1996	$42,313,814	$4,241,400	$14,085,546	$10,337,132	$8,893,156	$4,756,580	N/A	N/A
Aug 1996	$54,379,142	$5,161,365	$17,614,510	$14,930,300	$9,771,120	$6,901,848	N/A	N/A
Sep 1996	$69,774,289	$6,383,890	$22,871,373	$16,760,096	$11,304,149	$12,454,781	N/A	N/A
Quarter 4 1996	$167,816,136	$15,780,838	$55,697,470	$42,263,840	$28,916,495	$25,157,493	$2,295,102,600	$9,824,301,487
Oct 1996	$42,496,585	$4,269,027	$14,540,553	$10,574,661	$8,334,229	$4,778,116	N/A	N/A
Nov 1996	$53,892,331	$5,149,620	$17,784,102	$15,212,222	$8,918,248	$6,828,138	N/A	N/A
Dec 1996	$71,427,221	$6,362,192	$23,372,815	$16,476,957	$11,664,019	$13,551,239	N/A	N/A
Overall Satisfaction	3.71	2.31	3.96	3.80	3.67	2.82	4.72	N/A
Assurance	3.63	2.10	3.63	4.20	3.75	3.11	5.60	N/A
Delivery	3.69	1.96	3.74	3.79	4.07	3.24	5.25	N/A
Empathy	4.28	2.61	4.03	4.54	3.76	3.60	2.61	N/A
Price	1.82	1.38	1.86	1.59	1.43	1.92	5.06	N/A
Reliable	3.92	2.07	3.89	3.95	3.60	3.40	5.12	N/A
Responsive	3.89	2.36	4.18	3.67	3.95	3.33	4.53	N/A
Service	3.63	2.70	3.91	3.82	3.79	2.93	2.59	N/A
Tangible	4.48	2.51	4.23	4.05	4.19	3.86	5.14	N/A
Variety	2.97	2.25	2.81	2.93	3.13	2.23	2.49	N/A

Exhibit #3 -- Sales by Market #2

1996	Total U.S.	East	Midwest	South	West	Key Accounts
Advertising	$11,024,020	$1,030,536	$3,562,889	$2,785,017	$1,990,599	$1,654,979
Cash Discounts	$9,848,577	$934,111	$3,136,294	$2,530,880	$1,777,443	$1,469,849
Consumer Promotions	$54,623,471	$5,143,376	$17,531,403	$13,962,035	$9,890,823	$8,095,834
Damages/Returns	$3,319,876	$302,129	$1,058,173	$846,189	$607,298	$506,087
Deductions	$13,115,378	$1,205,993	$4,238,766	$3,302,059	$2,340,391	$2,028,169
Distribution Costs	$21,862,773	$2,033,688	$6,989,324	$5,577,092	$3,929,291	$3,333,378
Free Goods	$1,589,110	$151,987	$508,984	$403,578	$286,855	$237,707
Misc. Discounts	$6,636,998	$623,412	$2,127,887	$1,689,971	$1,198,934	$996,793
Promotional Allowances	$37,762,416	$3,610,249	$12,094,861	$9,590,711	$6,817,125	$5,649,469
Sales Expenses	$32,948,014	$3,106,610	$10,549,123	$8,435,010	$5,938,135	$4,919,135
Trade Expenses	$72,669,007	$6,865,864	$23,292,021	$18,464,106	$13,099,625	$10,947,391
Transportation	$21,918,273	$2,030,132	$7,036,121	$5,612,179	$3,980,229	$3,259,613

Exhibit #4 -- Sales by Product #1

LJL Industries	All Products	Deodorants	Fragrances	Hair Care	Makeup	Oral Care	Shaving Products	Skin Care
Prior Year Sales	$663,391,139	$102,560,661	N/A	$132,143,011	N/A	$172,825,390	$53,020,393	$202,841,685
Quarter 1 1996	$156,099,338	$24,907,124	N/A	$31,941,095	N/A	$38,750,761	$11,901,363	$48,598,995
Jan 1996	$38,937,002	$6,022,086	N/A	$8,601,247	N/A	$8,675,107	$3,905,150	$11,733,412
Feb 1996	$50,971,210	$7,813,125	N/A	$10,575,758	N/A	$12,351,983	$3,750,793	$16,479,551
Mar 1996	$66,191,126	$11,071,914	N/A	$12,764,090	N/A	$17,723,671	$4,245,420	$20,386,031
Quarter 2 1996	$171,353,353	$25,590,019	N/A	$38,098,592	N/A	$43,572,087	$13,283,761	$50,808,894
Apr 1996	$48,464,672	$6,043,168	N/A	$15,237,065	N/A	$10,141,689	$4,201,228	$12,841,521
May 1996	$53,615,854	$8,118,022	N/A	$10,839,790	N/A	$13,851,701	$4,157,807	$16,648,534
Jun 1996	$69,272,826	$11,428,830	N/A	$12,021,736	N/A	$19,578,696	$4,924,726	$21,318,839
Quarter 3 1996	$167,307,772	$25,984,423	N/A	$31,375,337	N/A	$45,094,857	$13,837,027	$51,016,128
Jul 1996	$42,531,716	$6,271,674	N/A	$8,711,533	N/A	$10,669,546	$4,467,888	$12,411,075
Aug 1996	$54,647,235	$8,250,960	N/A	$11,209,070	N/A	$14,215,038	$4,197,055	$16,775,113
Sep 1996	$70,128,820	$11,461,789	N/A	$11,454,734	N/A	$20,210,272	$5,172,084	$21,829,941
Quarter 4 1996	$168,630,676	$26,079,094	N/A	$30,727,987	N/A	$45,407,685	$13,998,243	$52,417,667
Oct 1996	$42,705,459	$6,305,827	N/A	$7,771,537	N/A	$11,174,361	$4,614,532	$12,839,201
Nov 1996	$54,169,144	$8,205,504	N/A	$10,183,902	N/A	$14,357,242	$4,275,956	$17,146,540
Dec 1996	$71,756,073	$11,567,762	N/A	$12,772,549	N/A	$19,876,081	$5,107,755	$22,431,926

Exhibit #4 -- Sales by Product #2

LJL Industries	All Products	Deodorants	Fragrances	Hair Care	Makeup	Oral Care	Shaving Products	Skin Care
Brand Stature	56.70	48.00	N/A	70.50	N/A	48.00	65.00	52.00
Brand Strength	54.25	50.00	N/A	56.50	N/A	50.00	62.00	52.75
Customer Value Index	72.91	66.93	N/A	71.01	N/A	66.93	90.67	68.99
Relative Price Assessment	0.97	0.96	N/A	0.95	N/A	0.96	0.96	1.01
Relative Quality Assessment	1.00	0.95	N/A	1.00	N/A	0.95	1.20	0.92

Exhibit #4 -- Sales by Product #3

Colgate-Palmolive

	All Products	Deodorants	Fragrances	Hair Care	Makeup	Oral Care	Shaving Products	Skin Care
Prior Year	$8,740,251,000	$1,181,115,000	$1,609,816,000	$1,268,605,000	$2,073,513,000	$918,645,000	$489,944,000	$1,198,613,000
Quarter 1 1996	$2,051,646,300	$277,249,500	$377,880,800	$297,786,500	$486,726,900	$215,638,500	$115,007,200	$281,356,900
Quarter 2 1996	$2,165,132,700	$292,585,500	$398,783,200	$314,258,500	$513,650,100	$227,566,500	$121,368,800	$296,920,100
Quarter 3 1996	$2,228,369,400	$301,131,000	$410,430,400	$323,437,000	$528,652,200	$234,213,000	$124,913,600	$305,592,200
Quarter 4 1996	$2,295,102,600	$310,149,000	$422,721,600	$333,123,000	$544,483,800	$241,227,000	$128,654,400	$314,743,800

US Industry

	All Products	Deodorants	Fragrances	Hair Care	Makeup	Oral Care	Shaving Products	Skin Care
Prior Year	$35,551,000,000	$4,870,487,000	$6,576,935,000	$5,225,997,000	$8,318,934,000	$3,768,406,000	$1,955,305,000	$4,834,936,000
Quarter 1 1996	$8,074,620,148	$1,106,222,960	$1,493,804,727	$1,186,969,162	$1,889,461,115	$855,909,736	$444,104,108	$1,098,148,340
Quarter 2 1996	$8,562,054,887	$1,173,001,520	$1,583,980,154	$1,258,622,068	$2,003,520,844	$907,577,818	$470,913,019	$1,164,439,465
Quarter 3 1996	$9,090,023,478	$1,245,333,217	$1,681,654,343	$1,336,233,451	$2,127,065,494	$963,542,489	$499,951,291	$1,236,243,193
Quarter 4 1996	$9,824,301,487	$1,345,929,304	$1,817,495,775	$1,444,172,319	$2,298,886,548	$1,041,375,958	$540,336,582	$1,336,105,002

Exhibit #4 -- Sales by Product #4

LJL Industries

	All Products	Deodorants	Fragrances	Hair Care	Makeup	Oral Care	Shaving Products	Skin Care
Advertising	$11,075,085	$1,716,504	N/A	$2,233,174	N/A	$2,850,026	$916,150	$3,359,231
Cash Discounts	$9,894,382	$1,549,823	N/A	$1,980,571	N/A	$2,535,365	$780,207	$3,048,416
Consumer Promotions	$54,877,867	$8,344,741	N/A	$11,039,928	N/A	$14,288,882	$4,413,491	$16,790,825
Damages/Returns	$3,335,156	$516,644	N/A	$667,357	N/A	$869,494	$255,188	$1,026,473
Deductions	$13,176,412	$2,060,119	N/A	$2,618,988	N/A	$3,417,508	$1,051,111	$4,028,687
Distribution Costs	$21,963,530	$3,333,050	N/A	$4,422,826	N/A	$5,748,328	$1,789,093	$6,670,234
Misc. Discounts	$6,667,904	$1,016,934	N/A	$1,325,157	N/A	$1,726,198	$540,402	$2,059,213
Sales Expenses	$33,101,550	$5,121,726	N/A	$6,596,649	N/A	$8,549,522	$2,609,200	$10,224,452
Transportation	$22,019,314	$3,386,574	N/A	$4,363,603	N/A	$5,716,577	$1,768,728	$6,783,832

Exhibit #5 -- Rating by Brand #1

LJL Industries	Volume (EQ)	Units	Relative Price Rating	Customer Value Index	Relative Quality Rating	Brand Stature	Brand Strength
Fulton For Women	14,364,836	5,218,590	0.96	66.23	0.94	25.00	31.00
Fulton For Men	5,884,064	2,102,185	0.96	67.63	0.96	71.00	69.00
Fulton Fraser Hair	15,414,494	5,638,096	0.95	53.78	0.82	72.00	39.00
Dippit	9,565,870	3,513,522	0.94	88.25	1.19	69.00	74.00
Fulton Fraser Family Care	9,783,296	3,593,632	0.84	55.81	0.95	56.00	33.00
Nice-n-Brite	7,781,941	2,868,621	0.80	61.28	1.06	36.00	39.00
Fulton-Fix	5,172,491	1,782,890	1.08	78.33	0.95	57.00	70.00
Milk Teeth	6,257,362	2,277,179	0.84	76.30	1.20	39.00	76.00
Fulton Fraser Manly	6,517,855	2,345,135	0.96	90.67	1.20	65.00	62.00
FF Foot Value	7,070,023	2,575,845	1.19	89.35	0.95	78.00	42.00
Fulton Fraser Skin Value	9,629,725	3,564,587	0.81	43.80	0.84	31.00	66.00
Fulton Fraser Sun Value	9,907,620	3,479,725	1.07	76.46	0.94	66.00	76.00
Red Hot - NOT	8,001,474	2,897,149	0.96	66.34	0.94	33.00	27.00

Exhibit #5 -- Rating by Brand #2

	Deal Sales	Non-Deal Sales	Brand Introduction Date	Gross Sales	Net Sales	Cost of Goods	Selling Profit
Fulton For Women	3,379,894	1,838,696	1996	$70,825,396	$62,961,621	$30,607,102	$17,240,969
Fulton For Men	1,370,277	731,908	1989	$31,735,265	$28,266,181	$13,286,219	$8,190,917
Fulton Fraser Hair	3,707,134	1,930,962	1987	$79,016,989	$70,343,570	$34,115,435	$19,139,671
Dippit	2,353,878	1,159,644	1991	$53,126,022	$47,261,041	$23,391,458	$12,301,867
Fulton Fraser Family Care	2,386,262	1,207,371	1989	$61,217,163	$54,477,056	$25,951,767	$15,348,910
Nice-n-Brite	1,876,614	992,007	1995	$51,021,757	$45,421,957	$22,787,076	$11,646,871
Fulton-Fix	1,152,620	630,271	1988	$28,014,800	$25,004,416	$11,825,696	$7,243,810
Milk Teeth	1,506,420	770,760	1994	$32,571,669	$28,955,390	$14,405,107	$7,496,246
Fulton Fraser Manly	1,507,995	837,140	1988	$53,020,393	$47,167,106	$23,227,464	$12,442,980
FF Foot Value	1,686,500	889,345	1990	$40,291,280	$35,891,796	$16,613,135	$10,774,322
Fulton Fraser Skin Value	2,355,887	1,208,700	1992	$61,335,653	$54,517,907	$27,244,477	$13,854,500
Fulton Fraser Sun Value	2,258,761	1,220,964	1993	$54,469,574	$48,502,934	$23,482,258	$13,367,491
Red Hot - NOT	1,899,669	997,480	1997	$46,745,178	$41,614,465	$21,267,648	$10,094,698

Exhibit #6 -- Sales by Competitor

	Prior Year	Quarter 1 1996	Quarter 2 1996	Quarter 3 1996	Quarter 4 1996	1995
Alberto-Culver Co	$1,590,409,000	$347,638,000	$396,146,000	$415,554,000	$431,071,000	$1,358,219,000
Avon Products	$4,814,200,000	$1,016,100,000	$1,128,700,000	$1,177,300,000	$1,492,100,000	$4,492,100,000
Block Drug	$862,471,000	$205,507,000	$203,523,000	$216,409,000	$237,032,000	$715,242,000
Carter-Wallace Inc	$656,181,000	$171,801,000	$161,192,000	$165,087,000	$158,101,000	$667,477,000
Colgate-Palmolive Co	$8,740,251,000	$2,051,646,300	$2,165,132,700	$2,228,369,400	$2,295,102,600	$8,358,200,000
Del Laboratories Inc	$232,951,000	$56,094,000	$58,060,000	$60,353,000	$58,444,000	$212,048,000
DEP Corp	$119,088,000	$28,928,000	$27,813,000	$29,568,000	$32,779,000	$127,689,000
French Fragrances Inc	$140,482,000	$19,316,000	$23,803,000	$60,819,000	$36,544,000	$87,979,000
Guest Supply Inc	$179,042,000	$41,714,000	$37,281,000	$47,863,000	$52,184,000	$159,450,000
Lamaur Corp	$117,083,000	$28,480,000	$31,682,000	$29,249,000	$27,672,000	$8,070,000
Lauder Estee Cos Inc	$3,194,500,000	$833,100,000	$860,800,000	$763,900,000	$736,700,000	$2,899,100,000
Revlon Inc	$2,167,000,000	$464,300,000	$517,900,000	$571,100,000	$613,700,000	$1,937,800,000

Exhibit #7 -- Census by State

LJL Industries	**Total Population**	**Over 65 Years Old**	**Under 5 Years Old**
Total U.S. Population	265,284,000	33,872,000	19,088,000
East	51,579,000	7,313,000	3,514,000
Middle Atlantic	38,229,000	5,445,000	2,655,000
New York State	18,185,000	2,434,000	1,322,000
Pennsylvania	12,056,000	1,912,000	761,000
New England	13,350,000	1,868,000	859,000
Connecticut	3,274,000	469,000	223,000
Midwest	62,084,000	8,139,000	4,343,000
East North Central	43,615,000	5,606,000	3,093,000
Illinois	11,847,000	734,000	915,000
Michigan	9,594,000	1,192,000	672,000
Ohio	11,173,000	1,497,000	759,000
Wisconsin	5,160,000	686,000	337,000
West North Central	18,469,000	2,533,000	1,250,000
Missouri	5,359,000	742,000	367,000
South	93,099,000	11,824,000	6,518,000
South Atlantic	47,616,000	6,522,000	3,081,000
Florida	14,400,000	2,658,000	956,000
Georgia	7,353,000	729,000	352,000
Maryland	5,072,000	578,000	360,000
East South Central	16,193,000	2,048,000	1,123,000
West South Central	29,290,000	3,254,000	2,314,000
Texas	19,128,000	1,951,000	1,583,000
Louisiana	4,351,000	496,000	328,000
West	58,522,000	6,596,000	4,713,000
Mountain	16,116,000	1,825,000	1,238,000
Utah	2,000,000	176,000	188,000
Pacific	42,406,000	4,771,000	3,475,000
California	31,878,000	3,516,000	2,736,000
Oregon	3,204,000	430,000	212,000
Washington	5,533,000	641,000	386,000

Appendix K

Exhibits for the Midterm Scenario

Exhibit #M1 -- Promotional Dollar Expenditures

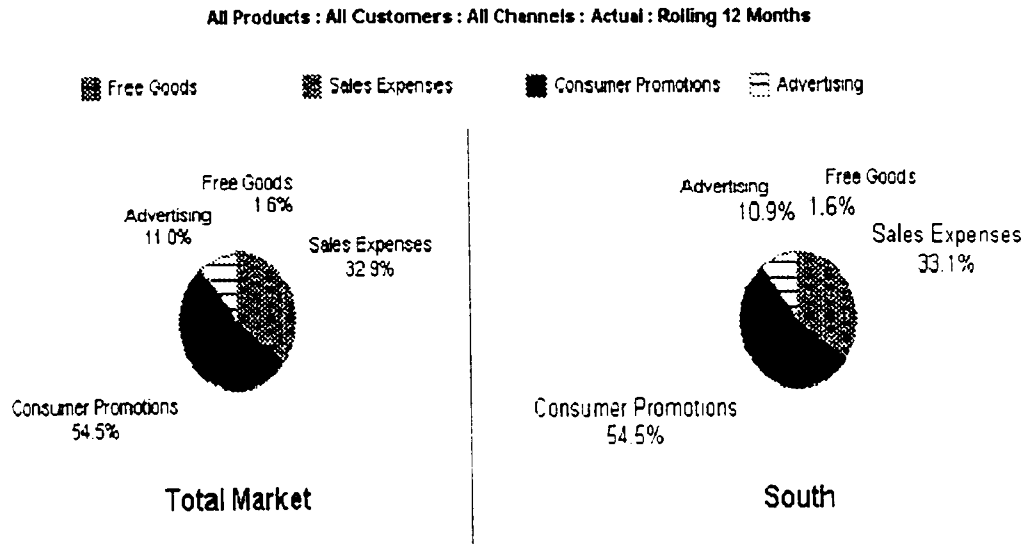


Exhibit #M2 -- Customer Sales Analysis for the Southern Region

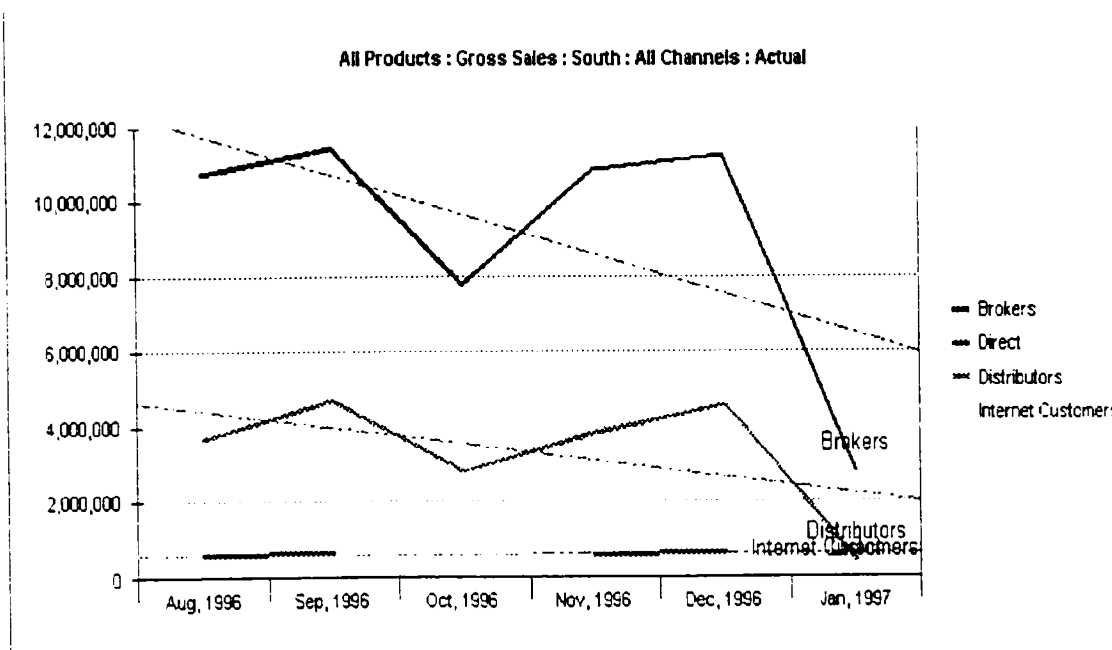


Exhibit #M3 -- Customer Sales Analysis for the US Market

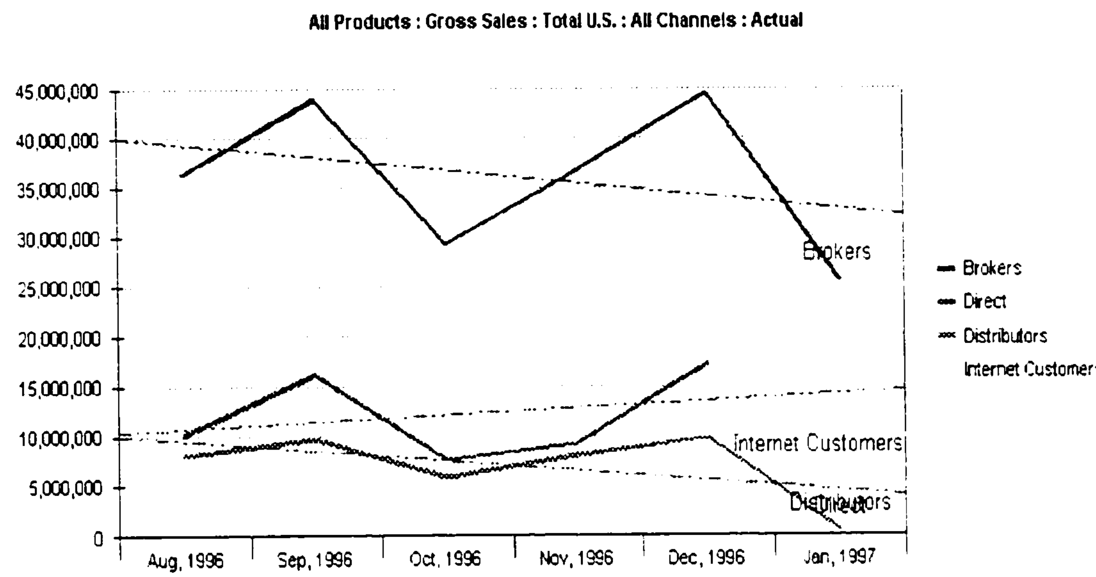
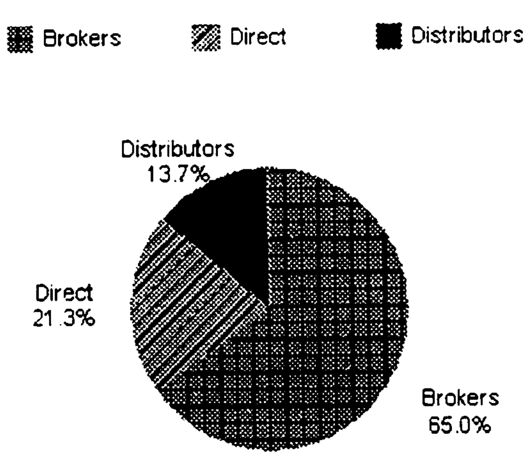


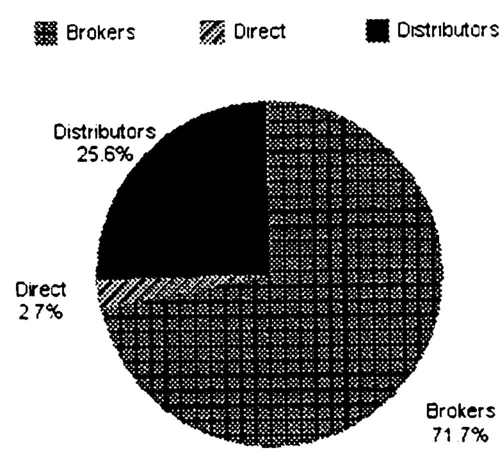
Exhibit #M4 -- Operating Profit by Customer



Operating Profit before Overhead

LJL Industries

US Operations



Operating Profit before Overhead

LJL Industries

Southern Operations

Exhibit #M5 -- Sales, Volume & Satisfaction Performance

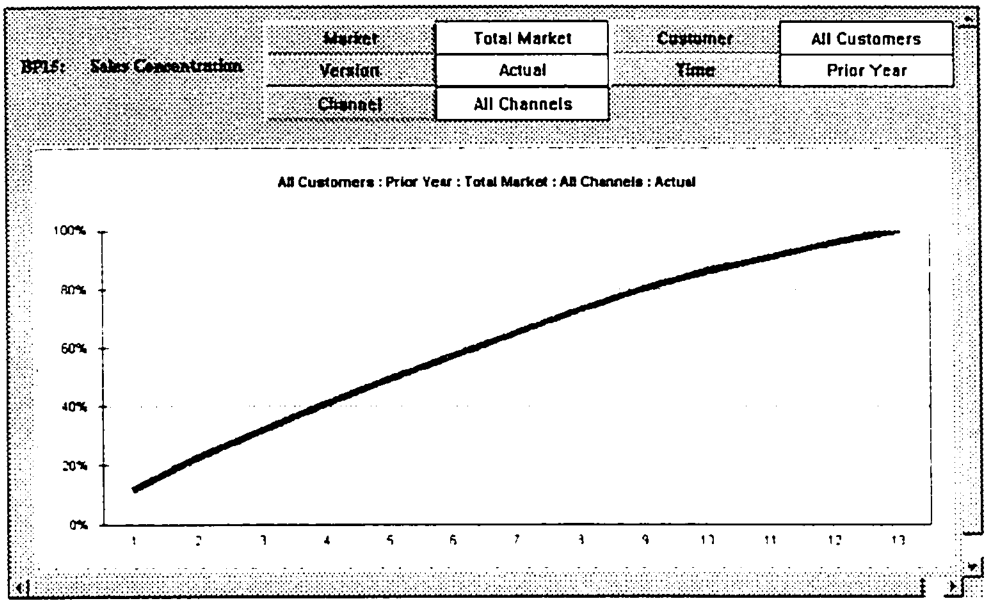
		Gross Sales	Units	Sales on Deal	Delivery	Service	Price	Variety
Total U.S.	All Customers	324,207,863	19,338,147	12,664,753	3.7	3.6	1.8	3.0
	Brokers	216,221,795	11,613,744	7,574,388	3.4	3.3	1.5	2.6
	Direct	60,146,119	4,358,284	2,870,051	3.6	3.2	1.7	2.4
	Distributors	41,615,992	3,067,887	2,026,781	3.4	3.9	1.6	2.8
	Internet Custome	6,223,957	298,233	193,533	4.4	4.2	2.4	4.1
South	All Customers	77,218,189	5,487,434	3,575,023	3.8	3.8	1.6	2.9
	Brokers	54,830,426	3,820,340	2,474,247	3.4	2.9	1.5	2.5
	Direct	2,431,696	188,416	120,090	N/A	N/A	N/A	N/A
	Distributors	19,956,068	1,478,678	980,686	4.2	4.7	1.7	3.4

Delivery, Service, Price, Variety
(1=Very Dissatisfied; 7=Very Satisfied)

Appendix L

Exhibits for the Final Scenario

Exhibit #F1 -- Sales Concentration by Brand



BP15: Sales Concentration

Market	Total Market	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	A	B	C	D	E	F	G
1		Gross Sales	% Share	CUM			
2	Fulton Fraser Hair	79,016,989	11.9%	11.9%			
3	Fulton For Women	70,825,396	10.7%	22.6%			
4	Fulton Fraser Skin Value	61,335,653	9.2%	31.8%			
5	Fulton Fraser Family Care	61,217,163	9.2%	41.1%			
6	Fulton Fraser Sun Value	54,469,574	8.2%	49.3%			
7	Dippit	53,126,022	8.0%	57.3%			
8	Fulton Fraser Manly	53,020,393	8.0%	65.3%			
9	Nice n Brite	51,021,757	7.7%	73.0%			
10	Red Hot NOT	46,745,178	7.0%	80.0%			
11	FF Foot Value	40,291,280	6.1%	86.1%			
12	Milk Teeth	32,571,669	4.9%	91.0%			
13	Fulton For Men	31,735,265	4.8%	95.8%			
14	Fulton Fix	28,014,800	4.2%	100.0%			
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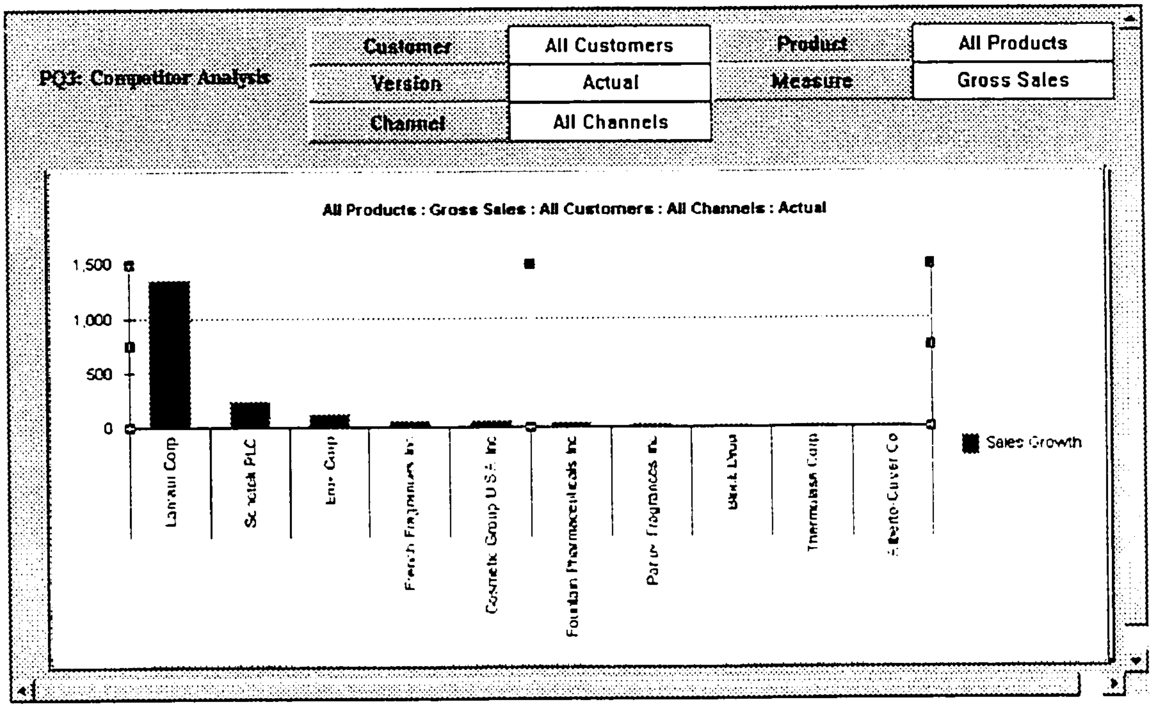
Exhibit #F2 -- Sales Growth by Competitor

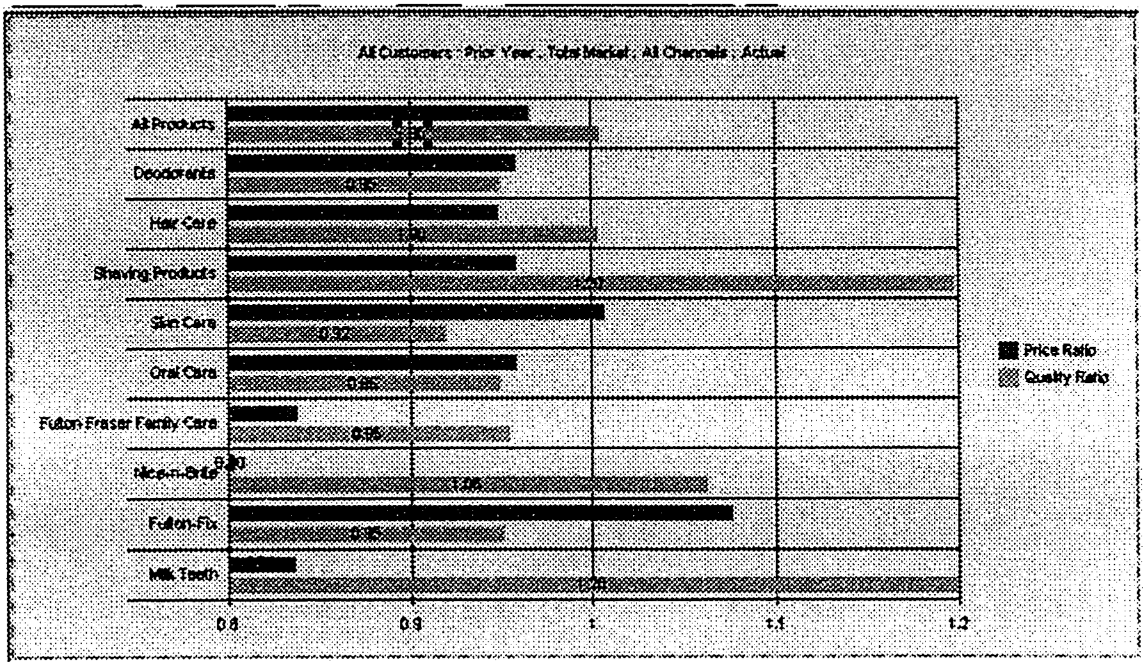


PQ3: Competitor Analysis

Customer	All Customers	Product	All Products
Version	Actual	Measure	Gross Sales
Channel	All Channels		

	A	B	C	D	E	F
1		Sales Growth	Prior Year	1995		
2	Lamaur Corp	1,351	117,083,000	8,070,000		
3	Senetek PLC	236	6,486,000	1,931,000		
4	Erox Corp	126	20,323,000	8,973,000		
5	French Fragrances Inc	60	140,482,000	87,979,000		
6	Cosmetic Group U S A Inc	54	15,180,000	9,833,000		
7	Fountain Pharmaceuticals Inc	45	1,677,000	1,159,000		
8	Parlux Fragrances Inc	29	87,640,000	67,727,000		
9	Block Drug	21	862,471,000	715,242,000		
10	Thermolase Corp	19	27,812,000	23,348,000		
11	Alberto Culver Co	17	1,590,409,000	1,358,219,000		
12	Carson Inc	14	77,730,000	68,319,000		
13	Guest Supply Inc	12	179,042,000	159,450,000		
14	Revlon Consumer Products	12	2,167,000,000	1,937,800,000		
15	Revlon Inc	12	2,167,000,000	1,937,800,000		
16	Hydron Technologies Inc	11	8,113,000	7,303,000		
17	Lauder Estee Cos Inc	10	3,194,500,000	2,899,100,000		
18	Del Laboratories Inc	10	232,951,000	212,048,000		
19	Alfin Inc	8	34,733,000	32,151,000		

Exhibit #F3 -- Customer Value Report

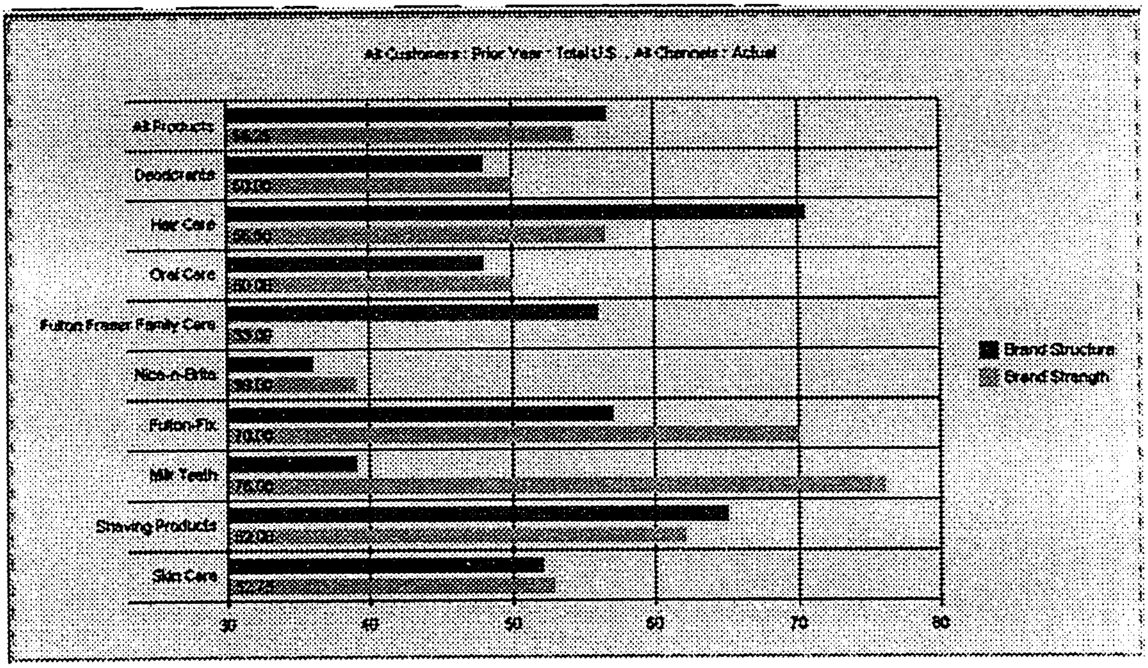


PQ1: Custom Chart

Market	Total Market	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	Gross Sales	Price Ratio	Quality Ratio	Customer Value Index
All Products	663,391,139	0.97	1.00	72.91
Deodorants	102,560,661	0.96	0.95	66.93
Hair Care	132,143,011	0.95	1.00	71.01
Shaving Products	53,020,393	0.96	1.20	90.67
Skin Care	202,841,685	1.01	0.92	68.99
Oral Care	172,825,390	0.96	0.95	66.93
Fulton Fraser Family Care	61,217,163	0.84	0.95	55.81
Nice n Brite	51,021,757	0.80	1.06	61.28
Fulton-Fix	28,014,800	1.08	0.95	78.33
Milk Teeth	32,571,669	0.84	1.20	76.30

Exhibit #F4 -- PowerGrid Report



PQ1: Custom Chart

Market	Total Market	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	A	B	C	D	E	F
1		Gross Sales	Brand Structure	Brand Strength		
2	All Products	663,391,139	56.70	54.25		
3	Deodorants	102,560,661	48.00	50.00		
4	Hair Care	132,143,011	70.50	56.50		
5	Shaving Products	53,020,393	65.00	62.00		
6	Skin Care	202,841,685	52.00	52.75		
7	Oral Care	172,825,390	48.00	50.00		
8	Fulton Fraser Family Care	61,217,163	56.00	33.00		
9	Nice n Brite	51,021,757	36.00	39.00		
10	Fulton Fix	28,014,800	57.00	70.00		
11	Milk Teeth	32,571,669	39.00	76.00		
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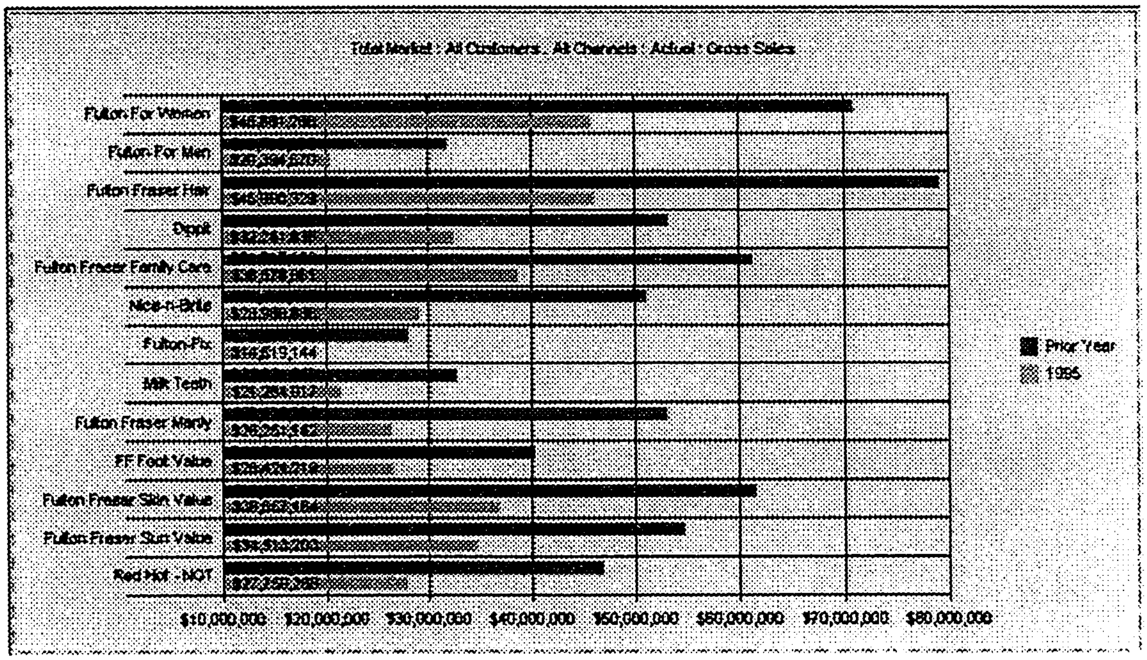
Exhibit #F5a -- Brand Equity Report



PQI: Custom Chart

Market	Total Market	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	A	B	C	D	E	F
1		Gross Sales	% of Sales	Units	Sales on Deal	Non Deal Sales
2	All Products	663,391,139	100.00%	41,857,158	27,441,910	14,415,248
3	Fulton For Women	70,825,396	10.68%	5,218,590	3,379,894	1,838,696
4	Fulton For Men	31,735,265	4.78%	2,102,185	1,370,277	731,908
5	Fulton Fraser Hair	79,016,989	11.91%	5,638,096	3,707,134	1,930,962
6	Dippit	53,126,022	8.01%	3,513,522	2,353,878	1,159,644
7	Fulton Fraser Family Care	61,217,163	9.23%	3,593,632	2,386,262	1,207,371
8	Nice-n-Brite	51,021,757	7.69%	2,868,621	1,876,614	992,007
9	Fulton Fix	28,014,800	4.22%	1,782,890	1,152,620	630,271
10	Milk Teeth	32,571,669	4.91%	2,277,179	1,506,420	770,760
11	Fulton Fraser Manly	53,020,393	7.99%	2,345,135	1,507,995	837,140
12	FF Foot Value	40,291,280	6.07%	2,575,845	1,686,500	889,345
13	Fulton Fraser Skin Value	61,335,653	9.25%	3,564,587	2,355,887	1,208,700
14	Fulton Fraser Sun Value	54,469,574	8.21%	3,479,725	2,258,761	1,220,964
15	Red Hot NOT	46,745,178	7.05%	2,897,149	1,899,669	997,480
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Exhibit #F5b -- Brand Equity Report

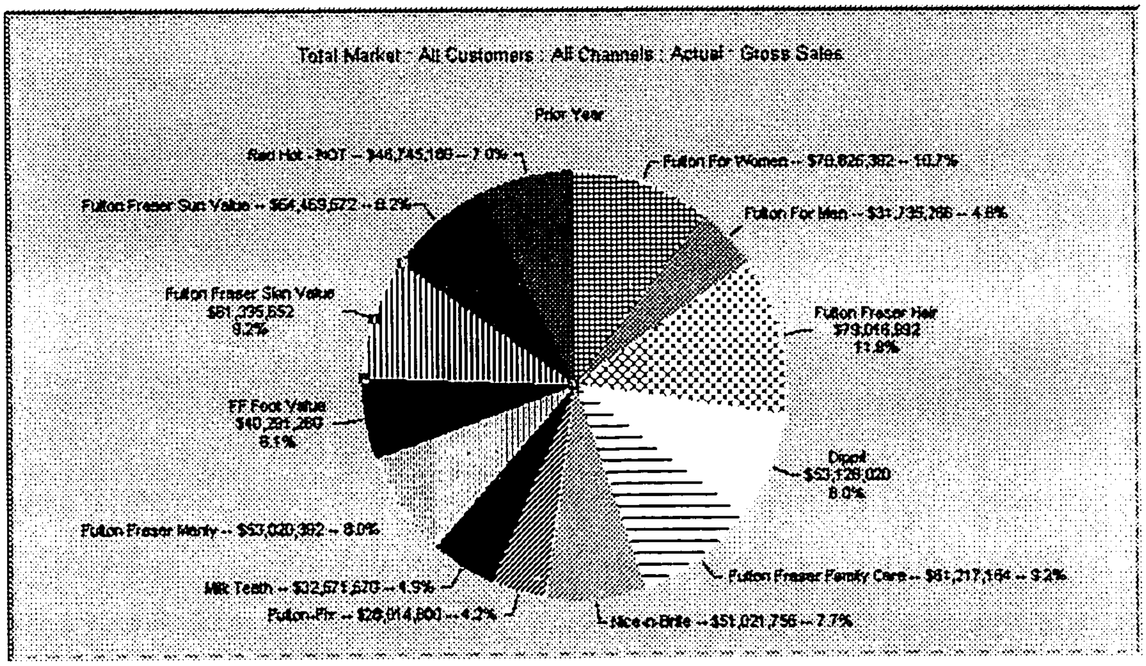
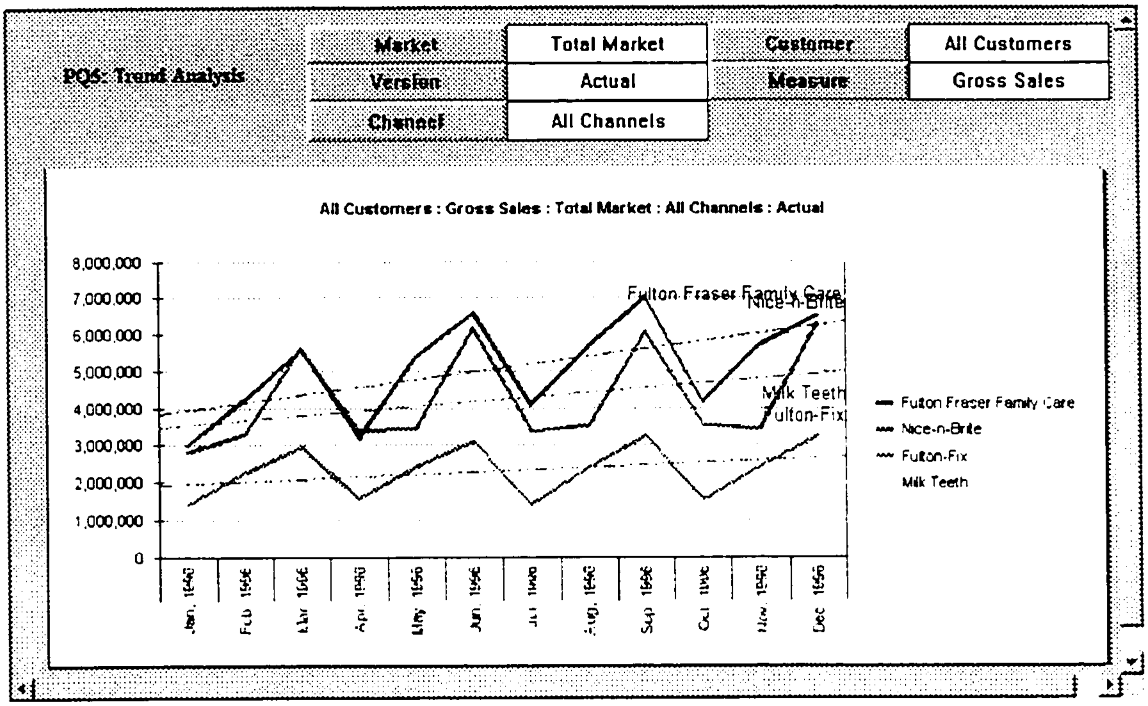


Exhibit #F6 -- Sales Trend for the Oral Care Product Line



PQ5: Trend Analysis

Market	Total Market	Customer	All Customers
Version	Actual	Measure	Gross Sales
Channel	All Channels		

	A	B	C	D	E	F	G
1		Fulton Fraser Family Care	Nice-n-Brite	Fulton-Fix	Milk Teeth		
2	Jan. 1996	3,018,649	2,820,809	1,402,433	1,433,216		
3	Feb. 1996	4,239,267	3,299,611	2,269,441	2,543,665		
4	Mar. 1996	5,594,129	5,621,197	2,950,619	3,557,726		
5	Apr. 1996	3,174,813	3,394,400	1,578,562	1,993,914		
6	May. 1996	5,378,250	3,461,440	2,416,814	2,595,197		
7	Jun. 1996	6,580,257	6,161,214	3,114,887	3,722,338		
8	Jul. 1996	4,080,439	3,369,198	1,404,332	1,815,578		
9	Aug. 1996	5,711,726	3,531,640	2,397,166	2,574,507		
10	Sep. 1996	7,029,336	6,068,432	3,268,096	3,844,409		
11	Oct. 1996	4,172,231	3,562,154	1,541,444	1,898,532		
12	Nov. 1996	5,715,521	3,440,754	2,425,475	2,775,492		
13	Dec. 1996	6,522,548	6,290,907	3,245,531	3,817,095		
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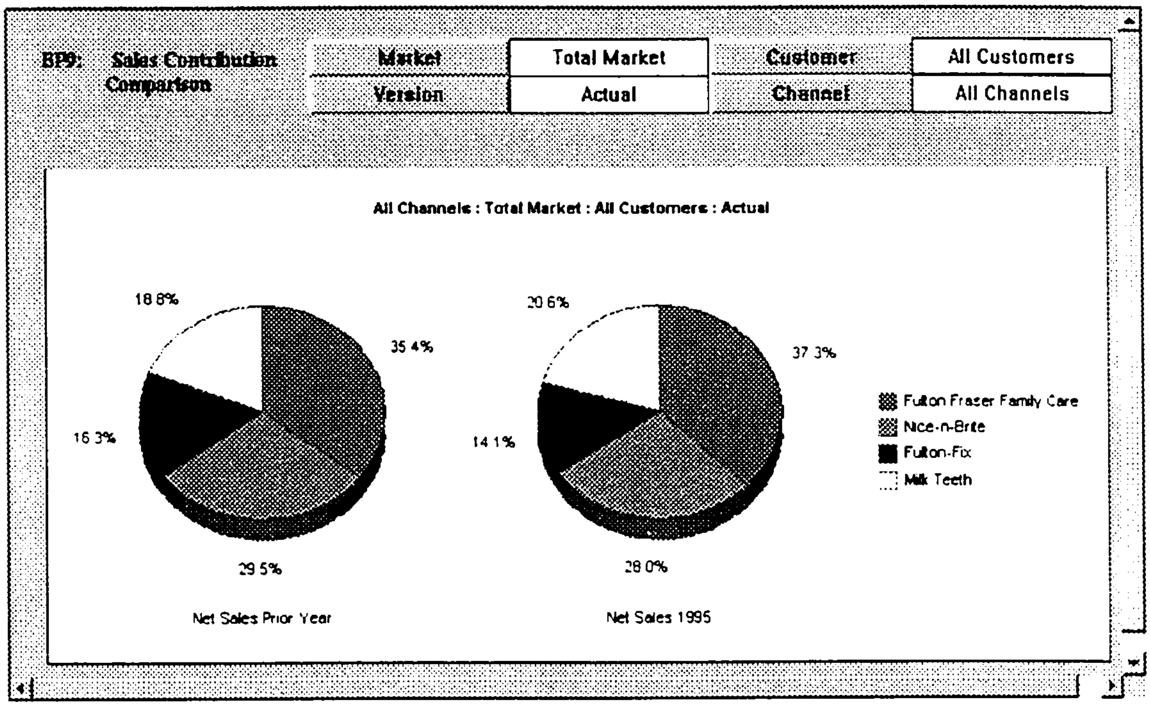
Exhibit #F7 -- Sales Contribution Analysis



BP9: Sales Contribution Comparison

Market	Total Market	Customer	All Customers
Version	Actual	Channel	All Channels

	A	B	C	D	E	F	G
1		Volume (EQ)		Net Sales		Selling Profit	
2		Prior Year	1995	Prior Year	1995	Prior Year	1995
3	Fulton Fraser Famil	9,783,296	5,984,865	54,477,056	34,344,768	15,348,910	9,994,253
4	Nice n Brite	7,781,941	4,478,328	45,421,957	25,801,142	11,646,871	6,813,409
5	Fulton Fix	5,172,491	2,921,275	25,004,416	12,943,272	7,243,810	3,663,129
6	Milk Teeth	6,257,362	4,025,476	28,955,390	18,920,767	7,496,246	5,037,352
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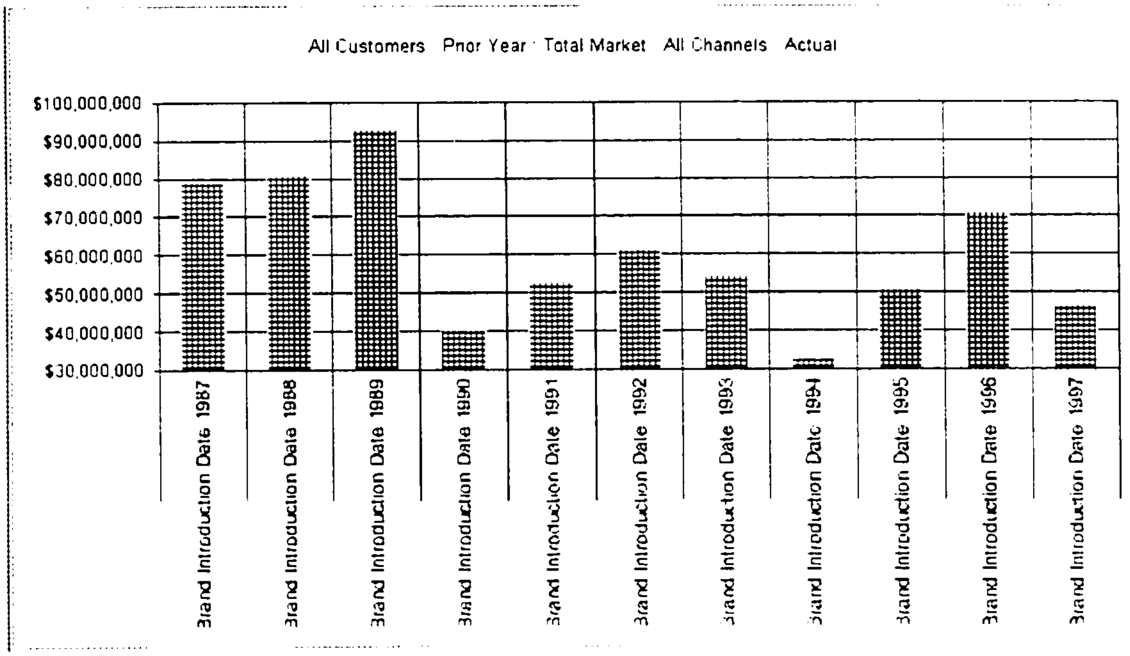
Exhibit #F8a -- Sales by Introduction Date for All Products



PQ1: Custom Chart	Market	Total Market	Customer	All Customers
	Version	Actual	Time	Prior Year
	Channel	All Channels		

	A	B	C	D	E	F
1		Gross Sales	% of Sales	Units	Sales on Deal	Non-Deal Sales
2	All Products	663,391,139	100.00%	41,857,158	27,441,910	14,415,248
3	Brand Introduction Date 1997	46,745,178	7.05%	2,897,149	1,899,669	997,480
4	Brand Introduction Date 1996	70,825,396	10.68%	5,218,590	3,379,894	1,838,696
5	Brand Introduction Date 1995	51,021,757	7.69%	2,868,621	1,876,614	992,007
6	Brand Introduction Date 1994	32,571,669	4.91%	2,277,179	1,506,420	770,760
7	Brand Introduction Date 1993	54,469,574	8.21%	3,479,725	2,258,761	1,220,964
8	Brand Introduction Date 1992	61,335,653	9.25%	3,564,587	2,355,887	1,208,700
9	Brand Introduction Date 1991	53,126,022	8.01%	3,513,522	2,353,878	1,159,644
10	Brand Introduction Date 1990	40,291,280	6.07%	2,575,845	1,686,500	889,345
11	Brand Introduction Date 1989	92,952,428	14.01%	5,695,817	3,756,538	1,939,279
12	Brand Introduction Date 1988	81,035,193	12.22%	4,128,025	2,660,615	1,467,411
13	Brand Introduction Date 1987	79,016,989	11.91%	5,638,096	3,707,134	1,930,962
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Exhibit #8b -- Sales by Introduction Date for Oral Care

PQL: Custom Chart

Market	Total Market	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	A	B	C	D	E	F
1		Gross Sales	Units	Sales on Deal	Non-Deal Sales	
2	Brand Introduction Date 1995	51,021,757	2,868,621	1,876,614	992,007	
3	Nice-n-Brite	51,021,757	2,868,621	1,876,614	992,007	
4	Brand Introduction Date 1994	32,571,669	2,277,179	1,506,420	770,760	
5	Milk Teeth	32,571,669	2,277,179	1,506,420	770,760	
6	Brand Introduction Date 1989	92,952,428	5,695,817	3,756,538	1,939,279	
7	Fulton Fraser Family Care	61,217,163	3,593,632	2,386,262	1,207,371	
8	Brand Introduction Date 1988	81,035,193	4,128,025	2,660,615	1,467,411	
9	Fulton Fix	28,014,800	1,782,890	1,152,620	630,271	
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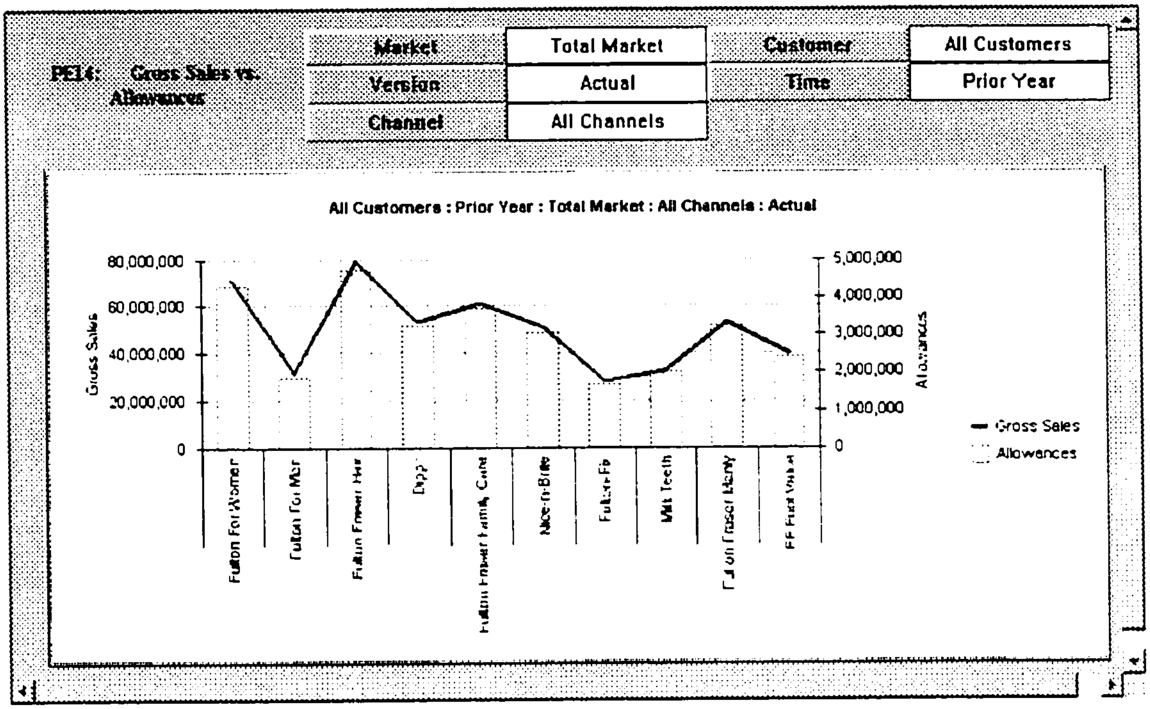
Exhibit #F9a -- Promotional Analysis



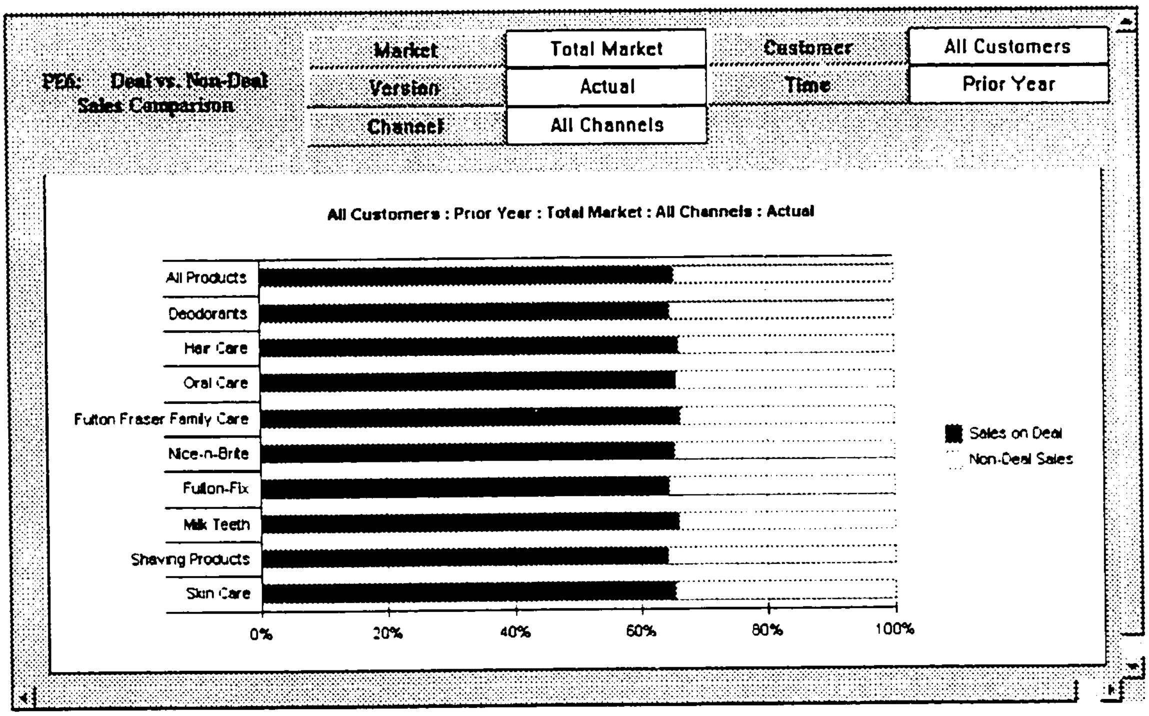


Exhibit #F9b -- Promotional Analysis

PE6: Deal vs. Non-Deal Sales Comparison

Market	Total Market	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	A	B	C	D	E	F	G
1		Sales on Deal	Non-Deal Sales				
2	All Products	27,441,910	14,415,248				
3	Deodorants	4,750,170	2,570,604				
4	Hair Care	6,061,013	3,090,606				
5	Oral Care	6,921,915	3,600,408				
6	Fulton Fraser Family Care	2,386,262	1,207,371				
7	Nice n Brite	1,876,614	992,007				
8	Fulton Fix	1,152,620	630,271				
9	Milk Teeth	1,506,420	770,760				
10	Shaving Products	1,507,995	837,140				
11	Skin Care	8,200,817	4,316,489				
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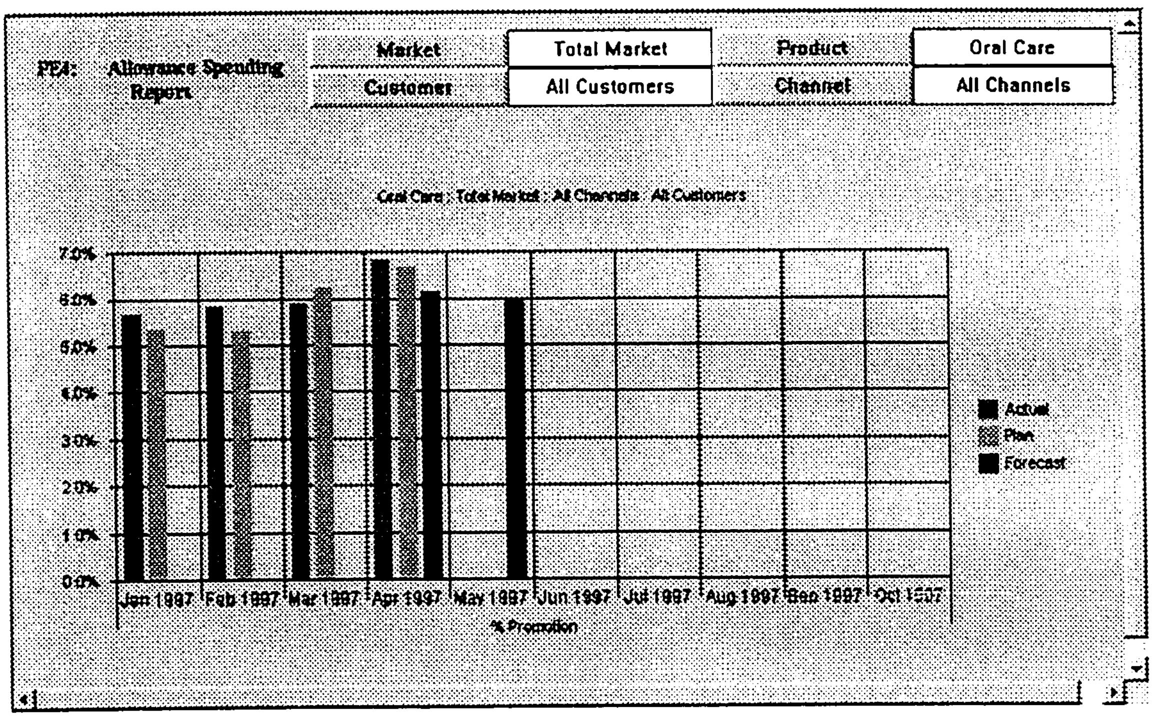

Exhibit #F9c -- Promotional Analysis

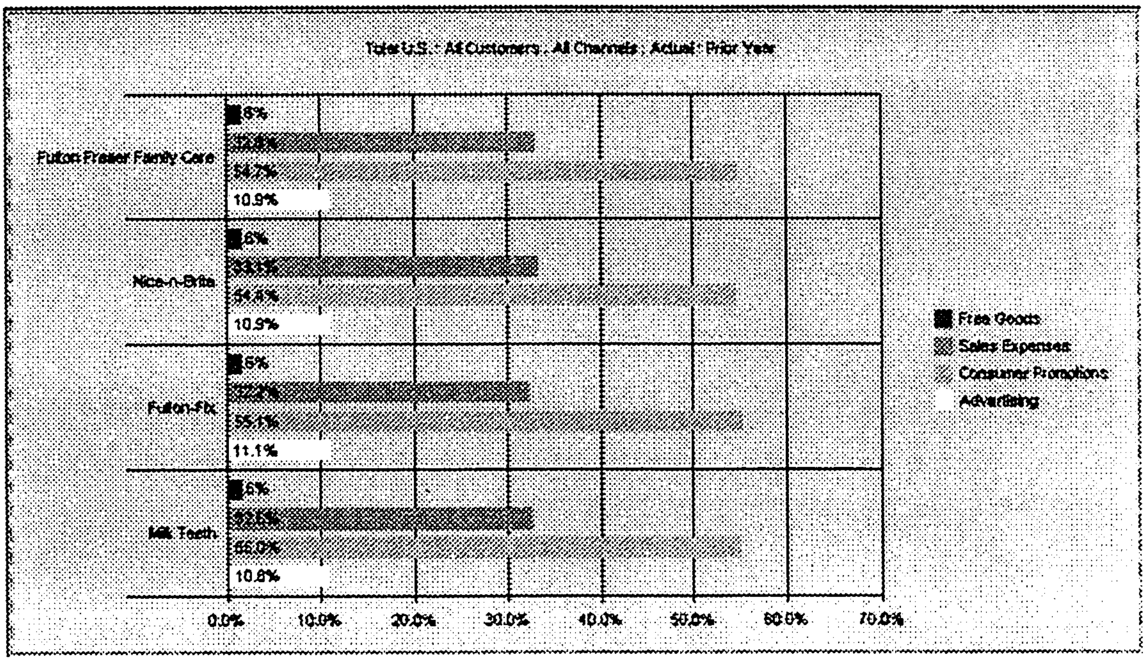

Exhibit #F10a -- Product Comparisons

BPII: Cost Comparison

	Reference Actual	Reference % Gross Sales	Group Actual	Group % Gross Sales
Gross Sales	171,751,703	100.0%	660,314,908	100.0%
Allowances	10,355,107	6.0%	39,748,178	6.0%
Deductions	3,396,216	2.0%	13,115,378	2.0%
Damages/Returns	864,126	0.5%	3,319,876	0.5%
Cash Discounts	2,519,443	1.5%	9,848,577	1.5%
Misc. Discounts	1,715,638	1.0%	6,636,998	1.0%
Transportation	5,680,936	3.3%	21,918,273	3.3%
Distribution Costs	5,713,408	3.3%	21,862,773	3.3%
Sales Expenses	8,496,122	4.9%	32,948,014	5.0%
Consumer Promotions	14,199,898	8.3%	54,623,471	8.3%
Advertising	2,832,328	1.6%	11,024,020	1.7%
Cost of Goods	74,504,668	43.4%	286,852,855	43.4%
Selling Profit	41,473,814	24.1%	158,416,495	24.0%

	Reference	Group
Product	Oral Care	All Products
Customer	All Customers	All Customers
Market	Total U.S.	Total U.S.
Channel	All Channels	All Channels
Time	Prior Year	Prior Year

BPII: Cost Comparison

	Reference Actual	Reference % Gross Sales	Group Actual	Group % Gross Sales
Gross Sales	32,396,373	100.0%	660,314,908	100.0%
Allowances	2,002,061	6.2%	39,748,178	6.0%
Deductions	636,939	2.0%	13,115,378	2.0%
Damages/Returns	165,574	0.5%	3,319,876	0.5%
Cash Discounts	471,727	1.5%	9,848,577	1.5%
Misc. Discounts	320,172	1.0%	6,636,998	1.0%
Transportation	1,087,087	3.4%	21,918,273	3.3%
Distribution Costs	1,122,527	3.5%	21,862,773	3.3%
Sales Expenses	1,592,452	4.9%	32,948,014	5.0%
Consumer Promotions	2,687,909	8.3%	54,623,471	8.3%
Advertising	525,455	1.6%	11,024,020	1.7%
Cost of Goods	14,322,754	44.2%	286,852,855	43.4%
Selling Profit	7,461,716	23.0%	158,416,495	24.0%

	Reference	Group
Product	Milk Teeth	All Products
Customer	All Customers	All Customers
Market	Total U.S.	Total U.S.
Channel	All Channels	All Channels
Time	Prior Year	Prior Year

Exhibit #F10b -- Product Comparison

BPII: Cost Comparison

	Actual	% Gross Sales
Gross Sales	50,738,310	100.0%
Allowances	3,044,067	6.0%
Deductions	1,019,259	2.0%
Damages/Returns	252,212	0.5%
Cash Discounts	741,879	1.5%
Misc. Discounts	511,710	1.0%
Transportation	1,703,939	3.4%
Distribution Costs	1,660,392	3.3%
Sales Expenses	2,541,877	5.0%
Consumer Promotions	4,182,856	8.2%
Advertising	838,108	1.7%
Cost of Goods	22,658,241	44.7%
Selling Profit	11,583,770	22.8%

Product	Nice-n-Brite
Customer	All Customers
Market	Total U.S.
Channel	All Channels
Time	Prior Year

	Actual	% Gross Sales
Gross Sales	660,314,908	100.0%
Allowances	39,748,178	6.0%
Deductions	13,115,378	2.0%
Damages/Returns	3,319,876	0.5%
Cash Discounts	9,848,577	1.5%
Misc. Discounts	6,636,998	1.0%
Transportation	21,918,273	3.3%
Distribution Costs	21,862,773	3.3%
Sales Expenses	32,948,014	5.0%
Consumer Promotions	54,623,471	8.3%
Advertising	11,024,020	1.7%
Cost of Goods	286,852,855	43.4%
Selling Profit	158,416,495	24.0%

Product	All Products
Customer	All Customers
Market	Total U.S.
Channel	All Channels
Time	Prior Year

BPII: Cost Comparison

	Actual	% Gross Sales
Gross Sales	60,779,019	100.0%
Allowances	3,661,456	6.0%
Deductions	1,204,200	2.0%
Damages/Returns	307,626	0.5%
Cash Discounts	910,613	1.5%
Misc. Discounts	609,545	1.0%
Transportation	1,991,963	3.3%
Distribution Costs	2,029,848	3.3%
Sales Expenses	3,020,163	5.0%
Consumer Promotions	5,033,495	8.3%
Advertising	1,007,059	1.7%
Cost of Goods	25,772,988	42.4%
Selling Profit	15,230,063	25.1%

Product	ulton Fraser Family Ca
Customer	All Customers
Market	Total U.S.
Channel	All Channels
Time	Prior Year

	Actual	% Gross Sales
Gross Sales	660,314,908	100.0%
Allowances	39,748,178	6.0%
Deductions	13,115,378	2.0%
Damages/Returns	3,319,876	0.5%
Cash Discounts	9,848,577	1.5%
Misc. Discounts	6,636,998	1.0%
Transportation	21,918,273	3.3%
Distribution Costs	21,862,773	3.3%
Sales Expenses	32,948,014	5.0%
Consumer Promotions	54,623,471	8.3%
Advertising	11,024,020	1.7%
Cost of Goods	286,852,855	43.4%
Selling Profit	158,416,495	24.0%

Product	All Products
Customer	All Customers
Market	Total U.S.
Channel	All Channels
Time	Prior Year

Exhibit #F10c -- Product Comparisons

BPIL: Cost Comparison

	Actual	% Gross Sales
Gross Sales	27,838,002	100.0%
Allowances	1,647,522	5.9%
Deductions	535,817	1.9%
Damages/Returns	138,715	0.5%
Cash Discounts	395,224	1.4%
Misc. Discounts	274,212	1.0%
Transportation	897,947	3.2%
Distribution Costs	900,641	3.2%
Sales Expenses	1,341,630	4.8%
Consumer Promotions	2,295,638	8.2%
Advertising	461,706	1.7%
Cost of Goods	11,750,685	42.2%
Selling Profit	7,198,265	25.9%

Product	Fulton-Fix
Customer	All Customers
Market	Total U.S.
Channel	All Channels
Time	Prior Year

	Actual	% Gross Sales
Gross Sales	660,314,908	100.0%
Allowances	39,748,178	6.0%
Deductions	13,115,378	2.0%
Damages/Returns	3,319,876	0.5%
Cash Discounts	9,848,577	1.5%
Misc. Discounts	6,636,998	1.0%
Transportation	21,918,273	3.3%
Distribution Costs	21,862,773	3.3%
Sales Expenses	32,948,014	5.0%
Consumer Promotions	54,623,471	8.3%
Advertising	11,024,020	1.7%
Cost of Goods	286,852,855	43.4%
Selling Profit	158,416,495	24.0%

Product	All Products
Customer	All Customers
Market	Total U.S.
Channel	All Channels
Time	Prior Year

Exhibit #F11 -- Population Statistics

PQL: Custom Chart

Product	All Products	Customer	All Customers
Version	Actual	Time	Prior Year
Channel	All Channels		

	TotalPop	% of Total Population	Over65	% Over 65	Under5	% Under 5
Total Market	265,284,000	100.00%	33,872,000	100.00%	19,088,000	100.00%
East	51,579,000	19.44%	7,313,000	21.59%	3,514,000	18.41%
Midwest	62,084,000	23.40%	8,139,000	24.03%	4,343,000	22.75%
South	93,099,000	35.09%	11,824,000	34.91%	6,518,000	34.15%
West	58,522,000	22.06%	6,596,000	19.47%	4,713,000	24.69%

Exhibit #F12 -- Sales Trend for Customer Type

PQ5: Trend Analysis

Market	Total Market	Product	Oral Care
Version	Actual	Measure	Gross Sales
Channel	All Channels		

	A	B	C	D	E	F	G	H
1		Brokers	Direct	Distributors				
2	Jan, 1996	5,345,349	1,424,910	1,904,848				
3	Feb, 1996	8,031,797	2,110,723	2,209,463				
4	Mar, 1996	10,715,471	3,586,756	3,421,444				
5	Apr, 1996	6,566,643	1,744,107	1,830,939				
6	May, 1996	9,463,220	2,155,704	2,232,777				
7	Jun, 1996	12,130,281	3,756,433	3,691,982				
8	Jul, 1996	7,218,034	1,444,193	2,007,319				
9	Aug, 1996	9,626,718	2,240,032	2,348,288				
10	Sep, 1996	12,908,677	3,691,766	3,609,829				
11	Oct, 1996	7,621,898	1,489,111	2,063,352				
12	Nov, 1996	9,774,156	2,315,503	2,267,583				
13	Dec, 1996	12,523,648	3,774,676	3,577,757				
14								
15								
16								
17								
18								
19								