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TEAMMIND: A CASE STUDY OF COLLECTIVE SYNERGISM,
TEAM DEVELOPMENT, AND DECISION MAKING
UNDER TIME CONSTRAINTS

by

Norina E. Finley

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education

University of San Diego

1997

Dissertation Committee

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ABSTRACT

TEAMMIND: A CASE STUDY OF COLLECTIVE SYNERGISM, TEAM DEVELOPMENT, AND DECISION MAKING UNDER TIME CONSTRAINTS

Advances in technology are challenging our concept of time and cognitive abilities to process and digest information in a dynamic environment. To develop a quality product that meets user's needs and to perform within budget and program milestones, requires the expertise and shared understandings of an intact multidisciplinary team in design decision making. Collaboratively team members need to communicate on solutions for integrated product development, from their different disciplinary perspectives. To survive in today's global competition, time-to-market gives research and development organizations the competitive edge in new product development, using emerging technologies.

Therefore, there is a need for qualitative research on teams in the workplace making real decisions under time constraints. This qualitative case study examined the decision making strategies an intact multidisciplinary team used in the workplace to develop the user interface for an information system originating from a concept.

The unique feature about this team is that the customer and contractor team members were co-located, involved in the daily decision making activities of new product screen design. The analysis indicated that during the decision making process communication provided the conduit for mutual adaptation and collective learning.

Through cross-fertilization, team members had to integrate their fragmented bits of tacit and experiential knowledge to create a *teammind* or a collective mind to ensure that the product meets the needs of the customer and the contractor. In a complex environment of ambiguity and creativity, the team engaged in a collaborative relationship using dialogue to resolve conflicts, take risks, and negotiate based on requirements. They made decisions from their different disciplinary and organizational affiliation perspectives to produce the required design documentation.

A significant implication of this study is that an organizational repertoire of a structured decision making process with feedback loops, provided a methodology to bring closure on design decisions. Although the time constraints and the size of the task were a challenge, through leadership based on expert power and collective learning, the team achieved their objectives. The recommendations include guidelines for program management and the need for research on collectivist cultures to identify how to train teams in new product development.

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DEDICATION

This dissertation is dedicated to the memory of my late father who was a strong believer in education and who ensured that each of his six children were able to obtain the skills necessary for an enriched and pioneering life. He provided me with my first opportunity to study abroad in High School in London, England, which stimulated my quest for knowledge and my curiosity about the world. This became my launching pad of discovery and growth as I experienced the world through travel, academia and the workplace. Even though he is not here to share this event with me, his spirit lives on through his vision.

This dissertation is also dedicated to my mother who is now 84 years old and is on a continuous journey visiting her six children around the world.

Thank you mum for instilling in me the discipline for quality and the values from which I grew. More importantly, thank you for being here to share this milestone with me.

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I thank the six team members who participated in this study. Your candid reflections allowed me to understand your “lived experience” of the decision making process in a challenging and ambiguous environment. Your narratives provided the meaningful structures that helped me to make sense of the strategies you used to make decisions that will change the way the users of the intended system will perform their tasks. I thank my confidant who graciously provided me access to the minutes of the decision making process meetings.

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CHAPTER ONE

STATEMENT OF THE ISSUE

Introduction

This is an era of “dramatic evolution in new product development . . . global competition has led to shorter product life cycles This period has seen an increase in the complexity of products due to the rapid development of many new material and process technologies” (Swink, Sandvig & Mabert, 1996, p. 230). In order to meet ever-challenging program milestones, generate quality products, satisfy customer needs and be competitive, multidisciplinary project team members need to participate in systems design decision making using face-to-face communication to ensure shared understandings on the project’s goals and objectives.

According to Cyert and March (1992), “in most theories of business decision making, communication effects are ignored” (p. 79). Yet face-to-face communication is the “very substance of decision making rather than merely its channel or medium” (Hirokawa & Poole, 1986, p. 21).

Senge (1990) states that conversations provide an environment for real-time social interaction whereby team members can engage in a collaborative leadership relationship that encourages participation in decision making.

According to Senge, it is through dialogue that team members share understandings and reconcile their differences using a process of “reflection and inquiry” (p. 249).

However, the dialogical process appears to be absent in engineering research and development organizations—even in those inclined towards postmodernism—where it should prevail. In an environment of complexity and accelerating change, communication channels provide the infrastructure for collective action. Postmodernism is defined as an organizational structure with an orientation to critique. It is an emerging structure that embraces dialogue as an enabling strategy to help individuals challenge the status quo and bring about change through shared understandings. It also thrives in a complex and turbulent environment, that values diversity as an opportunity for learning and growth.

The sophistication and complexity of developing technological products in today's organizations require "intelligence beyond that of any one individual. To solve problems in complex systems, we must learn to tap the collective intelligence of groups of knowledgeable people" (Isaacs, 1993, p. 28).

Complexity derives from the sum of all the details of those little parts of fragmented knowledge dispersed among a group of people. According to Sigfried (1997), "the single most counterproductive aspect of complexity is the friction it gives us in understanding and communication" (p.61). Current technology based on computer networks creates an interdependency among multidisciplinary team members that requires the shaping and aligning of functional cultural discipline differences, towards a collective culture. This acculturation or adaptation is necessary to ensure shared understandings for integrated new product development.

Adaptation occurs through an interactive learning process that exposes the different disciplinary perspectives of a multidisciplinary team engaged in new product development. This process becomes even more complex when it is

bounded by a time frame, because “everywhere people experience and interpret their lives in relationship to time” (Richardson, 1990, p. 116).

Thus time becomes a critical yet constraining element which may affect the dialogical process. Decision making for new product design has to be timely and fast because of task interdependency in an uncertain and ambiguous environment, where innovation and time-to-market enables an organization to maintain its competitive edge.

The interactive human network of a project team provides “a context for learning by doing. As information passes through a network, it is both freer and richer; new connections and new meanings are generated, debated, and evaluated” (Powell, 1990, p. 325). However, this process of new meanings and cognitive learning has to take place through face-to-face communication which requires time, and it has to occur within the constraints of program milestones.

Background of the Issue

Prior to the insights of postmodernism, organizational structures were hierarchical thus fostering a greater emphasis on top-down strategies in decision making. Decision making was controlled by a few individuals at the top of the hierarchy with very little input from those who actually perform a task. Even if those performing the task were consulted prior to a decision, in the final analysis the decision was still top-driven (Heath & Gonzalez, 1995, p. 305).

This kind of linear decision making is easily quantifiable because it is based on legitimate power and lends itself well to an input-process-output model of single-loop learning, characteristic of industrial or modern organizations, especially when conflict is regarded as deviant behavior to be discouraged and ignored. There is a need for linear process in decision making in times of life-

threatening crises or when conditions are deterministic. However, today's technological environment is complex and unpredictable where stochastic events "pose difficulties for organizations, as they provide moving targets for learning, because environmental changes occur more quickly than people in organizations can learn about them" (Roberts & Grabowski, 1996, p. 412).

Earlier research also concentrated on decision making strategies that responded well to measures of utility and rationality, and where iteration and feedback loops resulting from dialogue were not factored into the decision making process. This linear practice while expedient, curtails the need for dialogue. Dialogue is essential to establish shared understandings in integrated product development.

To prevent corrective measures in hindsight and to ensure that quality is built into the product, team members need to communicate and learn from each other. This learning is not a linear process or single-loop learning but double-loop learning that consists of feedback loops. In postmodern terms, organizations using hierarchical forms of decision making are engaging in discussion. This is a superficial back and forth interaction which does not include a listening component or which pays lip service to the interaction, resulting in compliance rather than commitment to the task on hand.

Also earlier research concentrated on decision making either at the individual or executive level and not at the level of project teams (Beach & Mitchell, 1990, p. 19). Postmodern organizations emphasize teams and collective action through relationships and processes. There is connectivity in relationships such as network structures, where processes and participatory decision making

contribute to shared understandings and that leads to commitment, which is motivating.

The assumption is that decisions made by groups of employees whose members variously bring diverse expertise “will be higher in quality than those made by employees with more homogenous backgrounds, or by any one employee.” To be efficient and competitive, organizations are looking to teams for decision making affecting process and performance (Gruenfeld, Mannix, Williams & Neale, 1996, p.1).

The Greek term “dia-logus” means a free flowing of meaning through a group allowing the group to discover insights not attainable individually (Senge, 1990, p. 10). This free flowing of meaning through dialogue is the process that helps to shape and align the pluralistic cultures of a multidisciplinary team towards acculturation and adaptation. This eventually leads to shared understandings in an information-based society.

In an information-based society, interaction and access to information are paramount to performing many interdependent cognitive tasks (Finley, 1994). Therefore, whoever has access to information has access to power. In a knowledge-based organization, I contend that the team members are the new power brokers. Collectively, they generate an organization's valued asset which is the proprietary data in the form of hardware or software which provides an organization with its competitive edge in the market place.

Project teams contribute to the competitiveness of the organizations in which they function and the outputs of their product design decisions have internal as well as external constituents (Shulman, 1996, p. 358). For competitive time-to-market reasons, project teams working in high technology research and

development organizations are driven by time requirements in the form of program milestones which serve as constraints in the decision making process. Shared understandings achieved through the dialogical process are essential to integrated product development, and that requires time.

According to Toffler (1990), in such organizations power is shifting from the top of the hierarchy to the generators of an organization's proprietary data, who in this case are the team members in new product development. As stakeholders and the new power brokers, the team members rightfully demand a voice in the decision making process. This is transforming the concept of power and influence within organizations. If these new power brokers are excluded from "defining and solving the problem risks developing an incomplete solution or a solution to the wrong problem . . . the distress of exclusion can also cause people to sabotage the process and attack authority" (Heifetz, 1994, p. 118).

Thus, organizational decision making has to become more participatory especially in research and development environments; it needs to reflect the interdependency of the collaborative leadership relationship that results in new product development. Since power and influence based on expertise are diffused within the team membership, the resulting communication channels need to resemble a decentralized, multidirectional interactive network of human nodes linked towards achieving mutual purposes.

The multidirectional path of such communication channels flow horizontally, vertically and cross-wise to support interdependency, creativity and innovation (Finley, 1995, p. 458). As part of the interactive network each team member can initiate the decision making dialogic process towards achieving project goals.

Postmodernists such as Bergquist (1993), Heifetz (1994), Isaacs (1993), Schein (1994, 1995), and Senge (1990), propose that communication through dialogue encourages individuals to engage in decision making using two approaches. First, they can share their views with others and focus on a "common ground." Second, individuals can each have "a view, a way of looking at a larger reality [similar to an] opening up" (Senge, p. 249).

During the dialogical process which involves the exchange of information and reflective thinking, "individuals gain insights that simply could not be achieved individually" (Bergquist, 1993, p. 139). This interdependency is essential for new integrated product development which relies on task coordination and the resident techno-cognitive expertise that is diffused among the multidisciplinary team membership. Each team member influences the decision making process during the different phases of the product development life cycle through expert power, not legitimate power.

The end result of dialogue is the decisions the team makes to develop a product that represents the sum of their collective knowledge which I describe as the *teammind*. Teammind is a word I coined to describe the core knowledge the team develops in the process of new product development that is embodied in the collective mind. Peters & Waterman (1982) advocate that in an age of complexity and ambiguity, we need, "a new language" and to add new terms to describe complex evolution in organizations (p. 106).

Dialogue enables individuals to suspend their assumptions and hold them up for examination while they actively listen and incorporate the views of others, to ensure decisions to which all team members can commit (Senge, 1990, p. 243). In such situations, decision making becomes an "iterative process in

which individuals import and export perspectives across boundaries," and these perspectives need to be orchestrated to result in a common solution (Heifetz, 1994, p. 119).

More importantly, if a time element is imposed on the dialogical process it can limit inquiry and the evaluation of alternatives. This constraint affects the quality of the decisions made because each individual's cognitive capacity to learn and assimilate material is different. So why are these dialogic strategies not being used by project team members who need to engage in collective decision making, especially under time constraints?

In the study of decision making in project teams, the concepts of decision making, communication, time and collaborative leadership are interconnected because they each influence one another and are necessary ingredients for an effective decision making process. They can be treated separately to a limited extent to discuss the theoretical foundations of each of the areas but in the human context of decision making where task interdependency is the driving force, they have overlapping connections for meaningful interpretation.

There is evidence that differences in cognitive ability may contribute to the frustration and stress level that is purported to occur in participatory or consensual decision making (Parks & Corwin, 1995, p. 268). As a result, individuals may resort to making decisions based on superficial knowledge rather than on a deeper understanding of the problem gained through generating and evaluating alternatives together. In an age of instant communication, time takes on an even greater economic dimension, which then affects communication patterns. Engaging in good conversations with colleagues through dialogue which is exploratory and generative, is fast disappearing.

Individuals pressed for time tend to communicate in media that are convenient and expeditious (e.g., e-mail or voice mail). Psychologically, these electronic forms of communication cannot replace the face-to-face or eye-to-eye interaction required for the participative decision making process. According to Tonne (1997), "voice-mail is *not communication* as there can be no true dialog and dynamic idea exchange . . . technology will *never* take the place of the fine art of human interaction" (p. 19). Face-to-face interaction provides the human touch of verbal as well as non-verbal behaviors and cues which are observed and acknowledged to help build an environment of trust and commitment. A project team can then collaboratively accomplish its tasks, and more importantly under time constraints.

Significance of the Study

Decision making under time constraints is affected by the communication patterns and shared understandings of project team members. Program milestones for new product development define time requirements in at least fifty-one different ways (Peters, 1995). Time becomes utilitarian and is commodified. It is treated as a "perishable resource," measurable in quantitative terms affecting "revenue, productivity, lost opportunity, cost of capital, and inflation" (Peters, p. 532). However, no consideration is given to the impact of time on the human need for conversation to ensure shared understandings, which is the "essence of the organization" (Bergquist, 1993, p. 135).

If team members need to reach shared understandings on the product's mission, they need to develop a core knowledge base to perform their interdependent tasks efficiently. They need time to engage in dialogue to acquire and establish collective knowledge and to take action. Developing this core

knowledge base takes time, even with experienced team members. The fragmented knowledge resident in the minds of each team member still has to be communicated, shared, analyzed and evaluated in a multidisciplinary team learning environment where empowerment and participation are critical to the decision making process.

Due to the competitive environment for highly skilled professionals, organizations are under pressure to strike a balance between the development of technological solutions and the solutions they develop to engage and challenge employees in the workplace to be effective and productive. "If we did not need to communicate in groups, then we would not need to work on dialogue" (Schein, 1995, p. 24).

In addition, to survive and be competitive in a knowledge-based society, organizations are going to have to pay attention to how they manage their knowledge base to support their core competencies as well as their finances (Leonard-Barton, 1995, p. xi). Through decision making a project team helps to develop the knowledge base about a new product that provides an organization with its proprietary data to maintain the competitive edge.

Allocating time to engage in dialogue is conducive to collective learning for decision making because during that process, information is shared which contributes to the increase in the knowledge level of the recipients and to more informed decisions. According to Bellinger (1997), one of the reasons why projects run late in American companies compared to the Japanese is that the Japanese "take an agonizingly long time to arrive at a decision as they collect opinions from a variety of sources, but once the decision is made, they stick with it. In the United States, a lot of the decision making is done by the seat of the

pants.” Although Bellinger points out the American strategy is not altogether “bad” he cautions that it is important to know “when to ship” (p. 121).

The absence of dialogue can lead to a lack of information for shared understandings among project team members which can result in product deficiencies because of superficially made decisions. “Each individual or group requires information from another individual or group to perform their jobs successfully. . . . Yet if the information provided is in error, late or not communicated, then the fate of the entire organization may be affected” (Burch, Strater & Grudnitski, 1979, p. 6). Consequently, organizations respond to such developments by initiating corrective action processes in hindsight to remedy the misunderstandings among the different stakeholders. For example, lack of specific information for shared understandings during the initial phases of product development when the customer requirements are analyzed and a design approach is defined, results in a crisis situation because project milestones cannot be met, resulting in cost overruns.

Organizational management reacts with the creation of an organizational task force or “red team” to investigate and deal with the crisis. These “fire fighters” then become the organization’s heroes and are usually well-rewarded as the knights in shining armour who are dispatched to a project’s rescue in times of a project’s crisis.

Resources of time and finances appear limited to ensure shared understandings through dialogue during the initial stages of a project but appear prodigious and considered well-spent to manage in a crisis mode. I contend that such an outcome is counterproductive to efficiency, competitiveness and profits

because it is reactive and costly. It also implies a lack of visionary leadership involving planning.

Dialogue “facilitates and creates new possibilities for valid communication” (Schein, 1995, p. 24), because it serves to listen and hear the voices of all members of a particular group. Through communication the group can arrive at a common ground in decision making. In a postmodern organization, the leadership relationship embraces dialogue as a proactive and visionary form of engagement because it aids in long-term planning. As such, the inattention to the dialogical processes within organizations can be construed as a continuing preference for short-term planning, top-down decision making or the majority rule, instead of the postmodern participatory decision making focus towards the common good.

Also, decision making in project environments still appears to concentrate on management controlling the bottom line (Frey, 1994, p. 558). Instead, open communication should be encouraged. Open communication among the various stakeholders can create an enabling environment that encourages team members to establish a collaborative leadership relationship, based on task interdependency, where there is trust and mutual respect.

“While small group scholars acknowledge the importance of communication processes, most readily admit that we do not possess a clear understanding of how communication operates in group decision-making” (Hirokawa & Poole, 1986, p. 15). Researchers who observe the communication process during social interaction agree that something transpires during the group process that affects performance.

However, there is no agreement on: (a) what transpires during communication that drives performance; (b) if communication affects the group process negatively or positively; and (c) how communication can be “monitored, analyzed, and altered” to be effective (Hirokawa & Poole, 1986, p. 16). Parks and Cowlin (1996) state that the research does not address what phenomenon occurs “within the group as it deliberates [and that] more research is needed on groups in the workplace” (p. 307).

Therefore, the missing link appears to be research on the impetus that triggers performance within groups in the workplace. The findings cannot be generalized; they vary from situation-to-situation since such outcomes are embedded in the culture of an organization (Beach & Mitchell, 1990; Hassard, 1996). They can only be reconstructed: (a) through reflective face-to-face interaction with the researcher after the fact, (b) with the researcher as an observer during the decision making process, and (c) by team members themselves.

Using a case study methodology, such as in this study, the researcher can analyze, evaluate and interpret the interview taped sessions in order to unravel the complexities of the social interaction in a decision making context. “A communicative act exists only in the dimension of time. It is fleeting and transient. It ceases to exist immediately and is not permanently available for observation” (Fisher, 1974, p. 231).

Interaction among such team members is viewed as a collaborative relationship engaging in a complex cognitive process of double-loop or reflective learning because of the multidisciplinary skill-base of the team members “that opens inquiry into underlying ‘why’s” (Isaacs, 1993, p. 30). Through the process

of developing shared understandings of the task on hand, the members augment their collective expertise defined as core knowledge, and make decisions that they each can live with in a dynamic environment, even though it may not be their preferred solution (Rentsch, Heffner & Duffy, 1994, p. 452).

As organizational structures change, so must the communication structures and the research processes aimed at analyzing those structures. Communication is the “connector that links people together and constitutes organizations as networks of relationships” (Putnam, Phillips & Chapman, 1996, p. 382). Most of the current literature and research on decision making in groups still focuses on decision making strategies at the executive or management level. Such strategies are generally quantifiable and linear because they are based on legitimate power of hierarchical structures rather than on expertise which is dispersed power of the team network structure.

According to Hirokawa & Poole (1986), there is a problem with group communication research methodology involving decision making (p. 24). By nature, face-to-face interaction in a multidisciplinary project team making decisions lends itself to measures that are neither quantifiable nor linear. As a general rule the environment for new product development is ambiguous, dynamic and complex; such an environment cannot be described quantitatively.

Since the 1960s most of the research on communication and decision making has focused on small groups but qualitative research on participative decision making by teams is in its infancy (Fisher, 1974; Hare, 1976). Shared understanding for decision making is a complex and multidimensional process that can only be achieved in an environment of trust and respect (Korsgaard, Schweiger & Sapienza, 1995).

In addition, “qualitative methods are better than quantitative approaches for characterizing multivalent meanings and for tracing complex connections,” (Hirokawa & Poole, 1986, p. 22). Unlike in the industrial era, decision making for new product design in a postmodern era does not take place under discrete or deterministic conditions. In a knowledge-based society, the events are more continuous and stochastic where judgment, past experience, and risk taking interplay in the process of collective learning. “New technologies knit people, transactions, and locations together in a continuous process” (Roberts & Grabowski, 1996, p. 412).

Hence, qualitative research is appropriate for enabling team members to reflect retrospectively on their dialogic processes and to become more aware of those elusive, complex connections that contribute to collective learning. Learning “is the creation of meaning from past or current events that serves as a guide for future behavior” (Daudelin, 1995, p. 41). The team engaged in a collaborative leadership relationship using dialogue in decision making is a postmodern concept. So too is qualitative research about the process.

These factors warrant on-going research as organizational structures, relationships and processes change to accommodate participatory decision making in the workplace of a postmodern organization. This fact is especially significant among a highly-skilled workforce who contribute to an organization’s competitive edge. These knowledgeable individuals want a voice in the decision making process (Boyett & Conn, 1992, p. 237).

Current research indicates that workplace practices represent the “patterns of activity, the forms of interaction, and the systems of planning and innovation through which the firm generates value for its customers,” to make the

firm competitive (Mavrinac, Jones, & Meyer, 1995, p. 5). Therefore, these workplace practices need to be researched further in the context in which they are embedded rather than in a laboratory setting. "Getting things done in an organizational setting is not always easy, and many writers have drawn attention to the problems of 'collective action'" (Miller, Hickson & Wilson, 1996, p. 293).

Statement of Purpose

This study has three objectives. The first is to identify the strategies an intact project team used in the participative decision making process, under time constraints. This will be accomplished through a reflection on the narratives of the six participants interviewed in this case study, the minutes of the meetings, and the documentation they generated to design the human/computer or user interface of a sophisticated on-line or softcopy photointerpretation system. Decision making under such conditions is a complex phenomenon of human interaction as team members grapple with innovation and the unknown, especially when the customer is co-located with the project team and is part of the product's life-cycle development.

This is a unique situation because although the customer and contractor have a mutual goal to develop the product within the project milestones, they bring to the decision making environment two very different perspectives on product development. Customers control the purse strings and are interested in maximizing their investment by introducing feature enhancements called "feature creep . . . [which] is a designer's nightmare, one that a team doesn't banish" (Bellinger, 1997, p. 75). These enhancements can affect schedule as well as contract costs. The contractor, on the other hand, focuses on developing a quality product that fulfills the contractual requirements and satisfies customer

needs, and delivering the product within the project milestones, while making a profit.

These different perspectives are one of the main sources of conflict in new product development environments. The challenge in such an environment is for the contractor to manage the scope of the project by controlling the growth of requirements “and yet keep the customer happy” (Leffingwell, 1997, p. 28). In such situations dialogue can provide an enabling strategy for diplomacy, mutual understanding and collaboration.

A second objective is to challenge and evaluate theory in the social reality of the workplace where decision making really counts and to determine if such theories can provide some guidance in bringing about transformational change. Learning organizations need to come to terms with the complexities of the technological revolution by engaging the expertise of its knowledgeable workforce, towards mutual purposes. As a member of a project team who has been exposed to the theories of Bergquist (1993), Heifetz (1994), Schein (1994, 1995), and Senge (1990), through my academic experience, I seize this opportunity to research decision making strategies used by project team members in the workplace as they engage in new product development under time constraints.

Based on my workplace experience, I advocate a greater use of dialogue in the analysis or initial phase of a project's life cycle especially when a multidisciplinary team has to develop a product from a concept defined by a customer. In such a situation viewing the product's concept from different disciplinary perspectives of the team membership before arriving at a design

decision requires shared understanding, recognizing that no one individual can have all the answers.

It becomes a learning process of holistic or systems thinking “about understanding wholes not parts” (Senge, 1996, p.101). During this period of a project’s life cycle, the knowledge-base about the new product is established taking into consideration the different perspectives of the stakeholders on the project team and this is critical to a project’s success.

Therefore, this study will serve to determine how the concepts of time, dialogue, decision making and collaborative leadership can interplay with one another in a holistic manner towards the common good of the team members and the competitiveness of the organization. I expect that at times these concepts will be so intertwined that it will become very difficult to take them apart.

For example, communication is essential in the decision making process because information needs to be shared among the team members and time can affect the decision making process and communication. In order to engage in collaborative leadership the team needs to engage in communication to reach informed decisions. These concepts of the human experience overlap and are deeply embedded in the social construction of reality in the workplace decision making process.

The workplace becomes a learning environment that promotes a rich social context for relationships that are built on the trust and mutual respect of shared expertise as team members transform a concept into a product. The workplace also becomes a complex environment that utilizes a “task dominant team approach, in which everyone focuses on the entire development process

rather than one piece of it," and where communication has to flow continuously and freely "along multiple channels" (Dougherty, 1996, p. 427).

The third and final objective is that the results of this study may be used to recommend team-building skills where collaborative leadership becomes the end as well as the means of fostering productivity in the workplace through participation. Organizations such as Wiz Electronics (a pseudonym), the target organization of this study, can use the results of the study to improve in-house processes through the practice of self-evaluation to prevent learning disabilities.

According to Blake and Mouton (1978), a process is experiential and "is concerned with how those responsible for a performance, product, or procedure interact with one another as they engage in problem-solving activities . . . and can be useful for improving the quality and outcome of future interactions" (p. 16). Rentsch et al. (1994) support the notion that a process is experiential and advocate the need for team training because teamwork is a socio-cognitive complex phenomenon. They state that even though more work is being accomplished by teams and there is "considerable research in the area of team training, little is known about how to train teams" (p. 451).

Organizations can also use the results to recognize the synergism of collective thought and action, and to restructure their organizations to facilitate open communication, thus providing an enabling context for collective action learning. Many organizations are not able to learn from the past and suffer "from learning disabilities. To overcome these disabilities, the learning organization must develop the capacity for both generative and adaptive learning" (Choo, 1996, p. 329).

Learning disabilities cripple an organization's ability to grow and be competitive. McGill & Slocum (1993) state that "learning organizations reframe issues from experience and learn from that process" (p. 67). In the cooperatives of Mondragón, "self criticism" is the norm and is embedded in the organizational culture that encourages the leaders and members of the cooperatives to step back and "reflect critically on the way their organization has been functioning" (Whyte & Whyte, 1988, p. 295). According to Cyert & March (1992):

A business firm is a temple and a collection of sacred rituals as well as an instrument for producing goods and services. The rituals of choice tie routine events to beliefs about the nature of things. . . . As a result, recent research on organizations has introduced concepts of decisions and decision making that highlight the role of decisions and decision making in the development of meaning and interpretations . . . the processes of choice reassure those involved that the choice has been made intelligently, that it reflects planning, thinking, analysis, and the systematic use of relevant people, that the right people are involved. (pp. 236-237)

For this study, I interviewed a sub-team of an intact multidisciplinary engineering project team in the workplace. The unique feature of this project is that the customer is part of the team, immersed in the daily activities of analyzing, designing and developing the new information system. This team engaged in a six-month period of intense communication where decision making was the purpose and the end result.

Interviewing these intact team members in the workplace places them in the context of their organizational social reality. Most of the published research on decision making is conducted with ad hoc teams in controlled laboratory

settings using canned scripts and artificial tasks and where the decisions made have no far reaching implications (Frey, 1994; McGrath, 1991; Pavitt, 1993).

“If we want to understand work group performance we are going to have to use non-laboratory methods . . . groups in organizations are not like ad hoc aggregates of individuals brought together in a laboratory for the occasion of research” (Shulman, 1996, p. 359). Thus, I used naturalistic inquiry through unstructured interviews to understand, interpret and analyze the narratives of the six team members as they reflected on their experience of the decision making process.

I recognize that the “multiple realities [of the world] are a function of personal interaction and perception [rather than the traditional] single, objective reality” which is the focus of quantitative methodology (Merriam, 1988, p. 17). Reflections like post-meeting reactions (PMR) are introspective as well as retrospective about a process. They provide an opportunity for team members to anonymously engage with the researcher in exposing their true feelings about a process they experienced (Blake & Mouton, 1978, p. 59).

Reflections also provide an environment for learning. Team members can retroactively reevaluate their experiences, which involves acting and learning, if they want to improve on a process (Dixon, 1994). Heifetz (1994) states that we can learn “by reflecting on daily actions, successes and failures, of ourselves and others” (p. 273). Through a descriptive case study, I interviewed a subgroup of six team members from a project team of over forty members and analyzed their transcriptions of tape recorded interviews and recorded historical minutes. The unstructured interviews of the subgroup were reflections of a decision making process that constituted their lived experience.

The objective of this subgroup's decision making process was to design a human/computer interface for a complex softcopy or on-line photointerpretation information system. This is an information system that is able to recognize digital imagery in "real time" and assign it a geolocation using photogrammetric techniques. It is interesting to note that these team members were designing the human/machine or user interface for the future users of an information system to make it user friendly, while they were struggling for coherence and shared understanding within their daily human-to-human interaction of their own social reality.

The impact of the team's decisions has far reaching consequences for the rest of the project team and the users of the system. The rest of the project team members are using the by-products of this process, which is the design documentation, to design and test the system. The user interface design decisions will affect how the future users of the system will perform their tasks in real-time, and how their job performance is affected by the screen designs.

I found the interviews educative in heightening awareness about the dialogical and decision making process. Dialogue itself becomes a means and an end of the decision making process and this has implications for collaborative leadership. The implications of the findings for collaborative leadership center around the notion that to successfully develop a relationship built on trust and mutual respect, team members need to engage in a dialogical process.

The process of inquiry and reflection encourages team members to evaluate the outcomes of their decisions, even under time constraints. "Through communication the form and content of decisions are worked out" (Poole & Hirokawa, 1996, p. 8). Dialogue enables team members to construct their own

social reality and evaluate alternative solutions towards enhancing the quality of decisions.

Limitations of the Study

The limitations of the study are also its strength. The unique workplace environment may be viewed as a limitation because it is influenced by the culture of the organization. The literature, however, advocates more research in the workplace where decision making really matters, realizing that such studies are not generalizable.

Another limiting factor was that although there was diversity in the professional disciplines, the subgroup was composed of all Caucasian males, which is representative of the demographics of the electronics industry. I can only speculate that the results may be different if there were a gender mix. According to some theorists, gender socialization affects communication patterns. Men display more rational or instrumental patterns associated with task orientation, whereas women are "socialized into communal or expressive patterns" (Barge, 1996, p. 307). Other theorists contend that there are no differences in gender communication patterns in a task-related environment.

Since this is a qualitative study which is concerned with "studying natural groups in context . . . that are characterized by stable yet permeable boundaries and are interdependent with their context" (Frey, 1994, pp. 555-556), there are no generalizations to the population at large. "What is being observed are people's constructions of reality, how they understand the world" (Merriam, 1988, p. 167).

The "lived experience" through the words of the participants, the recorded minutes of the decision meetings and the products the participants generated,

allows a researcher to capture what actually transpired during the intensive decision making process. The researcher can then interpret those actions to make some preliminary assumptions. "Tukey (1969) pointed out, quite accurately, that no single study, regardless of where and how it is conducted, can establish a generalization; only through replication can the findings from a study be extended reliably" (in Frey, 1994, p. 563).

Reflecting on the process is advantageous for research purposes. Participants can retrospectively re-evaluate and assign meanings to the decision making process, through a process of "integrative rehearsal" in long-term memory (Lindsay & Norman, 1977, p. 318). Integrative rehearsal is the process of subconsciously evaluating past experience to create meaningful structures that aids in long-term memory storage. The question remains whether the findings would have been different if the interviews were conducted shortly after the event rather than six months after the fact, when the recency of the experience in short-term memory provides for better recall.

Researching the reflections retrospectively has the advantage that team members had more time to step back from the process, digest and reflect on what happened instead of having to evaluate what is going on while involved in the process. Based on cognitive science concepts of memory storage and retrieval, there is the danger that human memory recall capabilities diminish with time. On the other hand, through "integrative rehearsal" meaningful structures or connections are developed which aids in the reconstruction of reality in a meaningful way, to present perspectives that lend themselves to a richer interpretation of events.

Another limitation may be the biases a researcher brings to the study because a naturalistic researcher is “the instrument through which the data are acquired” (Frey, 1994, p. 562). In order to minimize my biases and to ensure that I did not completely drive the analysis, after analyzing the data of the preliminary interview with each participant, I submitted my preliminary assumptions to each participant for their review and revision.

Their feedback served as a validity check to help me with the formulation of my analysis. I also randomly reviewed sixty meeting minutes and ten documents called the design requirements bulletins (DRBs) created by the team to validate some of the factual documented outcomes of the process. Through the use of triangulation, I hoped to further minimize my biases.

Restricting the interview time to two hours for each participant is seen as a limitation but it was necessary so that I would not abuse the unusual privilege of interviewing team members in the workplace especially when their time is at a premium. The literature review indicates that there is a real need to interview intact teams in the workplace making decisions that really matter, under time constraints. Access to such teams is difficult unless the researcher has the support of organizational gatekeepers (Frey, 1994; Pavitt, 1993).

Definition of Terms

In the spirit of more active communication and shared understandings, and when researchers explore new realities, they must ensure that their readers understand the terminology used in their studies. What follows is a definition of the terms used in the context of the issue under investigation.

Participative decision making is using political skills of negotiation and persuasion through dialogue to agree on a preferred solution to which all team

members are committed towards the common good, even though it may not be their preferred solution. Diverse opinions are considered and evaluated during the decision making process before a decision is made.

Toffler (1990) developed the concept of *powershift* which not only refers to the shift in power from the dominant in society to those in subordinate roles, but also to the transformation of power itself from order to chaos in a changing world of restructuring and disintegration. In a knowledge-based society power is shifting from the top of the organization to the generators of an organization's valued asset which is its proprietary data in the form of hardware and software. Therefore, the new power brokers are the team members who generate an organization's valued asset through expert power.

Teammind is a word I created as the researcher to describe the collective thought process of the team members that results in shared understanding and the core knowledge that develops during the collaborative leadership relationship that results in integrated product development. This includes the terminology and concepts about the product. The resulting product design decisions and the final product is therefore the sum of the teammind.

Real-time communication is defined as the social interaction among two or more persons as it naturally occurs. Real-time decision making is the ability of individuals to engage in critical thinking and make design decisions based on information as it is presented and without prior preparation. Doing something on a system in real-time means the ability to perform an action on the computer and obtain results while interacting with the system.

In an information age, knowledge professionals working in a multidisciplinary research and development environment have to develop

sophisticated high technology products while they interact with one another. This demands communication, interpersonal, technical, perceptual and synthetical skills, herein referred to as *socio-techno-cognitive* skills. This set of skills is needed in order to understand and collectively select and integrate the perspectives of other disciplines to form the core knowledge of the teammind, that results in integrated new product development.

The terms *cross-functional team* or *multidisciplinary team* are used interchangeably. Such a team is composed of members from different disciplines and customer and contractor organizations who work together on a project. In this study the team is drawn from the engineering functional areas of a matrixed organization and assigned to a specific project.

Multidisciplinary teams are generally co-located or all work in one area. The reason for the co-location is to facilitate communication and develop an integrated product that includes the perspectives of the functional disciplines of hardware, software, systems, human engineering (screen and screen behavior design), reliability, and quality. In this study the reference is made to a project team that is composed of members from such different engineering disciplines.

In most research and development projects the customer and contractor have counterparts in each of their organizations that make decisions on the product. It is rare for the customer to be co-located with the project team and participate with them in their day-to-day activities. Some projects extend their team to include the marketers, procurement representatives, etc. This study restricted the team to the engineering disciplines.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Multidisciplinary project teams using participative decision making under time constraints for new product development, present challenges to current hierarchical organizational structures. The literature review considers the use of communication and specifically dialogue as enabling an intact project team to engage in participatory decision making through shared understandings.

The selected theoretical origins and concepts of organizational structure and collaborative leadership, communication and dialogue, and decision making bounded by time constraints are cited to establish a framework for this case study research. Although these concepts are discussed separately, they are really interconnected in the decision making process since they represent the totality of the human experience within this research context.

The five concepts interrelated to decision making are examined in this literature review to provide the rich environment under which a project team performs their interdependent tasks: organizational structures, collaboration as structure, communication and dialogue, time, and decision making. I discuss each of the first four concepts separately in order to expose the complexities of each concept. I end with the literature review of the decision making concept because effective decision making really involves the blending of all the other components. The chapter ends with a summary of the literature review.

The Structure of Organizational Contexts

Organizations respond to the driving and restraining forces of the social, political and economic environment in which they operate. The speed of technological development and global competitiveness is challenging traditional hierarchical organizational structures and policies. Organizational structures and policies provide the infrastructure for change and they become even more important in periods of turbulence where opportunity and threat coexist.

To survive and be competitive in a turbulent environment that is marked by rampant change, organizations that develop and interact with complex technology are going to have to find new ways of communicating with and using the diverse talents resident in its entire workforce. According to Reich (1987):

If America is to win in the new global competition, we need to begin telling one another a new story in which companies compete by drawing on the talent and creativity of all their employees, not just a few maverick inventors and dynamic CEOs. (p. 80)

Bergquist (1993) refers to today's organizations as turbulent waters "typified by a mixture of accelerated and unpredictable change" (p. 233), which has implications for organizational leadership and the structures through which work decisions are made and products are generated.

In a knowledge-based society, the computer network structures that provide the infrastructure through which individuals perform many of their interdependent tasks are by nature horizontal rather than hierarchical, thus affecting how work is being organized. These network structures are horizontal because common software applications are shared resources and each

individual needs the input from another to perform their interdependent tasks so that the sum of their effort results in an integrated product.

The network structures also help to facilitate the flow of information through technology, to the human nodes that make up the interactive human network. Through these structures, human intellect produces technology and interacts with technology to develop a novel product. "Technology and structure are thus both a process and a product of human action and interaction" (Roberts & Grabowski, 1996, p. 418). Therefore, organizational structures are going to have to change to facilitate the accomplishment of complex tasks based on interdependency and technological sophistication.

Expert power which is based on cognitive and technical prowess is no longer identified with those in managerial roles, the legitimate power. In today's information society the speed of technology has contributed to an explosion of information that can be processed in nanoseconds faster than human beings can digest it. To perform complex tasks for new product development within this environment requires the expertise of a multidisciplinary team.

The information and knowledge that is needed for new product development decision making can only be analyzed and processed through the collaboration of several individuals engaged in a network of relationships. Power thus becomes more diffused within the workforce of the organization because no individual can have all the solutions to a problem. Today, whoever has information or access to information has access to power (Toffler, 1990).

The organizational structures that can support and enable the flow of this information in a meaningful way, with speed and timeliness, may ultimately determine the competitiveness of an organization in achieving its goals (Powell

1990; Toffler 1990). In addition, decision making in complex technological environments requires the collective intelligence of all those who contribute towards an organization's competitive edge; information based on expertise is generally fragmented in the heads of individuals and therefore dispersed throughout the organization.

If decision making is to be effective, the structures that support it need to match the environment. If the environment is complex which means it "contains varied and interactive institutions, customers, technologies and so on," then a wider participation of the workforce in the decision making is needed to ensure that the information is correlated and relevant for effective decision making (Bass, 1983, pp. 117, 187).

This has implications for leadership. Transformational leadership is about change and ensuring that all voices are heard in learning organizations. The organizational structures, whether hierarchical or networked, determine whether leadership will be position-based or dispersed.

"In times of great transition, leadership becomes critically important . . . and the magnitude of today's changes will demand not only more leadership but newer forms of leadership" (Conger, 1996, p. 32). Accordingly, an emerging form of leadership within postmodern organizations is change-oriented or transformational and relationship-centered, which emphasizes collaboration of the various stakeholders towards mutual purposes in an environment of trust.

Collaboration as Structure

In a knowledge-based society, transformational leadership can take place at many levels of the organization because it is based on expertise and

commitment to intended change, not on position. The literature refers to this as “dispersed leadership” (Bryman, 1996, p. 283).

Interdependency and collective socio-techno-cognitive prowess are fundamental to product success and cross-functional project teams provide the collaborative teamwork structure for such leadership. Today’s problem-solving environment involves the collective interpersonal, technical and cognitive expertise of the teammind. According to Heifetz (1994), “the lone-warrior model of leadership is heroic suicide. Each of us has blind spots that require the vision of others” (p. 268).

Chrislip and Larson (1994) indicate that the move towards participative and collaborative practices “of teamwork and collaboration, and organizational learning” in companies like Nike, General Electric, Ford and Herman Miller have contributed to their success in the “highly competitive international business environment” (p. 6). Katzenbach and Smith (1993) refer to such project teams with a high performance ethic as “real teams.” These teams are composed of “a small number of people with complementary skills who are committed to a common performance purpose, performance goals, and approach for which they hold themselves accountable” (p. 45).

Likewise, project teams in high technology research and development organizations need to collaborate because of their collective expertise to develop a new product for which they are held accountable. According to Chrislip & Larson (1994), collaboration’s “Latin roots—*com* and *laborare*—indicate, it means ‘to work together’” (p. 5).

The synergy of collaboration was evident in the Greek military campaigns “lasting until 448 BC, [when] a coalition of more than 20 Greek cities defeated the

powerful empire of Persia," because of the perfect synchronization and unison of the ships' rowers (Smith, Carroll & Ashford, 1995, p. 7). Thus the concept of cooperative forms of relationships is inherited from the Greeks and pervades the writings of Plato. It serves as the foundation for cooperation and coordination within organizational systems of the Western world.

However, Protestantism in the United States gave rise to "increasing self-reliance" and "the pursuit of personal interests." Then came the collectivist and relationship theories of both Durkheim and Weber (in Wagner, 1995, p. 153). It was the social scientist, Parsons, who introduced the distinction between "self-orientation and collectivity-orientation" to North America, pointing out that self-reliance pursued "private interests irrespective of their bearing on the interests of others" (Wagner, 1995, p. 154). The move towards promoting collectivism and the common good is based on relationships and processes; this concept is central to postmodernism (Bergquist, 1993).

Some research indicates that, "when society is chaotic and groups of people are in opposition, group-centered phenomena (cooperation-competition, group consensus, etc.) are central research concerns" (Davis, 1986, p. 7). This appears to be a valid observation especially in today's chaotic environment of restructuring and downsizing. Organizations are preparing for an age of alliances and partnerships recognizing that in such a competitive world, survivability is based on interdependency.

Organizations are less likely to operate in isolation but are affected by the dynamics of their environment. Organizational ecologists explain that "as environments change, leaders or dominant coalitions in organizations alter appropriate organizational features to realign their fit to environmental demands"

(Baum, 1996, p. 77). Thus, when societal relationships gravitate towards interdependency for survival, it has a rippling effect on organizational relationships. Postmodernists view collaborative leadership within project multidisciplinary teams as relationship-centered. It is an emerging concept with very little empirical research.

The research that is available on collaborative relationships concentrates on collaboration at the strategic management level in organizations and not at the level of project teams involved with new product design decisions in the workplace. However, project teams involved with the day-to-day design decisions for new product development are concerned with many functions of strategic management, (e.g., having the appropriate human resources, technological resources, planning, time, budgets, profits, customer satisfaction, quality control and their own career growth). In addition, according to Santo (1997):

In many companies, teams will assume functions typically performed by management, among them identifying applications of innovations and defining product opportunities. Doing that effectively requires the ability to inform or even sell upper management on a course of action . . . to contribute to corporate strategy. That requires business savvy and awareness of international markets. (p. C27)

New product management like executive management "is also inherently ambiguous and involves perception and social construction" (Dougherty, 1996, p. 425). Therefore, current available research on strategic management teams is also reviewed to evaluate the decision making strategies used by such teams, since they also need to operate under ambiguous conditions where they

construct their own social reality while contributing to an organization's competitiveness.

Collaborative leadership relationships advocated by postmodernists like Bergquist (1993), Heifetz (1994), and Senge (1990) promote the involvement of individuals in a relationship towards change. Heifetz (1994) describes this engagement of individuals as doing "adaptive work [where the goal is to] face rather than avoid, tough realities and conflicts" (p. 23). Embracing this challenge as an egalitarian process can help to foster a democratic spirit of collectivity towards change for the common good, as well as ensuring that individual goals are satisfied (Cheney, 1995, p. 171).

New product development requires the expertise of the team membership which promotes the concept of dispersed leadership. According to Barge (1996), leadership is defined as a process that helps the group:

Overcome the variety of task and relational problems encountered by the group. . . . Leadership must help the group understand what these information inputs mean and facilitate the group toward taking action that helps the group achieve its goals. . . . "According to Ashby's (1968) law of requisite variety, only variety can regulate variety." As the information environment becomes more complex, the number and variety of behaviors, processes, strategies and tactics that can be used to make sense of the environment and to take action must also increase.

(p. 319)

The concept of leadership has been evolving from the great man theory, to trait theory, to leadership styles, but all in the context of an individual in a position of power (Hughes, Ginnett & Curphy, 1993; Rost, 1992; Wren, 1995).

Burns (1978) introduced the notion of transformational leadership as a relationship between leaders and followers towards addressing mutual purposes.

Transformational leadership is concerned with change and action. According to Isaacs (1993), "given the nature of global and institutional problems, thinking alone at whatever level of leadership is no longer adequate. The problems are too complex, the interdependencies too intricate Human beings everywhere are being forced to develop their capacity to think together — to develop collaborative thought and coordinated action" (p. 24).

Many theoretical concepts can be used to describe collaborative relationships that advocate participative decision making. Five broad categories are: (a) exchange theory, which is a means of "maximizing economic or psychological benefits"; (b) attraction theory, which focuses on what attracts individuals and groups to each other; (c) power and conflict theories, which focus on "tendencies toward conflict" or its opposite, collaboration; (d) modeling theories, which focus on social learning process; and (e) social structure theories, that emphasize the role of structural factors in fostering collaboration (Smith et al., 1995, p. 17).

As workplace structures transition from the vertical to the horizontal in response to changing needs for information and action in an era of complexity, and multidisciplinary teams gain in popularity in organizations, a postmodern concept of a leadership relationship will emerge (Bergquist, 1993; Boyett & Conn, 1992; Bryman, 1996; Heifetz, 1994; Senge, 1990 and Toffler, 1990). "Leadership is a more complex phenomenon than originally thought. . . . [it] mediates the information inputs collected by the group," and facilitates the group's action towards mutual purposes (Barge, 1996, pp. 317-319). Therefore, just as in a

personal relationship, a collaborative leadership relationship can only survive if there is continuous and open communication.

Communication and Dialogue

Communication serves as the conduit and the “connector that links people together and constitutes organizations as networks of relationships” (Putnam et al. 1996, p. 382). This network of relationships enables collaboration through dispersed leadership based on expertise. In order to maintain a collaborative relationship in an environment of increasing complexity, where our concepts of time are changing, communication ensures the sharing of necessary information to make informed decisions.

Communication is at the heart of collaborative leadership and participative decision making. The Latin root “*communicare* means to share. We must be able to share if communication is to be truly meaningful” (Finley, 1995, p. 459). Sharing of knowledge and perspectives is fundamental to new product development. “A new product is a package of features and benefits, each of which must be conceived, articulated, designed, and ‘operationalized’, or brought into existence” (Dougherty, 1996, p. 425).

The project team, through sharing collectively, breathes meaning to new ideas in new product development. These new ideas create information systems that will transform the way a sector of society will perform their jobs. When team members have to develop a product from a concept given to them by the customer through a contract, a sharing of knowledge needs to take place in order to ensure that the right design decisions are made by the teammind.

The environment for group task performance in new product development is usually ambiguous, complex and uncertain. To reduce the uncertainty, team

members need to communicate by engaging in dialogue. Team members need to focus on "discussing issues, analyzing evidence and ideas, and advancing and refuting knowledge claims" (Salazar, 1996, p. 166). Through open dialogue where speaking and listening takes place, they can develop shared understandings and establish a core knowledge base which they will require for integrated product development.

During this dialogical process, team members share with one another their personal or private knowledge (called tacit knowledge) gained through experience. They integrate that private knowledge with the explicit knowledge or learned knowledge that can be easily shared to develop a core knowledge base about the product to be designed (Dixon, 1994). The integration of these diverse perspectives based on the tacit or explicit knowledge of the team membership takes place through communication and learning, and is then transformed into the core knowledge base which resides in the teammind.

According to Choo (1996), "knowledge creation is achieved through a recognition of the synergistic relationship between tacit and explicit knowledge in the organization, and through the design of social processes that creates new knowledge by converting tacit knowledge into explicit knowledge." Tacit knowledge is more subjective and categorized as personal knowledge or private knowledge that is hard to communicate to others and explicit knowledge is objective and learned and this is easier to communicate to others (p. 334). Choo (1996) and Dixon (1994) state that these forms of knowledge are complementary and when communicated, can contribute to team or collective learning.

In addition, through communication, team members construct their own social reality with their mental models and develop a project language around the

terminology of their new product. The construction of social reality based on “time and place” becomes an acculturation or a socialization process which demands adaptive skills as learning occurs (Hunt, 1984, p. 169).

According to Hibbard (1997), the creation of knowledge for innovation is a spiral process. “It starts with people sharing their internal knowledge by socializing with others or by capturing it in digital or analog form. Other people then internalize the shared knowledge, and that process creates new knowledge inside them. Those people then share their new knowledge, and the process begins again” (p. 52). The sharing of knowledge requires real communication.

Communication provides the linkage that connects people within organizations as networks of relationships that enable collaboration. “The emphasis on relationships is decidedly a postmodern concept” (Bergquist, 1993, p. 120). Miller (1993) characterized relationships as growth fostering, where “each person becomes a more developed and more active individual only as s/he is more fully related to others” (p.1).

However, it is communication through dialogue that can ensure a meaningful sharing of information. Through dialogue, team members “suspend their defensive exchange” and engage in action learning based on experience. “Dialogue can transform action and promote organizational learning through developing synergy, empathy, and authentic deliberation among individuals” (Putnam et al. 1996, p. 393).

The discipline of team learning has to start with dialogue, which allows team members to suspend their personal assumptions and to enter into a genuine thinking together towards developing the teammind or the collective mind. “Dialogue represents a rich and, many contemporary observers would say,

rare realm of human experience" (Anderson, Cissna & Arnett, 1994, p. 26). This kind of communication is the life-blood of the relationship where task interdependency requires the shared socio-techno-cognitive knowledge of the many disciplines for integrated product development.

In such an environment communication serves to link individuals in a network of human nodes as it flows in multidirectional paths. Because the input of each human node is vital to the collaborative leadership relationship based on the concept of diffused expert power throughout the team membership, anyone in the network can initiate the communication.

When such communication is initiated by one of the human nodes in the network it takes on a sense of urgency for strengthening human relations by demanding a response out of mutual respect. It is the stimulus of thought expressed through narrative that demands a response in the form of an action (Finley, 1995; Senge, 1996).

However, it is the face-to-face and eye-to-eye interaction through dialogue that is the focus of a particular form of action in the decision making process. "The more technology invades our lives (high-tech), the more we seek to balance it with some humanizing counterforce (high-touch)" (Young & Post, 1994, p. 28).

Through dialogue differing viewpoints are actively encouraged and solicited, thereby providing a multifaceted outlook towards the development of new mental models and cognitive structures, wherein learning takes place. "Dialogue aims to build a group that can think generatively, creatively, and, most important, together" (Schein, 1995, p. 25), so that the decisions the team members make represent the diverse perspectives of the team membership.

Dialogue also serves to ensure that the quality of the decisions made are neither based on majority rule nor premature consensus resulting in groupthink, like in the Cuban Missile Crises (Allison, 1971; Janis, 1982). Decisions should be based on a careful evaluation of the alternatives, even though there are conflicts. In a postmodern organization, conflicts present an opportunity for learning and growth. Therefore, through dialogue conflicts need to be addressed by all parties who then agree to a course of action that will help to ensure the integrity of a decision.

By evaluating the diverse opinions of team members, dialogue serves to provide alternative ways of looking at a problem and through focusing, selecting an alternative that determines the team's common ground. "The presence of dialogue, moreover, implies no given style of interaction. The 'mechanics' of the process may be different in each and every leadership situation" (Grob, 1984, p. 275). Dialogue embraces divergent thinking that enables team members to accept and respect their differences.

"Communicatively achieved understanding is dependent on undistorted communication, the presence of free discussion based on goodwill, argumentation and dialogue" (Alvesson & Deetz, 1996, p. 202). Once these differences or divergences are aligned and shaped through socialization and learning about product design, there is hopefully a convergence of thinking in the decision making process to a common ground. This convergence is particularly important in product design decisions because the sooner the team agrees on a solution, the faster they can start developing the product to meet project milestones.

According to Heifetz (1994), "the inclusion of competing value perspectives may be essential to adaptive success" (p. 23). Heifetz promotes the notion of adaptive work as a learning process where differences are addressed and reconciled as a proactive challenge to the leadership relationship. "Relationships among the team emerge through mutual adaptation, in response to the needs of the task" (Dougherty, 1996, p. 427).

To ensure shared understandings in a project team, members have to experience an acculturation or socialization process because they each speak with a different voice and use different terminology from the perspective of their functional disciplines. For example, for a software engineer the term "interface" could mean the interface between one software functionality and another; to a system's engineer "interface" could mean the interface between subsystems or hardware components of the system. While both definitions are correct they are interpreted from each engineer's functional discipline perspective which are parochial; there is a need to ensure understandings from a holistic or product systems perspective.

In addition, "to enhance communication and ensure accuracy of shared meanings, the team [needs to develop] a project language around the unique terminology and processes of their product and environment" (Finley, 1994, p. 65). Therefore, the voices of the different stakeholders have to be acknowledged, heard, understood and evaluated through dialogue to ensure a design that is the sum of the teammind, determined through shared understandings.

Dialogue, "is a process for building common understanding, in that it allows one to see the hidden meanings of words [and it also helps to speed up]

the development of the group" (Schein, 1995, p.27). According to Ford & Ford (1995), "dialogue provides an opportunity to (a) examine the assumptions which underlie thinking and to reflect on the implications of that thinking, (b) develop a common language among participants, and (c) create a shared context in which people learn how to talk to each other" (p. 548).

When engaging in complex ambiguous tasks, it follows that the communication activity also becomes complex. There is more information that needs to be collected, shared, evaluated and digested in order to make decisions that maintain the competitive edge, while meeting customer needs (Barge, 1996, p. 329).

Therefore, the important aspect of face-to-face communication is that it occurs in "real time,' over time, at a particular time, and in a particular setting" (Scheidel, 1986, p. 114). Real time is defined as the time at which communication actually occurs as one is speaking. A communicative act such as dialogue exists only in relation to time, and as time is fleeting it has ramifications for the decision making process.

Time

The speed of change brought on by technological developments is affecting our traditional concepts of time and space and how we communicate with one another. In cultures such as the United States where "life is hurried, and time is money" (Hofstede, 1991, 121), time is treated as a valued commodity to be used efficiently. It becomes a framework within which a culture orientates itself and an organization defines its goals either in short term and/or long term planning. In particular, an organization's culture embodies the values of the environment in which it resides.

Time is characterized as a constraint in the decision making process where task interdependency is essential for new product development. "A project is considered 'successful' if it is completed on time, within budget and to the specified standards" (Chan & Kumaraswamy, 1997, p. 55).

According to Bronner (1982), team members must be aware of the negative consequences of their non-performance in the decision making process for there to be a time pressure (p. 24). Constraints can have dual purposes and are defined as a "driving force or a restraining force, exogenous to the decision process, which modifies the process. . . . Constraints can curb, check, hold back and narrow the process, but they can also push, facilitate, stimulate, and expand it" (Bass, 1983, p. 115).

Time is also a constructed dimension. "We must live in the temporal world we build. At best it is an efficient adaptation to the patterns of nature and culture, a structure that gives meaning to our activities and allows us to have many different facets to our lives. At worst, time is a form of tyranny" (Friedman, 1990, p. 120).

These perspective of time have an impact on the way organizational leadership perceives and values resources such as time, especially in a competitive marketplace. In determining competitive strategies for new product development, time becomes the "equivalent of money, productivity, quality, and even innovation" (Spanner, Nuño & Chandra, 1995, p. 78). Mandating that the solutions for a product design have to be accomplished within a time frame of program milestones, places an "unspecified pressure for mental achievement" on team members. This can result in behaviors that appear stressful (Bronner, 1982, p. 1).

"The commodified image of time thus emerges as primarily a by-product of industrialism," with its sequential manufacturing processes and where time and motion studies quantified time in discrete units of discipline (Hassard, 1996, p. 583). However, this quantification and rationalization of work time lends itself well to repetitive processes and to machine-based tasks. Quantification and rationality do not support complex socio-techno-cognitive tasks. These tasks are usually ambiguous and interdependent on learning and knowledge integration through communication, reflection and double-loop learning, until understanding is achieved.

In an information-based society where human interaction is key to performing many cognitive tasks that are not repetitive and where one individual does not have all the answers, time has to take on a more qualitative flavor. These team member face-to-face interactions have to be meaningful so that the words and thoughts expressed help to build shared understandings —this takes time. In order for text and narrative to be understood, there has to be a timely interpretation of what transpires in the form of dialogue and an internalization of the concepts to ensure that the understandings lead to the development of a core knowledge base among the team membership.

The concept of "quality time" seems more appropriate. It does not mean that time is expandable but the emphasis has to be on ensuring that the available time for interaction is used productively and efficiently. It means that those involved in the decision making process need to have the necessary resources of information and appropriate people to engage in meaningful dialogue and to create their own shared understandings about the task to be accomplished.

Placing unrealistic pressures on project teams without the input of the team members involved in the process can result in some dysfunctional behaviors within the group (e.g., dominance by some group members over others resulting in passive behaviors by some members of the team).

Disregarding or not taking into consideration the input of team members erodes the level of trust and mutual respect that comes from engagement where different voices with different viewpoints are supposed to be heard and acknowledged.

Thus, time becomes a regulator of behavior and stress and that stress is situational. According to Driver, Svensson, Amato & Pate (1996), time together with “uncertainty, complexity and the prospect of important consequences, good or bad [constitute an] environmental load factor.” If the load factor is high people will resort to a satisficing or a “unifocus” style of decision making which is hierarchical. When the time pressure is moderate, the decision making style is more maximizing and “multifocus” or integrative. They further state that decision styles that dictate the moderate or heavy load styles are more prevalent when performing various roles in organizations, even in day-to-day operations (p.47).

However, most of the research to date on decision making under time pressure has focused on the related impacts on individual decision making. It has also focused at the management level rather than on the level of project team members making decisions. “March and Simon developed the first systematic approach that included time as a determinant in the behavior of resolving problems” (in Bronner, 1992, p. 12). With time pressure, individuals and groups use a process of screening and scanning to “weed out wholly unacceptable

options,” and switch between strategies of speeding up the decision making process or switching to “simpler strategies” (Benson III & Beach, 1996, p. 222).

The results of a study on five successful companies involved with developing sophisticated products ranging from the Boeing 777 Aircraft to a Digital Satellite System by Thomson Consumer Electronics, concluded that time considerations resulted in the emphasis on smaller and “less formalized teams with strong leadership roles [and less time spent on] development and evaluating product design alternatives.” However, there was also the emphasis on “strong communication links” with all stakeholders during the early period of product development (Swink et al., 1996, p. 241).

In a dynamic marketplace, maintaining the competitive edge in new product development and satisfying customer needs is paramount to survival. One of the strategies for survival is “shortening the time it takes for the product development process,” so the product can be marketed as fast as possible (Zirger & Hartley, 1996, p. 555). In order to shorten the development time, it is essential that all stakeholders, including the customer, reach a common understanding and agreement on the requirements for a new product, in a timely manner. Thus time is of the essence in new product development.

Although there is extensive research on decision making, “one aspect of decision making that has not been studied sufficiently is the question of time constraints on decision making . . . the principal problem of using time resources in decision making is a new frontier in science” (Bronner, 1982, p. 12). The existing research also views working time from the perspective of rational models which are linked to production management. Hassard (1996) argues that we need both qualitative as well as quantitative methods in evaluating working time,

because working time “is a much richer phenomenon than is portrayed in mainstream industrial sociology” (p. 585).

In a fast moving technological society with competing activities, time has “linearity and value . . . its scarcity enhances its worth” (Hassard, 1996, p. 583).

In addition, because of the accessibility to and intensification of information, decision making within organizations is also expected to be just as instantaneous, which is stressful and can affect the quality of the decisions.

According to Szilagyi & Wallace (1987):

Managers often note that their scarcest valuable commodity is time.

There is not enough time for engaging in conversation during new product development and this often leads to distorted communications. A major temptation when one is pressed for time is to short-circuit formal communication channels. (p. 408)

Even though this approach provides a seemingly expedient resolution to the design problems, it has detrimental consequences in an integrated product development team environment of task interdependency. In such an environment meaningful communication contributes to shared understandings of the project's mission and goals.

However, the element of time cannot be evaluated in isolation. It has to be analyzed in the context of the project environment demands and the organizational culture which provides the driving and restraining forces for the project team. Such an environment is dynamic and at times turbulent. Dialogue as proposed by Bergquist (1993), Isaacs (1993), Schein (1995) and Senge (1990), can contribute to productivity by ensuring shared understandings, using a cross-functional team that can think and act together.

Dialogue enables shared understandings for integrated product development by utilizing the skill-base expertise of the multidisciplinary team. Decision making in such an environment has to be open and public where the “need to formulate, adapt, and express ideas with language, takes time, requires explicitness, demands specificity and definiteness” (Scheidel, 1986, p. 121).

According to Parks and Cowlin (1995), the most important decisions in our society are made by groups and not by individuals. This observation is also valid for teams in new product development. “Each group member brings to the task a slightly different set of task-relevant knowledge; through discussion these sets become known to all members” (p. 267). Decision making in a new product development environment is a cognitive process of double-loop learning. This process takes time because a product core knowledge base needs to be developed, that influences the design decision making.

This knowledge base is composed of both the tacit knowledge and explicit knowledge of team members which takes time to develop into the teammind. In addition, technological development is accelerating at such speed that individuals in new product development cannot keep up with the latest hardware and software developments to ensure the product they develop incorporates the components that will provide them with the competitive edge.

Consequently team members are forced to learn about the breakthroughs of technology on the job “in real-time” and from one another. Their academic training cannot prepare them for the continuously changing technological developments. Dixon (1994) refers to this type of learning as “act through learning,” where the learning and acting have to be concurrent because of the fast paced environment in which the team functions (p. 121).

The workplace thus becomes the learning laboratory of an organization where practice supersedes theory. New behaviors develop in response to a socio-techno-cognitive coping mechanism during the integration of new technology into system design. While predictions of such behavior for the most part can only be based on conjecture in futuristic studies, such behavior can only be studied retrospectively.

This mode of real-time learning and acting also presents mental challenges. Our mental capacities to learn and absorb information are not uniform (Bass, 1983, p.146). Therefore, imposing a time limit on decision making without ensuring that all team members have developed a shared understanding of the task at hand, can lead to design misunderstandings.

Gouran & Hirokawa (1996) refer to the time limitations as "cognitive constraints" (p. 60). Imposing the time constraint limits the ability of the team members to make informed decisions especially in new product development which is novel and requires a greater period of research, data gathering, coordination and communication. Otherwise, there is the danger that the harassed team members focus on completing the task rather than understanding the task because they are overwhelmed by the "sense of urgency" imposed by the time limit (pp. 60-62).

In a project team environment, decisions on interdependent task-related issues have to be made in a timely manner using dialogic decision making strategies such as those advocated by Bergquist (1993), Schein (1995) and Senge (1990). While this is an ideal strategy for ensuring shared understandings, it can be time consuming according to critics and frustrating to the collaborative leadership relationship (Hirokawa & Poole, 1986, p. 259).

However, misunderstandings lead to conflicts in project teams. According to Pelled and Adler (1994), conflicts can be positive as well as negative. As organizations try to “accelerate time-to-market, the team can come under great time pressures, which can exacerbate the tendency for conflict inducing processes such as anxiety” (p. 21). The positive factors are “better problem solutions, greater productivity, increased ability to adapt and innovate and enhanced decision quality” (p. 21). The negative factors result in a decrease in performance and productivity, higher turnover or withdrawal and conflict avoidance to groupthink.

Based on studies of individual decision makers it is “well known that individual decision makers react to deadlines” negatively (Parks & Cowlin, 1995, p. 268). This information provided the foundation for the Parks & Cowlin study focusing on small groups of undergraduate students who had to make decisions given different alternatives under an imposed deadline. The study concluded that deadlines affect the quality of the decisions made because only a subset of the information was processed. The rapid processing of information only allows for a surface level skimming and evaluation of the alternatives (Gouran & Hirokawa, 1996, p. 66).

This finding has implications for decision making in a collaborative leadership relationship. If critical decisions need to be made where there are several alternatives, then adequate time has to be factored into the decision making process. This allows for the engagement of team members in a dialogical process that promotes reflection and inquiry and an evaluation of alternative solutions. On the other hand, if a decision is not as critical, imposing a deadline will serve to speed up the decision making process. Thus time acts as the

regulator of the type and degree of communication favored in the team decision making process.

Decision making

Decision making cannot be studied in isolation but only in the social reality of the organizational structures within which it is embedded. The preceding sections provided the theoretical foundations and discussions of the organizational context, collaboration as structure, communication and dialogue, and time as critical components that influence team decision making in new product development.

Presenting those components initially and independently can help to reveal the complexities of participative decision making and to provide a better understanding of why decision making in new product development cannot be studied adequately as a linear process and from a rational perspective. The section that follows on decision making integrates these various key components of the decision making process to provide the theoretical foundations of participative decision making.

As stated previously, in a knowledge-based society employees are demanding a voice in the decision making process especially in a task-oriented environment where complexity is a factor brought on by sophisticated technology that is changing our concept of time. Employees also realize that it is through their collective expertise that an organization generates its proprietary data which provides an organization with its competitive edge. In addition, studies have shown that employee participation in the decision making process contributes to motivation and therefore, productivity.

In a study on workplace practices, Mavrinac et al. (1994) stated that in the Department of Labor's 1993 report of workplaces with high performance, where employees were involved in decision making in an environment of technological complexity, decision-making has been "generally affirmative. A review of twenty-nine studies found that employee participation was associated with positive effects on productivity in fourteen studies and negative effects in only two studies; while the remaining thirteen studies had ambiguous results" (p. 27).

In the 33,000 strong employee-owned cooperatives of Mondragón, Spain, employee participative decision making in the workplace has resulted in improving its ranking from the tenth largest corporation in Spain to the eighth in 1997, in annual sales. Participation is the enabling strategy that permeates every aspect of Mondragón's cooperative culture (Whyte & Whyte, 1988). During my Summer 1997 Leadership Studies Seminar held in Mondragón, I was able to hear from managers and worker/members, and experience for myself the positive transformation of collaborative leadership in an enabling environment of employee participation in the decision making process.

The corporation fosters democratic values of economic and social justice and uses empowered teams in all areas of the workplace. They manufacture products for worldwide distribution, ranging from automobile components to research and development projects using robotic retrieval devices for NASA's space program. The quality of their products is so superior that even the Japanese visit to learn from them. While organizations have been downsizing around the globe, the cooperatives have been growing for the last forty-one years and creating more jobs through their collaborative spirit of solidarity. It is

through the integration of people, technology, finance and processes that the organization has been able to remain competitive, while others have failed.

In an environment of technological complexity, decision making for new product development cannot be captured and adequately explained as a linear process that is quantifiable, especially if the technology is novel. "The design of a product cannot be easily partitioned into a precise set of well-defined activities, since the ambiguity in basic design elements is significant" (Iansiti, 1995, p. 260). Furthermore, design decision making in complex environments cannot be made by individuals in isolation but by multifunctional teams who bring different perspectives to the decision making process by using a collaborative model of decision making:

Collaborative models encourage participants to talk directly to each other (rather than to a third party) and the decision rule used for making choices is that an "effort should be made to reach a decision that is acceptable to most or all of the participants" (consensus rather than majority rule or unanimity). (Andranovich, 1995, December, p. 432)

Collaboration among team members using dialogue where task interdependency is critical to success, contributes to double-loop learning (Choo, 1996; Dixon, 1994). Decision making becomes a process of information sharing, knowledge creation, sensemaking and team building so that the quality of the decisions made are in fact a collaboration of the holistic teammind.

The growing trend in organizations is to involve teams as a network in the organizational decision making process (Dougherty, 1996, p. 433). However, the literature indicates that although there is substantial research on group decision making, up until recently, "little effort has been made to examine groups at work .

... social factors that would arise during the group process should be important elements in the success of collaborative efforts" (Parks & Cowlin, 1996, p. 307).

Decision making is described as a "series of intertwining threads of activity which evolve simultaneously and interlock in different patterns over time" (Poole & Doelger, 1986, p. 41). It is a phenomenon that pervades every aspect of our thoughts and actions. For this reason, decision making is widely researched by professionals from various perspectives such as engineering, economics, psychology, sociology, policy-making, law, medicine and organizational behavior. Decision making is generally studied from the perspective of models, (e.g., rational, organizational, political, etc.), (Allison, 1971; Murray, 1986); styles (Driver et al., 1996); process (Miller et al., 1996); and the impact of the model, style or process on variables such as conflict, stress, control, and motivation.

"Decision making is the process by which courses of actions are chosen (from among alternatives) in pursuit of organizational [or product development] goals" (Murray, 1986, p. 10). There is agreement in the research that the process of decision making involves some basic stages with feedback loops where collective learning takes place (Jones, Saunders & McLeod, Jr., 1994; Murray, 1986; Radford, 1977). It is during these stages that the information gathering, the knowledge sharing and the sensemaking converge towards a design solution. The researchers categorize the three major phases of decision making as:

- 1) Analytical or Intelligence Phase. During this phase the goals, requirements and constraints of the task are discussed and information gathering takes place. The information gathering can involve quantitative as well as qualitative information from diverse sources both internal and external to the group and organization.

2) Design Phase. During this phase a course of action is determined based on the knowledge shared. However, this phase is where conflict is experienced which “may be due to the participants having different perceptions of the problem, different objectives, different values systems, or a combination of all of these” (Radford, 1977, p. 74).

3) Choice Phase. During this phase “the alternatives proposed in the design are evaluated, and some are selected for implementation” (Murray, 1986, p. 10). Radford (1977) identifies this third stage “as that of social choice,” where there is communication, negotiation and bargaining (p. 114).

These models, styles and stages provide a framework for organizational decision making during periods of turbulence and growth. Organizations are viewed as dynamic, responding to the driving and restraining forces of the environment in which they reside (O. Mink, B. Mink, Downes, & Owen, 1994, p. 85).

“Although organizational decision making is a complex, messy process, there is no doubt that it is a vital part of all organizational life: all organization actions are initiated by decisions, and all decisions are commitments to action” (Choo, 1996, p. 330). Time constraints may influence the social interaction in the decision making process within project multidisciplinary team environments.

Time is the driving and restraining constraint in decision making (Bass, 1983, p. 115). As organizational structures change to enable team members to participate in decision making, new models of decision making need to be developed to research this complex phenomenon of human interaction which by nature intensifies “friction among competing factions” (Heifetz, 1994, p. 122).

John Dewey (1910), characterized the process of human choice in decision making as a series of five stages of reflective thinking. The first stage is analyzing the cause and “implications of the problem.” The second is the “criteria for the ideal solution”; the third is the proposal of a “set of possible solutions”; the fourth stage is “the extent to which each of these proposals meets the criteria for the ideal solution”; and the fifth is choosing and implementing “the proposal that best meets the criteria” (in Pavitt, 1993, p. 218).

Dewey promoted the terms “activity,” “process,” and “growth,” thus contributing to the ideas for cognitive theory research. However, it was Chester Barnard who introduced the person as a “vital participant in the decision process” (in Goodyear, 1986, p. 21).

Simon rejected the prevailing trend of economists to imply that “economic models of individual choice behavior could be applied directly to organizational decision processes.” Although he agreed that behavior was affected as a result of problem solving, he furthered the notion that given the fact that decision makers act from a condition of determined goals and targets, they “sought solutions that were sufficient to address the problem” (in Miller et al., 1996, p. 305).

Therefore, Simon proposed that “each individual satisfices,” as each individual makes “decisions under a number of external and psychological constraints” which he termed “bounded rationality” (in Szilagyi & Wallace, 1987, p. 367). He stated that “each individual is a receptive participant and has cognitive limitations in making decisions and that in processing information reaches a decision that is satisfactory or good enough,” without necessarily evaluating all alternatives (in Goodyear, 1986, p. 22).

These concepts of satisficing and bounded rationality are well-researched and have implications for decision making through participation in postmodern organizations. The dialogical process seeks to raise the level of consciousness of team members to diverse perspectives and to reach solutions towards the common good but only after evaluating the alternatives to minimize the phenomenon of satisficing and to contribute to collective learning in the process.

However, placing time constraints on that process has to result in a re-evaluation of initial goals. In order to reach a decision that is acceptable to the project team membership, there has to be shared understanding which "is important because it provides common direction for team members" (Amason, 1996, p. 125).

"Meaning is not something that can be 'delivered' but it is cocreated through praxis" (Barrett, Thomas, & Hocevar, 1995, p. 353). Understanding and sensemaking can only be achieved through the dialogical process which enables team members to voice their points of view while others listen to hear a different perspective. According to Moscovici & Doise (1994):

The outcome of the socio-cognitive process is not so much to reduce the differences between points of view in order to make them conform to a single one but rather to clarify them and integrate them on a higher level, after which the members of the group see the problem in a different light. (p. 173)

Through the dialogical process as defined by Senge (1990), there is a fusion of thought and horizons that ignites collective action towards a design decision, while contributing towards mutual growth in a participatory environment. Gadamer (1977) explains the "concept of understanding as a concrete fusing of

horizons. The event of understanding is the elevation to a higher universality which overcomes not only one's own particularity but also that of the other person" (p. xl).

Although this study is not concerned with consensual decision making *per se*, but with participatory decision making, the concept of all project team members participating in the decision making process towards change and mutual purposes has parallels to consensual decision making. According to Hare (1976), consensual decision making has its origins in the villages of the non-Western world, "where all individual views are considered until a solution can be found which incorporates the concerns of all members and to which all can give their consent" (p. 345). Several laboratory experiments using versions of this methodology in group decision making conclude that the quality of the decision produced by groups is "of a higher quality with less emphasis on personal orientation than do groups using a majority rule" (p. 345).

Other researchers are more pessimistic and state that social interaction does not lead to quality decision making. They claim that interaction increases decision confidence but not necessarily decision quality (Heath & Gonzalez, 1995, p. 306). Parks & Cowlin (1996) maintain that group discussion should expand the knowledge base of the group so that an informed decision can be made. But according to the studies they researched, groups are not using discussion for this purpose.

Hence there is an inefficiency in group decision making. They further state that new information introduced by one member (tacit knowledge) is treated with skepticism unless it is backed by facts. Individuals only discuss information which is already known by the group through learning (explicit knowledge), especially

under time constraints. Therefore, it is important that team members engage in dialogue to ensure that both tacit and explicit knowledge are integrated into the collective knowledge of the teammind.

In a series of studies on shared information versus unshared information, the conclusion was that “there is a higher probability of shared information being recalled, since many members have it, than unique information, which is held by only one member” (Hollingshead, 1996, p.182). The Society of Friends (Quakers) has been practicing decision making by consensus for over 300 years and takes into consideration individual as well group concerns. Hare (1976) claims that consensus is “used by a group of people who have a feeling of affection for each other,” and who share understandings and have common values (p. 345).

The notion of relationship is further supported by Korsgaard et al. (1995), who state that when individuals observe that their inputs are taken into consideration during the decision making process, they “feel a sense of attachment to their group.” They become more collaborative and ensure that they achieve their goals towards the common good. However, when their inputs are ignored there is conflict resulting in acrimony which “limits consensus and acceptance of decisions” (p. 67).

Another observation is that “when teams have worked together for a while . . . they become more comfortable around each other, experiencing less intergroup anxiety” (Pelled & Adler, 1994, p. 25). These findings indicate that an intact team in an established collaborative leadership relationship where each individual's input is “valued and respected” (Korsgaard et al., 1995, p. 67), gains more from decision making by participation than an ad hoc team that does not have such a bonding.

The definition of an established leadership relationship in such a context is that team members are in contact with one another and “each makes some perceived difference in the experiential field of the other” (Anderson et al. , 1994, p. 128). Because the leadership relationship is not based on position, but on expertise, individuals are respected for contributing to the learning and growth of each team member in a growth-fostering relationship (Miller, 1993).

Other researchers caution against groups that become too cohesive. This development occurs when there is a homogenous group of individuals who develop high emotional attachments over a period of time. There is the danger of groupthink which prevents breakthrough thinking. In such an environment, to avoid conflict, alternatives are not evaluated, thus protecting the cohesiveness of the group. To guard against groupthink, the recommendation is to appoint “a devil’s advocate or bring in outsiders to promote more task conflict” (Pelled & Adler, 1994, p. 27).

How individuals make decisions has been the foundation for research on group decision making. The majority of the research has been conducted in laboratory settings with ad hoc groups, (e.g., undergraduates or graduates on college campuses), rather than with face-to-face interactions of intact groups in the workplace. The laboratory setting is an artificial environment where the researcher predetermines the scenario for the ad hoc group. An ad hoc group has no established working relationship and the decisions they make do not have real consequences.

According to Patton & Griffin (1978), such a setting is “satisfactory for exploratory work” (p. 102) and has high internal validity, but it cannot duplicate the dynamics of the natural workplace environment. Putnam and Stohl (1996),

state that laboratory studies of groups with zero history where the researchers selects the members “assigning them to groups, and providing them with a specific task” creates a social context that is separate from the group process (p.149).

Group research needs to be studied within the organizational context in which the group is embedded because groups “seldom exist in isolation; they are embedded within larger social aggregates—communities, organizations, neighborhoods, kin networks, and departments . . . to take full account of the physical, temporal, and social context within which those groups are embedded” (McGrath, 1991, p. 149).

Therefore, as previously mentioned, there is a void in the research of intact or natural teams functioning in an organization structure “as a major determinant of the decision making process,” and where time is a factor (Simon, 1986, p. ix). According to Korsgaard et al. (1995), because “intact teams are more likely to be emotionally invested in their teams [through their relationship,] they provide a more realistic and stringent test of the impact of decision making procedures than do ad hoc teams” (p. 68). It is important to select an intact team that has an established relationship within an organization, if the purpose of the research is to study shared decision making that leads to productive outcomes in the workplace.

How do organizations affect the decision making process? According to Choo (1996), organizational culture provides the decision makers with repertoires, procedures and rules of thumb or “heuristics” to reduce the complexity of uncertainty and risk in decision making, especially in novel situations. If the team is not observed within the social context of its embedded

culture, the “cognitive and informational requirements of the decision making process are reduced” (p. 331). This void fails to recognize the dynamics of the ecological environmental push and pull forces that affect the decision making process.

Teams rather than group shared decision making is an emerging research area. Structures in postmodern organizations will have to become more egalitarian or networked to support decision making by highly-skilled professionals who work in technologically-challenged environments and who generate an organization's valued asset which is knowledge-based. This valued asset is the proprietary data in the form of hardware and software that gives the organization its competitive edge.

Such organizations are experiencing a powershift as power, based on expertise, transitions from the top of the hierarchy to becoming more diffused throughout the organization. Whoever has access to information has access to power. I agree with Toffler (1990), that in such organizations the team members have expert power because they create an organization's proprietary data, its valued asset called knowledge. “Peter Drucker has called knowledge, rather than capital or labor, the only meaningful economic resource of the post-capitalist or knowledge society” (in Choo, 1996, p. 330).

Unlike legitimate power that is position based, expert power is mobile and dispersed because it is resident in the intellectual make up of the individuals. “Expertise collects in employees' heads and is embodied in machines, software, and routine organizational processes” (Leonard-Barton, 1995, xi). In addition, this diffused expert power is not used to control individuals but to challenge the status quo of how things could be and to learn. In postmodern learning organizations

"knowledge and expertise is dispersed throughout the organization, and is often closely held by individuals or work units" (Choo, 1996, p. 330).

The concept of diffused power among team members who want a voice in the organization's decision making process is a postmodern concept. There is "a lag of eight to ten years between the stimulating societal events and social researchers' conceiving, executing, and reporting group research" (Davis, 1986, p. 7). It will take several more years for substantial research to surface on participatory or shared decision making by intact teams using dialogue so theory can emerge to be evaluated and challenged.

Shared decision making is well-researched in the medical field. It is common practice to use a team of multidisciplinary physicians who collaborate to perform complex surgery or a team of physicians, nurses and aides to provide a network of services for each patient. In addition, the development of the patient/doctor relationship requires dialogue to ensure an effective diagnosis of a problem through shared understandings.

The strategies used in the decision making process in the medical field have parallels to decision making in organizations and should be reviewed in the spirit of learning from experience and from other perspectives. The role of sharing information is viewed as "an enabling strategy," where mutual acceptance is a "necessary prerequisite for shared decision-making" (Charles, Gafni & Whelan, 1997, pp. 683, 688).

"There is presently no unified theory of small groups, nor is there any unified theory of communication." This void creates opportunities for researchers to investigate small group communication from whatever perspective they wish (Fisher, 1974, p. 205).

Summary

Team participative decision making using a dialogical process in a collaborative leadership relationship is an emerging concept in organizations, especially in those with an inclination towards postmodernism. In the absence of substantial research in this area, I used small group research as the foundation and guide for the investigation of this study. If a collaborative leadership relationship is to be meaningful, the multidisciplinary project team needs to engage in dialogue even if time-limited, to share information and learn from one another because shared understandings are critical to new product development.

The challenge in such a relationship relies on the team's ability to use time effectively and to evaluate alternatives that emerge during dialogue so that the shared decision making process results in quality decisions that are reflective of the team's diverse perspectives and mutual purposes. In an environment of trust and mutual respect, participative decision making has to result in a product that is the sum of the project's teammind which contains the team's core knowledge base required for new product development.

Thus, time becomes a critical yet constraining element in the decision making process. Since time constraints can affect the quality of the decisions in group interaction negatively, they create stressful situations for team members. Therefore, when engaging in participative decision making, the leadership relationship needs to allow sufficient time for critical decision making to evaluate alternatives and to ensure a shared understanding of the problem. However, when decisions are not as critical imposing a deadline will serve to speed up the decision making process.

The literature indicates that there is a need to research project teams making decisions under time constraints within the organizational structures in which they are embedded. The relationship and growth that develops in such a team contributes to the teammind wherein resides the core knowledge base about the product they are designing. This core knowledge contributes to collective learning and provides the organization with its competitive edge.

There is growing research interest in this complex social phenomenon of a collaborative leadership relationship within technologically-challenged organizations. These organizations are experiencing a powershift. The multidisciplinary project team as the new organizational power brokers generates an organization's valued asset—its proprietary data. Therefore, the team expects a voice in the decision making process.

The organizational structures and collaborative relationships that support dispersed leadership based on expertise in multidisciplinary teams requires intensive face-to-face communication for decision making. This real-time decision making challenges the psychological and intellectual abilities of individuals. Such an environment calls for new research methods in evaluating emerging concepts of collaboration in the workplace. In addition, researchers need to identify how team members can be trained to be productive in a dynamic and ambiguous environment where an organization's survival depends on the core knowledge that needs to be established in the teammind of its multidisciplinary team.

CHAPTER THREE

METHODOLOGY AND RESEARCH DESIGN

Introduction

This study focuses on a multidisciplinary intact project team on Project R, in Wiz Electronics Company (both pseudonyms). This team engaged in decision making under time constraints to design the user interface for an information system. I used a descriptive case study methodology to reveal and understand the strategies the project team used to make new product design decisions under time constraints. I also wanted to determine if the dialogic process as defined by Senge (1990) has application for an intact team in the workplace since Senge's work focuses on the use of dialogue for decision making in teams.

Chapter Three contains an overview of the methodology, followed by the research design, the research site and organizational sponsorship, the interview setting and participant selection, the protection of human subjects, the data collection and analysis, and the background of the researcher. It concludes with a summary of the chapter.

Methodological Overview

Human interaction in decision making is a complex process that can only be studied effectively in the rich temporal construction of reality in which it occurs. A descriptive case study provides the rare opportunity for the researcher "to retain the holistic and meaningful characteristics of real-life events" by interacting with the participants in a naturalistic inquiry (Frey, 1994, p. 562).

Using a descriptive case study, I was able to interpret "the study of social and developmental phenomena as processes that are embedded within a larger historical and sociocultural context" (Rizzo & Corsaro, 1995, p. 438). Therefore, I can support the point that a qualitative "research design is emergent," and data collection and analysis is an on-going activity (Merriam, 1988, p. 123).

Research Design

Through interviewing I interacted face-to-face with the participants to learn about the decision making process in their own words, and to determine if there is praxis between theory and practice. "At the root of in-depth interviewing is an interest in understanding the experience of other people and the meaning they make of that experience" (Seidman 1991, p. 3).

The case study methodology allowed me to use unstructured interviews as the chief mode of inquiry where I was able to engage each participant in a conversation. This served to establish a relationship between me and the participant as a "partnership. . . . Too often, researchers have treated research participants as objects to be studied instead of coparticipants in the research process" (Frey, 1994, p. 564).

During the period of analysis I was able to go back to the participants and request additional information and clarification on issues that surfaced during the interviews. In fact many of the participants volunteered to assist in any follow-up activity and were excited to be part of this study. I reviewed 60 of the 115 recorded meeting minutes and 10 of the 60 design documents the team generated to document their design decisions. This documentation provided the factual information to validate the reconstructed statements of the participants, based on reflection.

One of the objectives of this study was to determine what strategies an intact project team used in the workplace, so that the lessons learned can help the organization with process improvement as well as with identifying the skills required for team building activities. Therefore, the outcome of this study may benefit the organization, the participants as well as the researcher. Management at Wiz Electronics supported this research activity. The organization is committed to improving its engineering processes and it is interested in these results which will be used to improve its current engineering processes in new product development.

The interviews provided the narratives of the decision making process. "Interviewing, then is a basic mode of inquiry. Recounting narratives of experience has been the major way throughout recorded history that humans have made sense of their experience" (Seidman, 1991, p. 2). The words of the participants are the data that describe their construction of social reality. This is of significance in determining what transpired during a particular phase in the project team's social reality that resulted in the decisions for the design of the product. A case study is mainly concerned with "interpretation in context [to uncover] . . . the interaction of significant factors characteristic of the phenomenon" (Merriam, 1988, p. 10).

Another objective of this study was to determine whether dialogue as defined by Senge (1990) can be used by project team members to develop shared understandings, in time constrained decision making situations. It is recognized that "theory used to discern and forge relationships among the words that participants share with interviewers must come out of those words themselves. Theory cannot and should not be imposed on the words but must

emanate from them" (Seidman, 1991, p. 29). Dialogue then becomes a means as well as an end in the praxis between practice and theory.

One of the thrusts of this research design was its focus on the content analyses of the interviews of the individual team members; to "discover, understand, gain insights"; and to find recurring themes that might contribute to a better understanding of the decision making process (Merriam, 1988, p. 49). The data collection and analysis process is "recursive and dynamic," requiring on-going activity; the intensity of the analysis increased as all the data were collected (Merriam, p. 123).

The questions of the unstructured interview covered broad areas of the decision making process, (e.g., time, knowledge and learning, multi-functional teams, communication and conflict resolution). This allowed for some flexibility in the focus of each interview.

Cultivating the respondent's narrative activity is a paramount goal. The interviewer encourages this at every juncture. This means that the respondent's positional shifts, linkages, and horizons of meaning take precedence over the tacit linkages and horizons of the predesignated questions that the interviewer is prepared to ask. (Holstein & Gubrium, 1995, p. 77)

The unstructured nature of the interviews allowed each participant to engage in the areas of experience that were important to them while providing further depth to my understanding of what transpired during those six months of intensive decision making activity. I prepared a set of guiding questions that I took to the interviews; these are contained in Appendix A. Since the participants came from different disciplinary backgrounds, and there were two customer and

four contractor team members who came to the decision making process from two different organizational perspectives, I used the cues from the responses to ask each subsequent question.

This strategy provided a deeper reflection of the process on an individual level while providing perspectives on the process for a more holistic and richer picture of the collective experience. "Such links among people whose individual lives are quite different but who are affected by common structural and social forces can help the [researcher] see patterns in that experience" (Seidman, 1991, p. 42).

The Research Site

The research site for this case study was in Wiz Electronics Company in a large city in the Western United States. It is a subsidiary of a larger company. Wiz Electronics Company has over 1800 employees and is organized around product development areas called focus business units. It is a matrixed organization with co-located project teams who are affiliated with each of the focus business units. The company competes for contracts in the defense industry and is recognized as a leader in the area of digital imagery.

Although there are several maintenance and long-term contracts, the organization maintains an innovative environment for new product development to sustain its competitive edge. Wiz Electronics bids for contracts that are cost plus, in other words where the customer is billed for project work as it is developed. Wiz Electronics also bids for fixed contracts where the product is developed based on a contracted price. On fixed contracts, such as the one involved in this study, any deviation from the customer approved requirements

results in additional funding through the submittal of proposals, called Engineering Change Proposals.

Both types of contracts provide challenges to the project team to develop effective design solutions that maintain the competitive edge while enhancing the organizations core competencies and contributing to profits. However, the fixed price contract presents even more of a challenge especially if the customer is part of the project team, such as in this study. The customer comes to the design decision making process from the perspective of wanting the maximum return on investment.

The contractor on the other hand, is in business to make a profit and will make design decisions that meet the contractual requirements and satisfy customer needs while ensuring a quality product. These diverse perspectives provide a challenge to the decision making process under time constraints because they can be a major source of conflict that needs to be resolved.

Organizational Sponsorship.

For the past several years Wiz Electronics has been in the process of conducting a self-evaluation to improve its internal Engineering processes to become more productive and to maintain its competitive edge. The organization has made substantial investments in time and resources to ensure it meets government and global initiatives for auditable business standards. It has been ISO 9001 certified, indicating that it has the required international standards and processes in place to compete in the global market. In addition, it has achieved Level III certification in software from the Software Engineering's Institute at Carnegie Mellon University, which means that it can compete for Department of Defense contracts.

With this in mind, I approached the Systems Engineering Manager on Project R, to discuss my proposal with him and to identify the individuals who would constitute the research participants. I informally talked to each of the participants and obtained their willingness and commitment to serve as participants if I was able to obtain the organization's approval.

I then scheduled an appointment with the Director of Engineering and took a copy of my Human Subjects Proposal to the meeting for his review. I discussed with him the merits of documenting the successful decision making process of the user interface group on Project R, and how it would benefit the organization as lessons learned to improve in-house processes and at the same time benefit my research interests. He provided me with the authorization and financial support to interview the participants during working hours. A copy of this letter is attached in Appendix B.

Next I scheduled an appointment with the Program Manager and Chief Engineer of Project R to discuss with them my research sponsorship and intent to interview the six participants that composed the subteam, and to request access to those participants for interviews during normal working hours. I told them that I had already obtained the sponsorship of the Director of Engineering. I assured them that my interviews and data collection activities would not be disruptive to the workplace. I also assured them that the research would not divulge any proprietary data. Once I obtained their approval, I submitted a copy of my Human Subject's Proposal to the Organization's Director of Ethics and Public Relations Officer and the Director of Human Resources. A copy of the letter is also attached in Appendix B.

In addition I obtained the approval of the customer representatives to participate in this study. Once the Human Subject's Protection Committee at the University of San Diego approved my Proposal, I contacted Wiz Electronic's Director of Security to obtain a property pass to use a tape recorder in the workplace and to transport the tape recorder between home and the workplace so that I could record and transcribe the interviews. After securing these permissions, I was then ready to proceed with the interviews.

The Interview Setting.

The objective of this study was to research an intact multidisciplinary project team in the workplace. "The first commitment is to studying natural groups in context. . . . Laboratory research decontextualizes groups, often on purpose, so as to increase the generalizability of the findings" (Frey, 1994, p. 555). Therefore, the individual interviews were conducted in one of the conference rooms of the building in which the over 50 project team members are co-located with the customer team.

The project is co-located in a stand alone one-story building in an industrial campus-like setting with other company buildings located on the cul-de-sac, which is off a main road. The setting for this study was in one of the regular conference rooms which the team uses for meetings. It is a conference room with a door that can be closed and with a long, rectangular, wooden table in the center that can accommodate about twelve people. The padded seat and back armchairs are arranged around the table. There are no windows, just a white board, overhead viewgraph machine and a telephone for conference calls.

The functional, air-conditioned room with walls to the ceilings provided the setting for each participant's interview. Here each participant could be

interviewed without interference from the rest of the project's team member modular cubicles that surrounded the three sides of the room. The fourth side of the conference room was the hallway to the snack room and drinking fountain, where the mail and photocopying facilities are located.

Projects within Wiz Electronics can have as few as five people to as many as forty. Subteams are formed from the larger project team around focused areas (e.g., test and evaluation or human factors engineering), and these subteams are generally multidisciplinary.

Being in a separate building provides the team members with a distinct identity and culture built around the product they are developing. It also encourages a sense of camaraderie as team members socialize with each other on and off the job. There are frequent barbecues and occasional company-sponsored parties to which the team members are invited. A project culture is established around the terminology and concepts of the product that is being developed.

This environment contributes to the development of relationships based on product identity even though project members come from two organizations — the customer and the contractor. Upon joining the project team, each team member is presented with a coffee cup bearing the product logo to welcome the member into the team.

Participant Selection.

This case study investigated an intact project team involved in a six-month decision making process on Project R. Therefore, the participants selected were a subset of a larger project team and they were members of the User Interface

Working Group (USWG). It was a convenient or a purposeful sample because it was a targeted population; the members of the user interface group.

The demographic composition of the six team members was all Caucasian men, which is typical of the composition of such teams in the Electronics Defense Industry. The Engineering profession is still categorized as a non-traditional profession for women and although women are entering the profession in greater numbers, their impact will not be felt for a few years.

The selection criteria for the participants was that each individual: (a) had to be an active team member to ensure the continuing relationship with the other intact team members, (b) had to have some familiarity with the terminology used in the environment to make the face-to-face interactions more meaningful, and (c) had to continue to be involved in the product development for the period of the study in order to be available for any follow up questions or clarifications that may ensue as the interviews progressed and data was being analyzed. The participants that were selected represented different engineering disciplines and project roles, (e.g., Systems Engineering, Software Architecture, Human Engineering, Design Engineer, Customer Human Factors Manager and Customer Subject Matter Expert). Their ages ranged from 25 to over 55.

Four of the participants have advanced degrees and one has a doctorate. Their professional experience ranged from 10 years to 30 years indicating that based on their years of work experience they could be considered experts in their particular fields. The general project team member experience ranged from 4 years to 20 years which indicates that they were experts rather than novices in engaging in team relationships and establishing teamwork knowledge.

According to Rentsch & Heffner (1994), if individuals have had substantial experience working in project teams they are “hypothesized to possess well-developed teamwork knowledge structures. These individuals are likely to be more effective and efficient team members than lower experience individuals” because they possess essential core teamwork knowledge which consists of elements of “interdependence, cooperation, communication . . . regardless of the team task or context” (pp. 452-453).

In addition, the project experience of the six team members on Project R ranged from 1.2 years to 4.6 years. They were therefore familiar with one another and had developed a project relationship through being co-located in a separate building. In a study examining the role of group composition and information distribution on group process and decision making, Gruenfeld et al. (1996) suggest that when members of a group are familiar with one another they “may be more effective at pooling information and integrating alternative perspectives than groups whose members are not familiar” with one another (p. 12).

Although their gender is homogeneous there is diversity in other factors like age, roles, functional or domain expertise and project team experience. According to Gruenfeld et al. (1996):

Diversity in groups can be a function of demographics, experience, expertise, values, personal style, and access to information . . . [such groups] . . . outperform homogeneous groups on tasks requiring creative problem solving and innovation, because the expression of alternative perspectives can lead to novel insights. (p. 4)

This diversity of experience and functional discipline brings a broader perspective to the decision making process. These team members were

engaged in making design decisions that will affect the success and competitiveness of new product development. If the product is accepted by the customer, it becomes a marketing opportunity for follow-on contracts. Therefore, the outcome of the team's decisions have far-reaching consequences not only for their own careers but for the competitiveness of the organization. According to Pavitt (1993), "group discussion research has often and rightly been criticized for studying groups making decisions about issues that its members care little or nothing about" (p. 220).

When I decided that I was going to study this user interface working group, I approached each of these six members to let them know that my research interests focused on decision making in project teams under time constraints. I then asked if they would be willing to serve as a research subject if I obtained all the authorizations to interview them in the workplace during the lunch hours. All of them were agreeable and even offered suggestions as to who should be involved as part of the core decision making group.

Once I obtained organizational and project approvals to conduct the study, I then went back to each participant to determine when they would each be available for the two interviews during the months of December 1996 and January 1997. After my proposal was approved by USD's Human Subjects Protection Committee, I started the interview process on December 12, 1996 with Participants 1 and 2.

Protection of Human Subjects

To conduct this study, I followed the guidelines of the University of San Diego's Protection of Human Subject's Committee. There were no potential risks

to the participants in the study except for possible minor fatigue. The benefits outweighed any perceived risks.

According to the agreements made with the Wiz Electronics Company and the six participants, I maintained their confidentiality by using a pseudonym for the organization and a number identity for each of the participants. The names of the participants do not appear on any of the tape recordings and the transcripts.

During the interviews I assigned each participant a number and in the interviews and in my analysis I refer to them by those assigned numbers. Demographic data was collected to determine the discipline diversity of the group, their educational levels and their professional years of experience, in order to reinforce the theoretical underpinnings of team composition and expertise relative to these factors in the decision making process.

Participants were very candid with their comments and I had to exercise some judgment in the use of quotations for the findings because of the sensitivity involved in researching a project team whose composition includes the customer. Each participant was made aware of their rights according to the established procedures of the University of San Diego's Protection of Human Subjects Committee. Each participant also signed a consent form, an example of which is contained in Appendix C.

Data Collection

The data collection involved two kinds of data. One is the interview data. The second is the review of the documentation which consisted of historical records of the decision meeting minutes and the design requirements bulletins which documented the agreed upon design decisions. This documentation

represented outcomes of each stage of the decision making process and served to validate the design decisions.

The complete set of data represents the totality of the human experience in context as the participants develop the teammind. According to Hibbard (1997), the creation of knowledge for innovation starts with "information in context or information put into action. . . . 'People usually have the specs and the parts list, but what they don't have is the story behind the decisions'" (p. 52).

Interview Data.

The story behind the decisions was interpreted and constructed through the interview data. The interview period extended from middle of December 1996 to the end of January 1997. I approached each subject to determine the best time for the interview. I reserved the conference room to ensure that the interviews could take place without interference. Each participant had two hours of interviews. Each interview took approximately one hour and there was usually a week's interval between the first interview and the second interview.

Prior to the first interview, I had each subject sign the informed consent form in the presence of a witness and I explained the purpose of the study once again. I scheduled the initial interview of two participants in the first week. In the second week, I followed up with their second interview and interviewed the next two participants for their initial set of interviews.

I found that this staggered scheduling strategy gave me an opportunity to transcribe the first set of recordings, and develop my preliminary assumptions which I could then share with those first participants. Based on the experience of the first set of interviews I was also able to refine my succeeding interviews and the phrasing of the questions for better quality responses.

At the appointed time of the interview, I was in the conference room to greet each participant with my tape recorder and notebook. Each participant and I shared a corner of the long table with the participant's back to the door while I faced the door. This was done deliberately so I could intercept any intruders even though the door was shut. For the most part the participants were on time but there was one occasion where a participant could not keep the appointment because of an unscheduled meeting and I had to reschedule the interview.

During the initial interview I had my set of guiding questions as listed in Appendix A to help me focus on the areas of interest, if I needed them during the course of the interviews. As the interviews were held during working hours, I realized I had to help the interviewees make a transition from what they were doing prior to the interview to the interview itself. Therefore, during the first few minutes we engaged in informal conversation to bridge that gap and to establish our relationship. "Interviewing is both a research methodology and a social relationship that must be nurtured, sustained, and then ended gracefully" (Seidman, 1991, p. 72).

The first question that launched each initial interview was, "Describe in as much detail as you can your experience with the user interface decision making process, its strengths and its weaknesses." From the responses I received I sensed that this question was general enough to provide the initial interview with a focus and each participant with an opportunity to dwell on the areas that were of interest to him.

Contrary to Seidman (1991) and others advocating avoiding leading questions, a couple of times I did ask leading questions to check the reliability of interviewees' answers on the process and key concepts. In some situations I

asked leading questions when I felt the need to “check repeatedly the reliability of the interviewees’ answers, as well as to verify [my] interpretation,” (e.g., the impact of time on the decision making process). According to Kvale (1996):

From a postmodern perspective on knowledge construction, the interview is a conversation in which data arise in an interpersonal relationship, coauthored and coproduced by interviewer and interviewee . . . [the leading interview questions should] lead in important directions, producing new, trustworthy, and interesting knowledge. (pp. 158-159)

I tape recorded all the interviews and made notes during the interviews if I felt that some behaviors showed stress because of scheduling the interviews during normal working hours and knowing that everyone on the program was performing under the pressure of deadlines. I also had to limit the interviews to one hour because of the project demands on the already over-extended team members.

Therefore, the interviews were conducted in the same temporal constraints of the environment in which the participants had to make their design decisions. This also meant that I had to closely monitor the timing of the interviews to ensure that I was using the interviewees’ time in the most productive way.

One of the objectives of this study was to determine if team members used dialogue as defined by Senge (1990) in the decision making process. During the interview process, I found myself actually engaging in dialogue while evaluating it. I had just asked Participant No. 6 a question about the process. While he was responding to the question, I found myself subconsciously making some assumptions about his response. I realized what I was doing and forced

myself to listen to what Participant No. 6 was saying hoping that he would later elaborate on my subconscious assumption or else that would be my follow-up question.

As I listened to what he was saying, Participant No. 6 proceeded to elaborate on his response covering the area of my suspended assumption on conflict resolution. I then realized I was actually engaging in dialogue “while I suspended my assumption” (Senge, 1990), and listened to his response. In this instance, as a researcher and practitioner, I actually experienced the praxis between theory and practice and the enabling strategy of dialogue.

Immediately following each interview I transcribed the recordings at home. I decided to transcribe the interviews myself because I wanted to “hear” the data as well as to be able to read it. I experienced a deeper sense of discovery as I heard the data and transcribed it shortly after the interview. I was able to reflect on each interview while transcribing it which helped to provide the text with the punctuation that I felt captured the flavor of each interviewee’s experience.

During the process I became “aware of some of the many decisions involved in transforming oral speech to written texts” (Kvale, 1996, p. 169); (e.g., how to handle punctuation or to capture the interviewer’s subtle changes in tones to denote positive or negative factors about the lived experience). I also used the time spent on the transcription to check on the quality of the recordings and used each interview experience to improve on my own interviewing skills.

When I completed the transcriptions, I generated my preliminary assumptions based on several reviews of the transcript which included listening to the recordings once again and reviewing the transcripts against the interview.

At this point I highlighted areas for further clarification or follow-up questions with each interviewee, in preparation for the second interview.

In consultation with each interviewee, I then scheduled the second interview which also lasted for approximately an hour. At the second interview, I gave a copy of the transcript to the interviewees to review and asked them to return it to me with comments and suggestions. All six participants were cooperative and provided me with comments for revisions including reviewing the preliminary assumptions and revising them.

For the most part, the recordings were transcribed verbatim except for a few times when they were edited for grammatical errors. Some of the interviewees were surprised about how “incoherent and confused” their transcripts were although I had forewarned them about this consequence. I reassured them that the transcripts were not for publication but for my research purposes. This seemed to satisfy most of them. These recordings involved a great deal of project specific technical language which could have been misinterpreted if I had contracted somebody else to transcribe the recordings.

I transcribed a total of twelve transcripts. This provided me with first hand experience of data gathering as a recursive and dynamic process. I found myself engaging in further literature reviews to determine the status of existing research on concepts that surfaced during the interviews and the transcription generation process. Following the completion of the second interview, I sent each of the participants a thank you card expressing my appreciation for their time and for their contribution to the body of knowledge for improving workplace team processes.

Documentation Data.

I had access to over 115 recorded minutes of the decision making meetings following each of the stages of the process. These were available on electronic media which I requested and received from a confidant. I randomly reviewed 65 of the meetings to understand, analyze, interpret and validate what transpired during those meetings.

These meeting minutes were generated and distributed for approval following each group meeting and it helped to validate the comments of the participants as to how conflicts were resolved and how the subteam created the core knowledge for the product. I was able to categorize the meetings as follows:

1. Presentation Meeting
2. Decision Meeting
3. Approval Meeting
4. Screen Design Reviews & Other Human Factors Issues Meetings
5. Feedback into the Design Meetings and Usability Tests.

During the analysis stage of the project, usability tests are performed with the end-users of the system. These tests help to verify that the proposed screen designs agreed to by the team members emulates the operational behavior of certain activities of the information system's operational environment, (e.g., assigning certain tasks to specific individuals based on contractual requirements). The tests also help to determine if the behavior of the design features, stimulated by the push of a button and a screen display response, are intuitive or user friendly and meet the expectations of the user. The feedback provided by the user from these tests is then evaluated, modified and incorporated into the screen designs as appropriate.

The decision making process is described in greater detail in Chapter Four and illustrated in Figure 1. There were three stages in the decision making process for each system function: presentation, decision and approval. Each function of the system, (e.g., the flow of message traffic in and out of the system), had its own design requirements bulletin or DRB. Following each of these stages the minutes were recorded and approved.

Since the data collection activity focused on a qualitative descriptive case study, I relied heavily on interviews, journal entries and documentation because of the exploratory and discovery nature of the problem that lent itself to interpretation and inductive logic (Merriam, 1986, p. 15). The case study documentation in the form of meeting minutes, the transcripts of the interviews, and the documentation generated in the form of DRBs provided for multiple sources of information that converged "so that data should triangulate over the 'facts' of a case" to provide for confidence in the occurrence of an event" (Yin, 1993, p. 67).

The DRBs as products of the decision making process are the working documents for the entire project team to use to generate the code for the system, as well as for the development of test procedures to validate the system. They are also the social artifacts that represent the agreements and decisions arrived through shared understandings among the team members.

This documentation provided another dimension to the interpretation of the decision making process:

The objective of interpretive research is not to explain differences in variables or populations by quantifying their degree of influence or correlation with other variables, but to understand social and

developmental processes that are embedded in diverse and complex cultural settings. (Rizzo & Corsaro, 1995, pp. 439-440)

These social and developmental processes can be interpreted from the different kinds of data that were available.

Therefore, the research design became dynamic as the data collection activity progressed because “in field research, observation, data processing, and analysis are interwoven and cyclical processes” (Babbie, 1994, p. 303). The research focus was to discover what strategies the intact project team used in the decision making under time constraints. It was not a verification of the process. The interviews were unstructured to engage the participants in a candid conversation where my “ability to listen actively to what the interviewee [said was] more important than the specific mastery of the questioning techniques” (Kvale, 1996, p. 132).

Data Analysis

I used a process of analysis characterized by Kvale (1996) as “ad hoc meaning generation [wherein the researcher uses] different approaches and techniques for meaning generation” (p. 206). The standard methods are “condensation and categorization of meanings.” I chose to use a “free interplay of techniques” to perform the analysis of the data because of the complex nature of the decision making process under study.

The raw data was in the form of transcriptions of recorded interviews, the recorded minutes of the meetings, and the design documents called the DRBs that the team generated. Although data analysis is an on-going activity, it builds as the data are collected and intensifies once all the data are in (Merriam, 1988, p. 123).

After reading the transcripts and making "marginal remarks" (Miles & Huberman, 1994, p. 67), and listening to the recordings a couple of times, I started to categorize phrases and sentences around themes and patterns so that I could define some common threads. Once I detected common themes, I was able to intuitively "respond to possibilities, hunches, initial impressions" (Merriam, 1988, p. 149), and to make some preliminary assumptions which I shared with each participant for their comments.

I found that identifying patterns in the narratives was critical to "inductively, performing fine-grained analyses of densely packed interactions" (Rizzo & Corsaro, 1995, p. 438). Once I had determined that I had sufficient data, I used descriptive analysis to consolidate, reduce and interpret the data. I performed my analysis on-line with the aid of Microsoft Word and an Excel spreadsheet.

Through the "find" and "search" commands in Microsoft Word, I was able to identify keywords, like conflict resolution, time and deadlines, etc., and then record the instances on each word or phrase, by participant, and enter that information into an Excel spreadsheet. I used numbered lines on each transcript in the left hand margin which helped me identify particular phrases or concepts that I could use to create structures of meaning.

Based on the repetitive phrases or concepts by participants, I was able to discern patterns that I categorized as the emerging themes of the research. I used the resulting causal claims emanating from the interpretation as the validating method to discover causal connections and thereby build theory (Shadish, 1995, p. 423).

All research should have some measures for "producing valid and reliable data in an ethical manner" (Merriam, 1988, p. 163). However, as this study is

concerned with interpretive research, validity is assessed on the basis “of how one's finding matches reality” (Merriam, 1988, p.167). It applies to a given context and it is not generalizable. Kvale (1996) agrees with Miles and Huberman (1994) that “there are no canons or infallible decision making rules for establishing the validity of qualitative research” (p. 242).

I validated my preliminary assumptions by discussing them with the participants at the beginning of the second interview. This not only contributed to the validity of the data but it also expanded further awareness of the decision making process and often prompted reflections within each participant as they retrospectively delved deeper into the team experience. Thus, the reality became mine as well as that of the participating team members.

Because this study is focused on the decision making process under time constraints in a project team, many times during the analysis I found it difficult to identify the emerging themes as isolated concepts. I discovered that there was a very strong interconnection between time, communication, decision making, organizational structures and collaborative leadership based on expertise. At times it was difficult to categorize them as separate concepts because of their overlapping nature.

I started to see these themes as the different dimensions and intensities of the decision making process. Each theme moved from the foreground to the background like the flicker of candlelight, depending on the questions and the conversation focus with each participant. They blended and faded to reveal the totality of the human experience from each participant's perspective. Listening and interacting with the different tones of the voices and analyzing the use of language in the narratives of each participant, gave each dimension an additional

richness of depth and sparkle, like a well-cut diamond that radiates with different levels of intensities depending upon how it is rotated.

As stated above, at times these dimensions were so intertwined that I could not readily analyze them as separate entities. The interpretation had to be accomplished in the totality of the human experience in context. According to van Manen (1990), themes “are like knots in the webs of our experiences around which certain lived experiences are spun and thus lived through as meaningful wholes” (p. 90). These themes provided me with meaningful structures in my exploration and interpretation of the decision making process.

Therefore, in this study the sole criterion for validating the group decision making process is to identify the strategies the team used in achieving their objectives as revealed in their own words. Their actions and open issues were recorded in the meeting minutes and resolutions in the design documents called the DRBs. These DRBs represented the shared understandings of the team as the social artifacts for the rest of the project team to use until the system has been built. This documentation provided the foundation for the design and development of the system.

The voices of the participants provided the rich narrative descriptions which helped to engage me “in a dialectical process with the material” (Seidman, 1991, p. 100). The analysis became an iterative process that extended from January, 1997 to October, 1997. During this time, I continued with the literature review to augment my understanding of the theoretical foundations for the emerging themes, which in turn helped deepen my understanding of the research experience.

Background of Researcher

I have twelve years of experience as a Systems Engineer, in an engineering research and development environment within a matrixed organization that uses multidisciplinary teams in new product development. The incredible synergy and collective learning that takes place in such an innovative environment compels me to focus on team-based research to learn how communicating meaningful information for shared decision making can contribute to team productivity and commitment.

My academic background includes courses in information science, cognitive science and human factors engineering both in my undergraduate and graduate studies. This provided me with the theoretical understanding of the role of information in learning and decision making as well as the importance of the user interface design, including the behavioral aspects of user interfaces in systems design. This study provided a unique opportunity to combine my academic experience with the practical reality of the workplace.

I am especially interested in using the lessons learned to recommend team building skills required for integrated product development in which time is limited. Developing an innovative product within time constraints is a challenge to the human spirit and intellect. This is especially so when the product involves using leading edge technology that can either process information faster than the human being can digest it, or when the product a team is designing requires technology that has not been marketed.

I am encouraged by the growing interest within organizations to focus on team-based participative structures in the workplace to utilize the collective brain power that contributes to an organization's core competencies. It is my

experience that the collective brain power within organizations is a valuable resource that is greatly underutilized and not well-managed.

Being part of a multidisciplinary team in a project environment is a challenging experience. This is especially true when the synergy of the teammind creates a product from a concept that will transform the way the end-users of an information system will perform their jobs. The unique fact about this project was that the customer was part of the project team involved in the daily life cycle development of the product. This experience has contributed to my practical understanding of what it means to have different perspectives and to attempt to satisfy mutual purposes through negotiation, diplomacy and cooperation.

It is in such an environment that the multidisciplinary project team forges a future together, collectively learning through shared expertise and a collaborative leadership relationship. It is an opportunity for individuals to collectively engage in dialogue to promote an environment of shared understandings, where participative decision making results in motivation that can replace compliance with commitment, to ensure a quality integrated product.

I will benefit both professionally and personally from this qualitative study and I hope others will in developing team skills to enable project teams to utilize their limited time to ensure shared understandings so that the product they develop represents the sum of the teammind. Shared understandings can only be reached through dialogue where listening to the diverse views of the team membership without interrupting, and arriving at a common ground, is critical to product success, while contributing to growth-fostering relationships.

Summary

Through a descriptive case study methodology, I had the opportunity to combine face-to-face interviews with each team member and review some of the recorded minutes as well as the documentation in the form of DRBs. The two-hour interviews allowed me to engage in a dialogical format with each participant which helped me to understand and interpret their lived experience. During the interviews and while analyzing the tape recorded data I was living in the methodology of the case study while I experienced and witnessed the dialogical process as the means and the end of a collaborative leadership relationship.

The participants were a purposeful sample and this subgroup of the project team was selected because of their six-month intensive decision making process where they defined the user interface of a complex information system. I am interested in the strategies they used in the decision making process and their accomplishments under time constraints.

Using multiple methods for the data collection—interviews, minutes of meetings and the documentation in the form of DRBs—helped to validate the factual aspects of the decision making process, and contribute to triangulation in the data analysis. Developing the preliminary assumptions from the transcripts of the first interviews of what transpired during the six-month decision making process, and presenting it to each participant prior to the second interview, provided for comments and further validation of my preliminary interpretations.

Data collection, analysis and the literature reviews was an iterative process which extended over a period of almost nine months. Although I defined the research areas as separate themes of organizational structures and collaboration, communication and dialogue, time, and decision making, during

the analysis I found that the themes were interrelated. These themes emerged as different dimensions of the decision making process and at times they were difficult to categorize and analyze as isolated concepts.

Since the themes represented the holistic experience of the project team involved in the decision making process I think it is appropriate to treat them as interconnected during the analysis. The case study methodology provided me with a vehicle to “hear” and understand the experience of the project team as they defined their social construction of reality. Through the voices of the participants, the depth and richness of the data coming from their different perspectives of the “lived experience” provided me with the meaningful structures to present the findings and analysis that follow.

CHAPTER FOUR

FINDINGS AND ANALYSIS

Introduction

This chapter is divided into two parts. The first part will describe the context of the decision making process which is depicted in Figure 1, in order to help with the understanding of the data analysis.

The second part will be a reflection on the process while presenting the findings based on the major themes of time, decision making and communication, conflict resolution, cross-functional teams, and collaborative leadership. The chapter will end with a critical summary of the findings.

The Background of the Process

The decision making process itself was an evolutionary one. Prior to the structured process to be described in Figure 1, a subgroup of this team had participated in a less structured process to design the user interface screens for the system. Based on questions I asked each team member of how they decided on the process and how they compare the first and the second decision making processes, their responses resulted in the following statements.

According to the team members, the absence of a facilitator for the meetings which had no structure, developed into free form discussions that resulted in inaction. The experience of that initial process according to Participant No. 3 was quite negative. There was no shared understanding about the characteristics of the product to be developed from the perspectives of the

customer and contractor and the interdependency of the human factors design, which dictates screen design and behavior, on the software, for example.

According to Participant No. 4, with the first process "being unstructured we would end up in the meeting revisiting all the previous decisions we had made about the design, changing them, going back and forth, taking a change we made and working it back out . . . it was very difficult to converge on a solution." He further stated that the size of the task was large and "progress was very, very slow"; this combined with the lack of focus and no deadlines served as restraining forces in the productivity of the process.

Participant No. 5 confirmed what Participants Nos. 3 and 4 had indicated. The first process was unstructured and had no plan or focus resulting in "chaos." Also the interviews indicated that the previous process tended to concentrate on the screens and completely disregarded the behavior behind the screens.

Defining the behavior of a screen is critical to developing user friendly interfaces that emulate the operational environment of the system being developed, from a user's perspective. These negative comments meant that there was unsatisfactory progress and the team was falling behind in the program schedule. This fact was brought to the attention of program management by the customer following a major design review.

Program management responded by committing resources of time, the appointment of a facilitator, and the formation of the subteam devoted to an unprecedented effort in the experience of the organization to define the user interface for the system in Project R. This structured decision making process is depicted in Figure 1 and described as follows.

The Context of the Decision Making Process

To be able to analyze the process it is important to first understand the context in which the decision making process is embedded. New product development presents challenges to an organization as well as to the respective multidisciplinary project team. It is an environment where ambiguity and creativity prevail requiring the collective experience of each team member's expertise to provide design solutions that will meet program objectives.

Therefore, the environment is what Wilson (1992) characterizes as in a "quasi-stationary equilibrium" state—which is the state between status quo and equilibrium. The [tension of the] driving and restraining forces create a state of temporary imbalance while the team adapts to change" (p. 30). These forces can be both positive and negative. They provide an opportunity for collaborative leadership where collective growth and learning takes place. The driving forces "act as a catalyst for change," and the team membership is challenged to learn as they engage in and utilize their collective expertise to develop a product that will represent the sum of their teammind. The restraining forces inhibit change (Mink et al., 1994, pp. 86-87). This is a period of instability which challenges the team relationship with threats and opportunities towards collective growth and product innovation.

The driving and restraining forces affect the quality of the communication and the use of dialogue, the exchange of information, the relationship of the team members, and their ability to make informed decisions. These combined forces can affect the competitiveness of a new product. Through communication the team constructs its own social reality and makes decisions that affects the design of a new product. The decision making process proceeds through phases with

feedback loops where double-loop learning takes place in an ambiguous environment where ideas are openly challenged.

Communication initiates the actions towards change as the team constructs their own social reality through sharing of information. Information by itself has no value. Only when information is communicated and acted upon that it is transformed into knowledge which has value. Communication in the decision making process also helps to bring closure to the decision making "wherein tension with past events is reduced or removed and balance and equilibrium are restored" (Ford & Ford, 1995, p. 551). When equilibrium is restored the team is able to move forward.

Figure 1 is a representation of the decision making process under study. In order to understand the strategies this intact project team used in the decision making process, I will first describe the three distinct steps of the process. I derived the information about the decision making process from the interview data, historical data from the minutes of the meetings and other materials on the process provided by a confidant. It shows that the process is affected by the environmental and organizational driving and restraining forces and project constraints.

The first stage of the decision making process was the screen design phase. During this period a design engineer was assigned to produce the initial screen design for a given task. He used a Human Factors Engineering style guide which was developed on the project and other paper screen designs that may have been prototyped or validated for feasibility of such a design. The focus of the screen design activity at this stage concentrated on defining the necessary data fields, the choice of user commands and responses to a user inquiry or

Figure 1. The decision making process.
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action for each of the screens, as well as the behavior of the screens in interactions with other capabilities of the system being designed.

The responsible design Engineer using the product requirements garnered the expertise of the team members, on his own outside the decision making meeting time, to produce this initial design. The Screen Design Product was the Engineering Design Requirements Bulletin (DRB) for each of the software functional capabilities, (e.g., the functional capability that handles the protocols of the message traffic both internal and external to the system).

The DRB is a design document that describes the team's agreements with each other on the user interface design and behavior for each particular group of functional activities that constitutes a coding or programming module, based on contractual requirements. It provides a guide for the software engineers to write the software design code and serves as a basis for the system engineers to develop the procedures to test or validate the system to make sure it meets user requirements.

During the second stage of the process, the responsible design engineer presented to the user interface subgroup team members the initial screen designs with the behavioral features, recommended by the team members in the first stage for review. This included reviewing the comments that were incorporated into the design as well as defending why certain comments were not included in the design.

This team, called the User Interface Working Group (UIWG), included representatives from Wiz Electronics Company as well as customer representatives including a subject matter expert who represented the users of the system and was familiar with the operational domain of the intended system.

The purpose of the second meeting was to communicate further information about the design and the limitations based on available resources and requirements. During this meeting no design decisions were made but team members were invited and encouraged to ask questions about the design and address any issues that required further clarification.

There was on-going consultation with individual members of the team if some issues could not be implemented as part of the recommendations resulting from the presentation. At the end of the second meeting, the design engineer incorporated the feedback into the screen designs in the form of comments or changes made by the team during the presentation meeting. Members of the team used the information from this meeting to prepare for the third stage which was the decision approval stage.

The third stage of the decision making process was the design resolution phase. The purpose of this meeting was to finalize the screen designs and to address comments, including customer comments, to the documentation and the screens. Once team members were satisfied that the updates to the screens presented an agreed-upon solution, approval was given for the screen design and the DRB was signed as approved. This action brought closure to the design decisions for a specific functional capability.

At each stage of the process, the facilitator maintained minutes of the meeting wherein key decisions were made and where issues that required follow-up actions or further investigation were recorded. These minutes were also reviewed and approved by the organizational representatives on the team. Team members were encouraged to prepare for the meetings by reviewing the submitted documentation prior to each meeting.

A weekly schedule of the subteam's activity was disseminated and posted so that each member was aware of what software functionality was to be discussed and at what stage of the decision making process, (i.e., the first stage, the second stage or the third stage). Also the weekly schedules were posted on the project bulletin board to keep all project team members informed of the subteam's weekly activities.

When the decision making activity on each functionality was complete and documented in the DRB, (e.g., the message traffic to and from the system), the software programmers were able to develop the code from the DRB and generate the scripts or scenarios to determine the usability or initial feasibility of the design. This design then became the basis for the development of the prototypes which were the first cut at working models of the system which the customer community could then exercise and evaluate for further comment and revision. The comments were then reviewed and incorporated into the screen designs.

The context of the decision making process as depicted in Figure 1 and described above, served as the basis for the findings and later analysis of the interview data. The decision making process involved the elements of time, communication, decision making and collective learning towards a collaborative leadership relationship that was embedded in the social construction of reality within which the participants related their experiences. It also represented the strategies used to develop the core knowledge base of the new product in the teammind.

Since the team interviewed consisted of six core team members, only data that will not identify the participants will be presented in the findings that follow.

This approach was taken in accordance with the agreements reached with the management of Wiz Electronics Company, the targeted organization, and the University of San Diego's Human Subjects Protection Committee.

I use exact quotes from the interviews and at other times paraphrase the text where appropriate, to conceal the identities of the participants. Further, each of the participants has been assigned a number to protect their identities.

The Decision Making Process

The organization, through self-evaluation and based on customer-expressed feedback, used the first process to develop the strategy for the second process. The following data are related to the decision making process as a whole. Participants agreed that a structured, iterative process not only provided the team membership with focus but also an opportunity for feedback.

According to Participant No. 1, as soon as the team members agreed to some standards on the screen designs, (e.g., "the placement of buttons and how you would do certain things), the process went much faster. Now you aren't wasting your time trying to figure out what the new standard might be."

Participant No. 2 called it a "defined process. Things were driven to completion in a set of meetings and it was tailored to the personalities of the people involved . . . and resulted in project documentation that was useful to every developer [and could then be] translated directly into a piece of code." However, he commented that the meetings were long and that there was a tendency to talk "about people's comments in the meetings subsequent to the presentation meeting, rather than directly to the material itself."

He also felt that at times the focus on important issues and on the process tended to be sidetracked, "steered by the strongest personality rather than by

some systematic trip through the material." In addition, he felt that people on this user interface team had other responsibilities outside the area of the user interface group and therefore, the preparation for these meetings became "onerous" making competing demands on their time. These team members had other responsibilities within their own project disciplinary groups, the user interface group and to the project as a whole.

Participant No. 3 agreed with Participant No. 2 that at times the meetings tended to get off-course, and that while individuals are involved in the process they found it difficult "to judge" whether they were off-track. He also stated that the process helped to minimize the risks of making "a big mistake," because each issue was discussed during several meetings and there were "so many ideas and so many people involved, that you couldn't make a big mistake."

Participant No. 4 described the process as structured and providing opportunities for feedback which allowed the program to put "the appropriate designers in the process, people with the right backgrounds." This was appealing to the customer because it demonstrated that the design solutions were being made by engineers with a "software background as well as the domain background."

The domain background, or system operational background, is provided by the users of the system who are referred to as the subject matter experts. Using such an approach ensures that the user interface of a system can be designed taking into consideration the software application aspects as well as meeting the operational requirements of the users. He felt that having the team in one building or co-located helped to enhance the communication process.

Participant No. 5 believed that there was more accountability in the decision making process described in Figure 1 compared to the previous process. Individuals came prepared for the meeting, otherwise the meeting did not take place. This contradicts what Participant No. 2 said about not being prepared for meetings. The recording of the minutes and the documentation of the design in the DRB provided further accountability, responsibility and credibility to the process. This documentation contained the factual data of the meeting results and the agreed-upon design solutions.

Participant No. 6 agreed with Participant No. 4 with the fact that having the right people from all disciplines, "systems, human factors, software, the database and of course the customer both from the systems point of view and also from the operational point of view" provided for a "continual process of evaluation."

He also found that "no particular discipline had an advocate that could push or steer the design one way or the other." He thought this provided a good balance "across all functionalities." This contradicts an earlier statement made by Participant No. 2 who stated that the meetings tended to be "steered by the strongest personality rather than by some systematic trip through the material."

Contrary to Participant No. 5 about individuals being prepared for the meetings, Participant No. 6 agreed with Participant No. 2 that some members of the team did not have a chance to review the material for comments and so came to the meeting unprepared. He thought being unprepared was "a disadvantage for everybody else because they [those members] did not have a chance to look at the comments."

This meant "that those comments had to be basically digested in 'real-time' and you had to provide arguments or comments about those suggestions

immediately." He also agreed with Participant No. 2 that some members of the team had competing demands on their time and felt that the program was understaffed; consequently, many tasks had to be done "in parallel."

The data just presented was related to the process as a whole. What follows is an identification of the emerging themes based on the data analysis. I am presenting the themes as separate entities here to parallel the literature review presented in Chapter Two, where that is possible.

The research indicates that groups do more than make decisions. During decision making, teams or groups contribute to their human development both personally and professionally in areas which are not well researched, such as collective learning, developing relationships, and leadership. As our organizational environment becomes more complex and we realize that success is based on interdependency not independence, these issues will require further research so that we can make the workplace more productive.

Emerging Themes of the Process

In this section, I will first present the findings based on themes and then follow with a critical summary of the findings not as separate themes but as an integrated experience of the decision making process. The six participants were very candid about their experience of the process.

Although there were negative and contradictory statements, I sensed that the team members managed to work collectively through mutual adaptability and within the constraints of the program resulting in the extensive documentation that they generated to help the program move forward. I observed that their contradictory statements are just as contradictory as the theories analyzed during the literature review in Chapter Two.

In Figure 2, I depict the emerging themes of the interviews as integrated, represented by a three-leaf clover. The team functions in a project environment of an organization that is responding to the driving and restraining forces of a competitive environment in which it operates. Therefore, the cultural dynamism of the workplace is strongly affected by the push and pull forces of the context in which the team functions. Figure 2 also represents the symbolic characteristics of the emerging themes.

The geometrical stem of the clover embodies the stability and rigidity of time in U.S. organizations and the regulating effect it has on the behavior and actions of human beings as they attempt to make decisions that affect their work and team relationship. I represent communication and decision making as fluid structures that are affected by time and they are at the same level of hierarchy in the collective experience.

Time, communication and decision making, constitute the collective experience of the team through learning. During the decision making process, the team develops a collaborative team leadership relationship based on expertise and collective learning. This is the third fluid shape to complete the three-leaf clover representing the emerging themes of the data analysis.

The emerging themes of this study are an interplay of views, perspectives, actions and human dynamism that are enmeshed in an intricate web of interdependence. One can attempt to extract the components to understand each better but the sum is the human experience in context, as related by the participants involved in the process, which is subject to interpretation.

What makes this decision making process unique is that this collective human dynamism is involved in bringing to life a product from a concept. The

Figure 2. Integration of emerging themes.
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product is intended to change the way the future users of the system are going to perform their current jobs, using the latest technological advancements in softcopy photointerpretation.

Softcopy photointerpretation involves the end-user's interpretation of digitized images photographed from remote sensors to which geolocations can

be assigned on the screen as the images are captured. Human drama in the workplace is thus enacted in an environment where creativity and innovation need to prevail and where there are no easy answers.

The end-result of the process was that within six months, the user interface working group was able to generate 1800 pages of documentation in the form of 60 DRBs and over 500 screens. Therefore, they succeeded in achieving their objective of documenting the user interface design for others to implement. What follows is the findings based on the interpretation of the emerging themes of how the team achieved their objectives.

Time.

In Figure 1, time is characterized as a constraint in the decision making process and in Figure 2, it is depicted as the stem of the three-leaf clover that regulates the behavior of the decision making process. It is also viewed as a driving and restraining force and the interviews will reveal the extent of those forces on the process. The project team had six months to complete the task of determining the user interface design for the photointerpretation information system. What follows is the participants' experience of time during this ambiguous journey of discovery.

Participant No. 1 stated that the team "didn't have time to investigate all the different possibilities," and even though there was probably a better way of doing things, "you didn't have time to go back and do a redesign." At other times he felt he could not investigate "one way versus the other." It was a trade off because he "knew [he] had to get it done in a period of time." However he felt that the iterative decision making process educated everybody as to "what your

design was going to be and [this gave the team members] enough time to think about the ramifications of the design.”

According to Participant No. 2, in order to have a successful engineering product “there’s a limit to the size of the job that can be done by a team of human beings developing software that needs to be constrained both by the number of people working on it and the time it’s going to take” to develop it. This echoes the sentiments of previous statements about the process.

He also felt that the meetings were a big consumer of time. He agreed with Participant No. 1 that there was no time to consider all the alternatives. Participant No. 2 felt that because of the time constraints the more prudent way was “to kill alternatives” in order to stay focused.

Participant No. 3 regarded time as multidimensional. He stated that “time is money,” and of course they wanted to save time and make the meetings short. But in the process of discussion, especially with important issues, the group would spend almost two hours on one issue so that everybody could understand the issue. He felt that discussing an issue thoroughly is time well-spent and “so it’s a trade off.”

He described the time spent on the user interface design process as important because it “extracted the horse from the carriage.” He realized the importance of synchronizing and coordinating the software design and development efforts with the user interface or human engineering aspects and will take this experience with him on future projects.

He was also quite emphatic that he did not allow time to influence his decision making and meetings were extended to reach sound decisions. Extracting the horse from the carriage is interpreted as separating the user

interface design activities from the software development. He felt that the user interface design should precede the software code development because it defines the screen design which aids in the development of the software code. Therefore, by extracting it from the software development, the team members were able to concentrate on the interface design itself.

Participant No. 4 agreed with Participant No. 2 “that the time constraints, the size of the task, the amount of resources assigned to the task, the schedule to get it done, and knowing that our schedule was driving the whole program schedule, meant that the amount of time a designer could spend designing restricted his freedom to explore alternatives and limited our right to comments.” Contrary to Participant No. 3, Participant No. 4 felt that the time constraints “cut off the discussion” and forced decisions. Given less time constraints, some of those decisions may not have been made. As a result, Participant No. 4 surmises that the product design is not as complete as it could have been given different circumstances. In the follow-up interview he further stated that “if we compress time people are not going to be as thorough . . . in a short time period people don’t necessarily think of everything.”

Participant No. 5 also talked about how stressful it was with the time constraints and the workload. He felt pressured to take work home to complete the task which presented him with a dilemma in his ability to juggle the balance between his “family life and his job,” leaving little time for relaxation. He stated that the time allocated to completing the DRBs and each of the steps in the process was “too tight, and unrealistic.” He did agree with the other participants that understanding what needs to be done takes time and that the process in the project schedule was timely.

Participant No. 6 felt that the team “had a very short turnaround time for comments on the design package.” According to him the whole process was a “time-intensive kind of activity,” because they were reviewing four or five design packages every week and each meeting lasted approximately two hours. He stated that if the team members were not physically in a meeting, they were reviewing another design package or multiple design packages, writing comments, talking to the design engineer who was working on the screens and the behavior of the screens. In addition, team members had to go back to the contractual and design documents to reevaluate the requirements against the suggested design. He felt that the program was understaffed therefore it created demands on those who had other responsibilities besides participate in the user interface design process.

Decision Making and Communication.

As was just discussed, time serves as a regulator of the communication process. “Communication is the process through which we constitute experience” (Barrett et al. 1995, p. 353). In the interview data these two themes—decision making and communication—are intertwined and for the most part it becomes difficult to analyze them as separate categories. “Decisions are social products embedded in ‘social reality.’ Communication processes are the primary means through which social realities are created and sustained, and therefore are the prerequisites for making decisions” (Poole & Hirokawa, 1996, p. 8).

Consequently, because decisions are outcomes of communication and are an integral part of the decision making process, they will be presented within this joint framework for the most part and separately when appropriate.

“Conversations include not only what is said, but also what is done in correlation with what is said (i.e., a gestalt)” (Ford & Ford, 1995, p. 545).

According to Participant No. 1, the group had to make decisions quickly without investigating all the different possibilities. Their past experience provided the judgments for actions. When one person presents an idea as in the first stage of the process described in Figure 1, “usually even if you don’t agree with the design, the other team members look at your design and say well it will work. The group usually goes along with your recommendation.” Whereas when you “put it out for discussion, everybody starts arguing about it.”

For Participant No. 1, having a facilitator for the meetings helped to keep the focus on the issues. Good ideas as well as “a decision saying that we don’t want that widget or we want this type of widget” were recorded in the minutes of the meeting. Action items were generated for those issues that required further research; these were assigned to individuals. These action items were tracked to completion as documented in the meeting minutes.

Participant No. 1 tried to minimize the risks in decision making by designing something that “was more straight forward and yet would satisfy the [design] requirements.” In preparation for the screen design meeting, he would solicit the ideas of “each person and asked what is your idea if you were to design this”?

Participant No. 1 stated that for the most part he went along with the decisions made by the team although he didn’t always agree with them. He also stated that you reach a point where you cannot affect the decision making process either because the decision has to be made at a higher level or because

you reach a certain point and say that the decision is acceptable because it will still work.

Participant No. 2 talked at length on the issue of the balance between the team members presenting creative solutions and what was humanly possible within the time constraints of the project. He stated, "there's only so much that a team of human beings can implement in a 3-5 year time period and if you cannot release a product that does something useful within that amount of time, history shows that you will probably never release anything at all."

Therefore, the decision making solutions had to take this factor into consideration when eliminating the many good ideas that surfaced during the discussions. Participant No. 2 claimed that he went into the meetings "relatively unprepared in terms of [his] depth of knowledge on the material." When the arguments went on indefinitely "[he] tended to give in on things because [he] just didn't know."

For Participant No. 3, "to take all those ideas, all those comments and try to come to a common understanding, is very difficult." But working in a cross-functional team helped him to see "the bigger picture" of the system and also see it from the user's perspective which is different from the contractor's perspective. As a member of the team he was able to understand why a certain idea could not be implemented even though it was a good idea and this helped him with the decisions he made. He also agreed that everybody participated in the decision making. Sometimes, however, the majority rule prevailed. Although at times he was of the minority opinion, he did not object to the majority rule.

Participant No. 4 stated that the comments on the screen presentations provided an opportunity for everybody to participate in the decision making. "The

person who generated the comments had to defend why they thought that something should be changed and then the other members of the group had the opportunity to either agree, or disagree." It also prompted a lot of discussion which involved dialogue. Sometimes individuals "conceded and in some cases it was a negotiated solution."

In discussing the issue of how the team knew when a decision was complete, Participant No. 4 responded that it was very hard to tell when "a decision had been reached." According to him, some decisions were complete when "there was something concrete that somebody had to do to say I'm done." In this situation, the approval of the DRB signified the closure of the decision making phase for the design of a particular operational capability of the system.

However, there were other incidences when some team members thought they had an agreement because "we'd talk around it for a while and everybody would be talking one way and then somebody would do a total reset. And there was for all intents and purposes what appeared to be a complete lack of communication." He concluded the discussion on this subject by stating that "there are some people who while they accept the outcomes they don't necessarily agree with the decisions."

Participant No. 6 indicated that in the real world the development of the software and the performance of the software in the actual system had to be considered for every window or screen. Consequently, "there were some compromises made between the best possible user interface and what would also work in the software world."

He didn't think that the compromises undermined the design effort but it did create complexity in the window designs that probably the user will not need

“on a day-to-day basis.” However, he stated that the complexity was hidden in tab structures that can be accessed only when the user needs them. Using tab structures would not be distracting to the user and therefore would not affect performance.

In referring to the use of dialogue during the process, Participant No. 6 stated that there was “a lot of dialogue in our meetings, every one of them was lively, lots of lively discussion and that has to do with the fact that what the customer would like to have, usually exceeded what we were required to do.” He added that the software developers had considerable experience in determining what was feasible for implementation without affecting performance requirements. Through discussions, they were able to convince the customer to lower expectations of what could actually be done. In the process they were also able to persuade the customer that the solutions would still be compliant with the program requirements.

Conflict Resolution.

When contractor and customer personnel are members of a team there are bound to be conflicts. They come from different organizational perspectives even though their common goal is to develop an information system that meets the contractual requirements. The customer seeks to maximize his investment by contributing to “feature creep” which is a designer’s nightmare, while the contractor wants to generate a quality product within the constraints of the contract and still realize a profit. Feature creep is described as design enhancements beyond the scope of contractual requirements.

In addition, within the team there are representatives from different disciplinary backgrounds who have different perspectives on the design

decisions which have to be understood and negotiated through communication. This creative tension triggered by the existence of the multiple realities challenges the equilibrium of the relationship towards mutual adaptability.

According to Participant No. 1, some conflicts were not handled during the meetings. Some conflicts were resolved by action items that he or another engineer were assigned to research and resolve. Participant No. 1 felt more comfortable and in control of a situation by talking with individuals on a one-to-one basis outside the confines of the scheduled meeting because "then you can really focus attention on the issue at hand for some kind of a discussion."

Participant No. 2 discussed a different strategy that was used to "hold the line" on issues where there were persisting differences of opinion between the customer and the contractor personnel. Contrary to what Participant No. 1 stated that conflicts were not dealt with during the meetings, Participant No. 2 said he developed "demos [to] show how things could be used with the prototype and [went] through endless discussions with whiteboard drawing . . . to get some of those ideas adopted." There were occasions when the contractor personnel had to say "no" to a design feature and cited the contractual requirements as the constraint to the customer representatives. On other occasions, persuasion through demonstration was the only way to resolve conflicts.

Participant No. 4 reiterated earlier statements by Participant No. 1 that some conflicts were handled by an individual being assigned an action item to further research a given issue. Some of these action items were directly connected to requirements. "If they could show there was a requirement, they could take the action upon themselves to do it," otherwise it was considered a non-issue. However, in other instances there were some issues that were

implemented even though they were not requirements if they were simple or the team felt "it was the right thing to do."

In resolving conflicts about the operational issues of the system, the customer delayed the decisions until there was either further investigation or communication was established with the end-users of the system who were in a different location. When the information was made available, the customer representatives provided a solution that was discussed further and then either accepted or rejected by the contractor team members.

Borrowing a metaphor from fencing, Participant No. 6 described how conflicts resulted in "thrust and parry . . . agreements and counter arguments as to why we would or wouldn't do something." He also admitted that at times during the process, "a person would not truly listen to another person's opinion or design concept." Those individuals would jump in before the person speaking had a chance to finish which led to conflict and having to repeat the issues for discussion.

To tame the resulting conflicts, the facilitator stepped in to re-establish a more productive and less threatening environment by "someone getting an action item to go off and research a particular issue." Participant No. 6 also stated that when the discussion was not going anywhere, "we tried to arbitrate things that got into a deadlock situation . . . go back to the source documents, (i.e., the contract, requirements documents, etc.), to find out what the real requirements are and start from there."

Another source of initial conflict was a lack of communication and understanding between the customer and contractor team members on the importance of determining the user interface design and how it affects the

software development process. This failure to communicate according to a participant created the time constraint under which the team was now expected to perform. The customer representatives either did not understand or were not aware of the specific guidance the software designers needed from the subject matter expert or the customer representative on the operations of the user interface.

“We didn’t look at the entire picture that was the problem . . . I thought, what is it? Why don’t they ask me exactly what they need? They waited, waited, waited for what”? The concluding comments expressed were, had the contractor representatives communicated this information earlier, the time constraints would have been less stringent.

Cross-functional Teams and Learning.

Since the members that make up a cross-functional or multidisciplinary team are drawn from different engineering disciplines, and in this case from contractor and customer organizations as well, they each bring their perspectives on a design issue depending on their respective disciplinary backgrounds or roles. To be part of a cross-functional team, members have to go through a process of socialization or acculturation where communication and shared understandings enable “mutual adaptability.” During this period, individuals learn to work collaboratively and view the system they are developing in its totality and to see how their individual parts contribute to the whole.

This socialization process creates a learning environment through the cross-fertilization of perspectives to develop a product’s core knowledge that resides in the teammind, as discussed in earlier chapters. In addition, team members develop a collaborative relationship based on expertise.

According to Participant No. 1, he “gains in interaction with people from other disciplines” because it provides him with the “big picture” or systems perspective on the product. This fact is facilitated if the project team is co-located in the project area away from their normal organizational or functional discipline workplace. He admitted that there were strong personalities on the team and there were times individuals would get hung up on semantics which tended to extend the meetings.

He also added that when working in a team “one of the first things you learn is trust.” If you commit to something and do it, this establishes a good working environment. However, if there is mistrust then “people get too detail oriented like they want everything nailed down.” He felt that the advantage of working in cross-functional teams is that you find out the strengths and weaknesses of individuals. If you want things done quickly, you go to the individuals who have the expertise, for efficiency reasons.

The strategy Participant No. 1 used in coming up with a design solution in preparation for the first stage of the process, was to approach individuals and solicit their inputs. In the process individual learning took place incrementally as a series of building blocks. “I got different viewpoints that I might not have thought of . . . I thought it was a good idea and I would take one part of his design idea and another idea from someone else and combine them with mine.”

Participant No. 2 talked about the concept of producibility in product development where “an engineer can design something really slick but whether or not it can actually be manufactured has to be considered” in the design decision. For this reason, it is important “when the team actually cross-fertilizes

one another in terms of knowledge then everybody learns a little about what the other guy knows.”

In this way a team builds a product that addresses all the requirements and does what it is supposed to do in a more holistic way. So an interdisciplinary team “where people learn from one another so that they go off and do things taking into consideration the total product,” is the better way to achieve positive results.

Also during the process of cross-fertilization for example, the subject matter expert had to be educated on the limitations of the software characteristics and the software engineers had to be educated on the operational characteristics of the intended system. This helped them develop the right user interfaces through the screen designs to enable the future end-users to operate the system in the way it is intended to be used.

Participant No. 2 viewed customer participation on the team “as a mixed success.” According to him, “there is a place for customer participation on a team because it is critical that the product truly supports the customer.” However, when the customer starts building complexity into the system, there is “a significant risk of great overrun and a purge later at great expense of functionality” which will require “on-the-fly redesign to get rid of the complexity.”

He further clarified his perception of what customer participation should be as “an excellent understanding of the problem and a rudder that steers you back onto solving the problem,” especially when the team deviates from what would be effective. He also stated that customer participation on a team should provide a forum to “bounce ideas off so that you are not stuck with blindly implementing the requirements.”

For Participant No. 2, the exchange of knowledge that transpired during the meetings focused on the “requirements, about operational usage of the intended system, about philosophy, about the current training and capabilities of the personnel who would use the system, reformatting the code conversions from the intended system to the external systems with which the system is supposed to interface, etc.” With the customer present on the team “all members brought something to the meeting in terms of knowledge.”

Participant No. 4 gained domain knowledge from the process and the “rationalization of why you do and do not want to do something on a certain interface requirement based upon requirements, design capabilities and customer desires.” He also cautioned that the decisions made involved some risk and that during implementation the software developers will find that some of the decisions made were wrong and some features that the customer felt they needed to have “they don’t really need.” This last statement supports Participant No. 2’s comments about the customer’s involvement and building complexity into the system.

Participant No. 4 also agreed with other earlier statements made about the domineering personalities in the group. Some of the designers were more forceful about saying “we ought to be doing this as opposed to here’s the problem tell me how the decision turns out.” He also stated that if the presenters had not adequately prepared for the meetings, the meetings would have degenerated into an open, endless loop.

Participant No. 5 enjoyed the cross-functional aspect of the team because it was comprised of individuals from different fields. If, for instance, they did not understand what the problem was with the software, “the software expert was

able to describe the problem which helped us understand what the issue was and discuss it further.” He felt that it was good to have recorded the minutes of the meetings but felt that “in a few places we rushed to conclusions.”

In addition, Participant No. 5 agreed with other participants that because some people were more vocal than others, it was difficult to interrupt the discussions to solicit different viewpoints from individuals in the room who did not have a chance to speak. He also advocated that “people should be patient and learn to listen and understand” what the group meant by a required solution that was incorporated in the DRB.

To influence the decision making on a particular issue, Participant No. 5 used “real life” examples to convince the other team members of his solution. If they still disagreed he asked the team members to “convince [him] because [he] is very open to new ideas,” but that he needed to be convinced whether what was being suggested was or was not a good idea. He was specifically referring to the use of color and shapes in the design of the screens when talking about his decision making strategy.

Participant No. 5 reported that besides the learning aspects of the process he developed individual skills such as “speed reading, speed writing, the ability to identify the major comments by skimming through the material, etc.” As a result of the process, he learned that the computer has limitations and that it is up to the human being to develop the processes to come up with the intended results.

Participant No. 5 also realized that everybody has perspectives on an issue depending upon whether they were the customer or the contractor, and that it was “very important to know how to communicate with each other” because of the different viewpoints. His experience of the decision making

process was likened to living in a learning environment: “you were alive, living in the material . . . for me it was great.”

Participant No. 6 described at length the tools that were researched and evaluated to aid in the design development. “Individuals would go off and look at a particular breakthrough in their particular field dealing with object-oriented database design . . . we had people looking at the Internet to find particular kinds of widgets that fit into our environment to cut down on our software development.” This information was shared to make tool selection decisions within budget constraints.

Participant No. 6 also reiterated earlier statements that “most of the people on the team [were] vocal and opinionated and not shy . . . and so at times we had multiple conversations.” This of course meant that some individuals were not listening and as a consequence the same question had to be restated which would “upset” members from the contractor team.

According to Participant No. 6, having the customer as part of the team slows down the decision making process because:

They have their own agenda, that they bring to the table which is how much can I get in my system for the dollars that I have paid? . . . You want the users to be involved because you want it to be a useful system in the field. On the other hand, I think that the process slows down too much by having the customer involved daily.

The significant risk he expressed is that “having the customer in a working session on a daily basis tends to cause a merging of views over time—between their view and our view—and the design then tends to become a homogeneous

view. And I don't think you really want that . . . you want the users involved because you want the system to be useful in the field."

Participant No. 6 stated "that he learned a lot from the customer and specifically what they wanted." He felt that there were many features "that the developers thought were important but that the customer from an operational standpoint didn't think was important at all." He learned that "the developers had concerns not so much about the interactions with the screens but how difficult the interactions would be to code and test which was lacking on the part of the customer representatives. This gave him an appreciation for their point of view that [he] hadn't had in the past."

Collaboration as Structure.

In a research and development environment, team members are appointed to a project team based on their expertise. Today's product development environment involving leading edge technology is so complex that no one individual can have all the answers to a design solution.

In this study, the collective expertise of the team members helps to develop a product from a concept that will transform the way the intended users of a system will perform their jobs. Therefore, it is through the collaborative expertise of such individuals that decisions are made.

Leadership in such a team is based on expert power not legitimate power and is dispersed within the team membership. The team develops a relationship that has to be based on shared understandings and mutual respect to ensure that the product they design meets project goals while furthering their own human development. Although no explicit questions were asked about collaborative leadership, collaborative leadership based on expertise is assumed

to be prevalent and is interpreted from the words and described actions of the participants.

Participant No. 3 cited each of the team members strengths while displaying respect for each one's expertise and how important that was to the process. A customer team member summarized the team relationship with the following anecdote. He said when he first came to the project and a team building seminar was proposed, he thought it would never work because he could not see how customer personnel and contractor personnel could be part of a team when they came from different perspectives. He felt that they could be two different teams but not one team.

As he reflected on the six-month decision making process experience, almost two years later, he realized that the team had built a relationship around the product they were designing while learning from each other. He admitted that in the process they actually "worked as a team. And it's a great team." He commented that they worked together by helping each other to come up with an appropriate user interface design. For example, they jointly researched a tool for effective user interface design and used it to develop the user interface.

Participant No. 4 was "impressed with how some of the people kept up with reviewing the material for the reviews," and felt that the customer "did an outstanding job of reading the documents." He stated that the relationship was "strengthened by the process." He echoed earlier statements by other team members that "there was certainly mutual respect among a lot of members of the team."

On the issue of trust, he stated that he did not think there was "total trust. Because there certainly were incidences where in a disagreement one side said I

absolutely think it's not a requirement and the other side said well let me go check . . . so it wasn't implicit trust. But there certainly was a level of trust."

Participant No. 5 felt that the process "strengthened the relationship between people because we [started] to respect each other . . . we were bonded together like glue." He also stated that team members began respecting and recognizing the individual expertise within the group.

Participant No. 6 stated that the work that was completed by this process could not have been accomplished by a group that did not have an established relationship. "Because we knew everybody and we had all worked together except for some of the interface designers, we already had a pretty good idea of what everybody's style was and we laid down the rules of how the team was going to operate." According to Participant No. 6 when a team does not have such a relationship they have to sit down and write the rules during the first couple of meetings.

Summary of Findings

The emerging themes from the analysis of the data as represented in Figure 2 are communication and dialogue, decision making, conflict resolution, collective learning and collaborative structures. These themes are an interplay of views, perspectives, actions and human dynamism enmeshed in an intricate web of interdependence. I presented the findings as separate themes to reveal the complex dimensions of the decision making process. However, in the final analysis I represent the dimensions as an interconnected human experience, which is depicted in Figure 2 as a three-leaf clover and summarized from that perspective.

In their discussion of conversation as "speech acts," Ford & Ford (1995) state that "all speaking is performative, in that it is made up of 'speech acts,' which are actions in language. These actions are not idle: they bring into existence a social reality that did not exist before their utterance" (p. 544). In the context of this study, this social reality resulted in the decisions that the team made to bring to life a new product from a concept that will change the way the future users of the intended information system will perform their tasks.

Based on the interviews and the minutes of the meeting, I depicted the decision making process described in Figure 1 as three defined stages with opportunities for feedback to improve the user interface design as the team shared information and made decisions. This structure was defined through a process of self-evaluation and organizational learning based on the chaotic experience of an earlier process. "Learning organizations discover what is effective by reframing their own experiences and learning from that process" (McGill & Slocum, 1993, p. 67).

The structure provided the user interface working group with a roadmap of the decision making process so that the members had a common understanding of the stages of the process and what the expectations were from the participants at each stage. Such a defined process provides an organization with a framework or an organizational repertoire within which to function during periods of turbulence and growth, and is in sync with established research practices (Jones et al. 1994; McLeod, Jr., 1994; Murray 1986; Radford, 1977). The participants commented on the positive by-products of the process in the form of design documentation once consistency was established through templates,

which provided the rest of the project team with a design basis for code and test procedure development.

Other statements from the participants focused on the imposition of a deadline on the process. According to Parks & Cowlin (1995), "individual decision makers react to deadlines" negatively (p. 268). This was supported by the numerous statements where the participants admitted that they either came unprepared to the meetings or focused their limited time on reviewing the comments rather than the material itself. The decisions they made were trade-offs based on incomplete information, which involves some risk.

One participant felt that coming unprepared to the meetings was disadvantageous for the rest of the team members because those participants had to make ad hoc comments that had to be digested in "real-time" by the rest of the team. This places additional cognitive pressure on team members who have to digest the information and act on it in parallel. It is what Dixon (1994) refers to as "act through learning," where learning and acting have to be concurrent because of the fast paced environment in which the team has to function (p. 121).

Another participant admitted that he had to give in to the arguments on a design issue because he was not able to review the facts. He was more concerned with "completing the task rather than understanding the task . . . because of the sense of urgency" imposed by the time limit (Gouran & Poole, 1996, pp. 60-62). However, according to the literature, making informed decisions with complete information is an ideal situation that is seldom achieved. The research also indicates that even when individuals have all the information

they need, decision makers still selectively process only a fraction of the information obtained.

Some participants were overwhelmed by the size of the task and the conflicting demands it placed on their other project responsibilities. This created a stressful situation for some, and one member in particular had to take work home thus contributing to destabilizing the balance between his work and family life. Some of the participants found the deadlines unrealistic and demanding.

According to the research when unrealistic time pressures are placed on project teams, it can result in dysfunctional behaviors which tends to destroy the level of trust and mutual respect necessary for collaborative action. Participants indicated that sometimes the discussions were dominated by a few and that the majority rule prevailed during some sessions.

As a result, at times the team resorted to a hierarchical or unifocus style of decision making which is antithetical to a collaborative and participatory environment required for integrated product development where expertise is dispersed among the team membership. At other times the decision making style was more maximizing and multifocused or integrative which is more collaborative (Driver et al., 1996). As one participant cautioned, some of the decisions made involved risk and may turn out to be "wrong" during the implementation. Some "features that the customer felt they need to have" may turn out to be unnecessary. But he considered all these decisions as trade-offs in the early design stage of the product.

Although at project inception it is hard to predict what design changes will result downstream, Leffingwell (1997) states that a contractor needs to manage the scope of a project through the evaluation of requirements to avoid

unnecessary “feature creep.” He also proposes that as changes occur and are identified, the scope of the project needs to be reevaluated and negotiated with the customer to determine the “must have . . . critical priorities,” so that utility and quality are not compromised and the product can be delivered within program milestones (pp. 28-29). This negotiation requires intensive communication or dialogue, diplomacy and tact where the various stakeholders come out as winners; herein lies the challenge to the leadership relationship.

The time restrictions affected the decision making process because dialogue which is essential to ensure shared understandings had to be curtailed. Some participants resorted to satisficing; in other words, they made decisions that were good enough, as long as they met the minimum criteria of the requirements. They did not necessarily engage in dialogue to explore the various alternatives of their team members who had different perspectives.

The team members also “killed alternatives” rather than explore the different possibilities through communication and dialogue for more informed decision making. “The rapid processing of information only allows for a surface level skimming and evaluation of the alternatives (Gouran & Hirokawa, 1996, p. 66). In addition, our mental capacities to “learn and absorb information are not uniform” (Bass, 1983, p. 146). Therefore, individuals had to make decisions under these external psychological constraints which Simon termed “bounded rationality” (in Szilagyi & Wallace, 1987, p. 367).

According to the literature, interaction through communication and dialogue among the team members does not necessarily improve the quality of the decisions but provides for more confidence in the decisions made. Participants were in agreement that they learned from each other through a

process of cross-fertilization and that they had the right people or experts on hand who could provide answers to questions and verify the feasibility of the design.

Cyert & March (1992) state that having the right people in the “process of choice reflects planning, thinking and analysis” (p. 237). If the team felt an issue needed further investigation, the decision was either postponed until the results were available or an action item was assigned for further research. This strategy provided for effective use of valuable time and was recorded in the meeting minutes so that issues could be systematically tracked to completion.

There were mixed reactions to the customer being part of the user interface core team. While the contractor team members realized that the customer's participation contributed to the team's understanding of the domain or operational expertise of the design effort “because it is critical that the product truly supports the customer,” some participants stated that too much complexity was built into the design that may not be needed.

On the other hand, having the customer on the team meant that the customer had a timely understanding of why certain features were implemented and others were rejected. This is a preferred way of communicating with the customer, rather than trying to explain why certain features were not going to be implemented at a later date, when the design decisions were frozen and it becomes a “no win” situation for the customer.

The customer's presence on the team created conflicts especially when they were perceived by the contractor representatives as wanting to maximize their investment by adding enhancing features to the design that were beyond the scope of the requirements. According to Participant No. 6, contractor

representatives also contributed to “feature creep” by building in technological complexity in the screens that the customer does not really need.

In response to customer requests for enhancements, the contractor representatives resorted to invoking the contractual requirements as the delimiting factor. They were trying to manage the scope of the task and avoid “feature creep” (Leffingwell, 1997, p. 78). At other times, the contractor representatives incorporated the “feature creep” even though it was not a requirement because “it was the right thing to do.”

These strategies had the effect of possibly eroding the level of trust between the customer and contractor representatives. This can be damaging to a collaborative relationship that is supposedly built on trust and mutual respect. On the other hand, having the appropriate expertise mix on the team served to establish a level of trust and confidence in the design decisions that were made, which minimized the risk of making a big mistake.

Also one of the participants remarked that the role of the customer was to guide the design effort so that the customer’s perspectives truly represented the end-user’s interests. However, if the customer is part of the design team, his daily presence on the team can lead to a “merging of views” of the design effort; there is then the danger that the end-user’s perspective is either lost or diluted in the process.

Janis (1982) coined the concept of “groupthink” to describe the dangers of cohesiveness in the decision making process. This occurs when groups have been working together for a while and individuals give in to group pressure to maintain the status quo rather than challenge a solution for breakthrough

decision making. He advocated the strategy of using a devil's advocate or an outsider to challenge the viewpoints in the decision making process.

However, based on my interpretation of the statements the participants made about the communication patterns and decision making practices of the group, I do not think the group displayed symptoms of "groupthink." Some members conceded to the majority opinion during the discussions either because they did not have the information or because the time restrictions forced them to make decisions without considering all the alternatives.

The team relationship during the process was described as cohesive by one participant, "the process strengthened the relationship because we [started] to respect each other . . . we bonded together like glue." However, another participant using a metaphor from fencing characterized it as confrontational; there were "arguments and counter arguments like thrust and parry."

In her discussion of narrative Richardson (1990) states that we perceive "argument is war," and therefore use combative metaphors to describe such communication patterns of "cognitive content." She asks the question of "how differently we would experience arguing if the metaphor were "argument is a dance"? (p. 119). In light of this perspective, the arguments and counter arguments can be perceived in a different light towards positive dialogue and collective learning.

There were several statements alluding to the fact that there was lively discussion during the process because the customer expectations exceeded the contractual requirements. As long as they are not destructive, arguments imply that some point or perspective is not understood or addressed. "At that moment

we usually respond with anxiety and/or anger, though we may be barely aware of it" (Schein, 1994, p. 3).

The findings did indicate that there was a form of dialogue during the decision making process as advocated by Bergquist (1993), Schein (1995) and Senge (1990). According to Grob (1984), "the presence of dialogue, moreover, implies no given style of interaction. The 'mechanics' of the process may be different in each and every leadership situation" (p. 275).

There were at least three occasions during the interviews when participants indicated that multiple conversations were going on during the decision making process. They reported that individuals did not listen to the person speaking or wait till the person finished speaking before interrupting. Listening to what an individual has to say is critical for shared understandings and meaningful communication.

Through dialogue, discussion, negotiation and diplomacy, the team was able to generate 1800 pages of documentation in the form of 60 DRBs and over 500 screens in a period of six months. Whether the decisions they made during their social construction of reality are sound, will be put to the challenge as the design is implemented and eventually accepted by the end-users of the system.

However, through the case study methodology of the participants' lived experience I was able to peer into some of the complexities of the decision making process of an intact project team, under time constraints. The learning experience involved in new product development requires the expertise of the teammind that matures through participative social interaction.

Communication is the conduit through which we constitute the decision making process. As Ricoeur pointed out, when narrative or communication is

interpreted in relationship to time, "time is made human" (in Richardson, 1990, p. 120). It is against this backdrop of the human experience that the workplace drama is enacted.

The workplace is where this project team is challenged to collaboratively make design decisions to develop a product that will change the way a sector of society will perform its jobs, using the latest technological developments. As discussed earlier, such an environment is filled with creative tension resulting in disequilibrium that presents a threat to the collaborative relationship. Once there is closure on the decision with the approval of a document or the DRB, equilibrium is re-established and the team moves forward, re-energized to deal with the next opportunity for challenge. Thus, working time "is a much richer phenomenon than is portrayed in mainstream industrial sociology" (Hassard, 1996, p. 585).

A reflective and qualitative methodology reveals the complexities of the decision making process given time constraints which has implications for organizations. Organization theory now includes attention to the postmodern era, where the speed of technology is changing our concept of time while as human beings we recognize our inherent limitations to respond to such a challenge. Bronner recommends further research on "the principal problem of using time resources in decision making [as] a new frontier in science" (1982, p.12).

This recommendation has relevance for research on intact project teams in the workplace. As each of us cognitively learns and absorbs information at different rates, this presents a challenge to the collaborative relationship. Collaboration for integrated product development requires the synergism of the teammind wherein the project's core knowledge base is accumulated and stored

to provide the solutions for new product development. This can only be achieved through communication for shared understandings and informed decision making, to ensure an organization's competitive edge—and this takes time.

CHAPTER FIVE

IMPLICATIONS AND RECOMMENDATIONS

Introduction

This chapter begins with a summary of the study. It describes the purpose of the study, the literature review which provided the theoretical foundation and framework for the different concepts that interplay in the decision making process, and the reasons why the case study methodology was chosen. The summary includes the findings based on the analysis of the data.

Following are the implications of the study and the significance for workplace practices. The chapter ends with recommendations for organizations and program managers, as well as for future research.

Summary of the Study

The sophistication and complexity of developing technological products in today's research and development organizations require the socio-techno-cognitive abilities beyond that of one individual. This development is having an impact on organizational structures where interdependency and collaboration of a multidisciplinary team need to prevail if the organization wants an integrated product that is marketed on time, to maintain the organization's competitiveness.

As discussed in the literature review, "a project is considered 'successful' if it is completed on time, within budget and to the specified standards" (Chan & Kumaraswamy, 1997, p. 55). However, to develop a quality product that satisfies the user's needs within budget and time constraints, multidisciplinary teams in

new product development need to engage in dialogue to develop shared understandings. This way they can ensure that the decisions they make are a collaborative effort of the teammind, especially in the face of ever-challenging program milestones.

I interviewed a multidisciplinary subteam of six team members in the workplace, who represented both the customer and contractor organizations and who had participated in a six-month intensive decision making process. They achieved their objectives of defining the user interface design for a novel photo-interpretation information system which is contained in 1800 pages of design documentation that they generated.

This documentation of the design can benefit the rest of the project team who need to use it to write the software code and the systems engineers who need to use it to test and validate the system. The subteam's design decisions when implemented, can also transform the way the future users of the system intend to perform their tasks using the information system being developed by the team.

Study Objectives.

This study had three objectives. The first was to determine the strategies an intact, multidisciplinary project team used in decision making under time constraints, to develop the user interface design solutions for a photo-interpretation information system that originated from a concept. The unique features about this team were that they had an established working relationship for over a year, and the customer was co-located with the contractor team in the workplace to perform the daily tasks of the system's analysis, design and development.

The second objective of the study was to determine how praxis can be achieved between theory and practice in the workplace so that everyday work integrates theory with practice. The third objective of the study was to use the lessons learned to identify team skills for the training and building of multidisciplinary teams in organizations, so that they can become more productive and use their limited time more efficiently. The lessons learned can also help the organization to improve its internal practices to make the design decision environment more effective especially in the analysis stage of a project, when shared understandings among the various team members need to occur.

Objective 1: Decision making strategies used by an intact team. The literature indicates a need to research intact teams embedded in the social reality of the workplace, dealing with real problems where decisions have to be made under time constraints. Most of the research studies have focused on ad hoc teams of students in laboratory settings with the researcher imposing an artificial problem on the participants resulting in decisions that have no consequences. In addition, the researcher has a solution to the problem the team is requested to solve. In contrast, in the workplace decisions made have real consequences on an individual's career and organizational competitiveness and there are no easy answers.

When research has been carried out in the workplace, researchers have focused on management or executive teams. Quantitative and qualitative methods are used to research top-down decision making emanating from position-based leadership or legitimate power. It appears that there is very little research on project teams where qualitative methods capture decision making strategies in new product development. In this situation, the team relies on

dispersed leadership, based on expert power that resides in the minds of the multidisciplinary team membership.

The main strategy the team used in the decision making process is defined in Figure 1. It served as a roadmap and provided the focus of a decision making process for the project team. It helped to contribute to shared understandings among the team members so that at each stage of the process each participant knew what was their expected contribution.

Although the team did not have the training in how to use this process, they found the structure forced them into decision closure once they had completed the three stages and there were no unresolved issues on a particular function, (e.g., message flow in and out of the system). This was especially useful in the ambiguous and yet creative environment in which the team had to function and construct their own social reality.

Objective 2: Integration of theory and practice. As a practitioner, I have studied the theories of postmodernists such as Senge (1990) and Bergquist (1993) among others. I wanted to find out if their theories about learning organizations have relevance in the social reality of the research and development engineering workplace, where there are no easy answers.

I was particularly interested in determining whether dialogue as defined by Senge was a viable tool in collaborative structures of a multidisciplinary team, especially since the literature promotes dialogue. However, I did not locate any studies to support its use in the workplace. I am aware of the on-going research of the Dialogue Project at the Massachusetts Institute of Technology and have referred to the works of several of its key researchers such as Senge, Schein (1994, 1995) and Isaacs (1993). Since I was not able to locate any studies that

used dialogue, I assumed dialogue was absent in the workplace. This study investigated the use of dialogue as an enabling strategy for information sharing and meaningful communication that leads to shared understandings.

Shared understandings is essential when discussing program requirements. Program requirements are what limit the scope of a project. If customer and contractor representatives do not clearly define and understand the implications of the agreed-upon requirements during the requirements analysis phase which occurs at the beginning of a project, “feature creep” invades the scope of the project like a parasite. This can result in cost overruns and program milestones that cannot be met.

If the contractor does not manage the scope of the requirements carefully, they become a major source of conflict between contractor and customer representatives resulting in mistrust which is antithetical to collaboration. Just as in a personal relationship, it is difficult to reestablish trust once mistrust gains a foothold to destroy an existing good working relationship.

Objective 3: Identify team building skills. According to Rentsch et al. (1987), experienced team members who have developed teamwork structures such as interdependence, coordination and communication skills make better team members. They state that even though there is a substantial research on teams we still do not know how to train teams.

Also team members need to develop critical thinking and writing skills to be able to process, analyze and evaluate information in real-time and produce the specific kind of technical information to assist in informed decision making. Negotiation, tact and diplomacy skills need to be developed to ensure that all parties—both customer and contractor—emerge as winners for real collaboration

to take place. Team members also need to learn how to share unique or tacit information for collective learning because it is through unique information sharing that breakthroughs in collective thinking occur.

Since the Engineering curriculum does not develop this combination of socio-techno-cognitive skills in the classroom (Bellinger, 1997, p. 78), these skills have to be developed in the workplace depending on the kind of the product the team is developing and with whom they are interacting. In this study, the use of a facilitator helped to keep the team focused, document the team's meeting minutes and track action items to completion. Based on my workplace experience, team members need real-time training in teamwork structures of cooperation, communication and collaboration to overcome the emphasis on individualism associated with modern or industrial organizational cultures.

Methodology Summary.

As stated earlier I used a descriptive case study methodology to research and understand the strategies a project team used to make new product design decisions under time constraints. Human interaction in decision making is a complex process that can only be studied effectively in the rich temporal construction of reality in which it occurs.

Through unstructured interviews I was able to interact face-to-face and eye-to-eye with each of the six participants who were a purposeful sample and who engaged in participative decision making on the user interface design of the system. Using a reflective method of inquiry allows the participants to reconstruct their experience in a meaningful way, forming the connections between thought and action or thought and inaction. The result is a more insightful presentation of the experience through a human cognitive process of "integrative rehearsal." This

occurs when individuals attempt to make sense of experiences, recollect and then retrieve those experiences as meaningful structures that are stored in long-term memory.

The two-hour interviews allowed me to use a conversant format with each of the participants which helped me to understand and interpret their lived experience. I followed an unstructured interview format, although I had prepared a set of guiding questions to help me focus during the interview, if that became an issue. I used multiple methods for the data collection: interviews, minutes of the meetings and the documentation in the form of Design Requirements Bulletins to help validate the factual aspects of the decision making process. This contributed to the triangulation in the data analysis. I attempted to minimize the biases of my assumptions, as the instrument of the research, by sharing the results of the first interview with the participants and inviting their comments.

The data collection, analysis and literature reviews were a recursive and dynamic process that extended over a period of ten months. Through the case study methodology I was able to "hear," listen, and understand the experience of the project team as they defined their social construction of reality.

The voices of the participants provided an unexpected depth and richness to the data as team members articulated their experiences from their different perspectives. These perspectives blended and faded like the flicker of a candlelight, as each focused on the issues that appeared most significant to them. I am grateful for their candid narratives. In the presentation of the data I had to use judgment in providing the analysis without revealing the identities of the participants. I also had to be discrete and sensitive to the fact that the

customer was part of the team, when analyzing the advantages and disadvantages of having the customer as part of the team.

The decision making process as depicted in Figure 1 was an evolutionary one. The information was derived from the interview data and from the decision making process materials provided by a confidant. The three stages of screen design, design presentation and design resolution served as an organizational repertoire that guided the team in the decision making in an environment of ambiguity and creativity.

The structured process was developed based on a previous unsuccessful and unstructured process that proved unproductive. The stages in the decision making were subject to the driving and restraining forces of global and the organizational environment and the project constraints of time, budget and personnel. As the meetings progressed from one stage to another with feedback loops, the participants used the time to collect, analyze, research and develop knowledge that resulted in the teammind.

After I heard the recordings of the interviews and read the transcripts, I used a spreadsheet program to capture the keywords that were then grouped into recurring themes and patterns. Once I discerned meaningful structures, I symbolically depicted the emerging themes from the data analysis in Figure 2 as a three-leaf clover .

During the analysis I found that communication serves as the conduit and the "connector that links people together and constitutes organizations as networks of relationships" (Putnam, Phillips & Chapman, 1996, p. 382). Even though in the literature review I presented the theoretical framework of organizational structures, collaborative leadership, time, communication,

dialogue and decision making as separate concepts, they are really integrated in the decision making process, as I discovered during the data analysis process. In the literature review these concepts are discussed separately because they are researched separately by experts in the field to provide the foundation and framework of theory within which this study is conducted. These concepts overlap with one another to constitute the phenomenon of human dynamism in participative decision making for new product development.

Therefore, in Figure 2, I represented the rigidity of “time” as the stem of the three-leaf clover. Communication and dialogue, and decision making and conflict resolution formed the two horizontal clover leaves as fluid structures. The third leaf in the center represented the leadership relationship which developed through collaboration and contributed to collective learning. The significant implications of the findings are discussed in the section that follows.

Implications

The most significant implication of the eight discerned from this study is the light it sheds on the complexity of the decision making process. The second implication is that decision making under time constraints can be both positive and negative. The third is that multidisciplinary project teams who practice participatory decision making under time constraints for new product development, present challenges to current hierarchical organizational structures. The fourth implication is the additional complexity of the decision making process created by the presence of the customer on the team. The fifth is the role of communication in transmitting information through the human nodes of the multidisciplinary team network structure.

The sixth implication is that the benefits of dispersed leadership based on expert power in a multidisciplinary team can result in action towards change and achieving organizational goals. The seventh is the value of integrating theoretical concepts into workplace practices so that researchers and practitioners can learn from one another by creating workplaces that take into consideration the human element in organizational processes. The eight and final implication is the value of self-evaluation through lessons learned to enable an organization to improve its processes.

The Complexity of the Decision Making Process.

In this study six members of a multidisciplinary team attempted to breathe life into a product from a concept that is intended to change the way the users of an information system will perform their jobs. In addition, the data revealed that in new product development the combined socio-techno-cognitive abilities of a multidisciplinary team are challenged by the complexities of the ambiguous yet creative environment in which they have to perform their tasks. Such teams have to resolve conflicts while they develop a quality product that truly addresses both the needs of the customer, as well as that of the contractor organization. According to the participants, when discussions got out of control, the contractual requirements were used to help the team members focus on the task.

In parallel, team members have to develop a working relationship as they learn from each other. Their fragmented bits of tacit and explicit knowledge gained through experience and training, have to be integrated into the collective knowledge resident in the teammind that will transform a concept into a product. These challenges become even more profound when bounded by a time frame which affects the decision making process. Therefore, the decision making

process as depicted in Figure 1 promoted double-loop learning. During the decision making process, iteration and feedback loops through arguments and counter arguments and cross-fertilization resulted in decisions, after considering the different perspectives of the team membership.

Decision Making Under Time Constraints.

Decision making under time constraints can be both positive and negative. Imposing a deadline can speed up the decision making process provided the team membership understands the consequences of their actions and the decisions they make will not impact the design in a major way. However, when the decisions are more complex, conversation in the form of dialogue has to occur in order to permit shared understandings of the problem to minimize the risk of making bad decisions. In such complex situations, more time is needed for this activity in the program schedule.

With a multidisciplinary team, diverse perspectives can generate alternatives that need to be evaluated and challenged. While discussing the alternatives, breakthroughs in product development occur. However, if alternatives are killed because of time constraints, the team ends up with a strategy of "satisficing," or making decisions that are good enough. This can affect an organization's competitiveness for generating innovative ideas.

Collaborative Instead of Hierarchical Structures.

Multidisciplinary project teams who practice participatory decision making under time constraints for new product development, present challenges to hierarchical organizational structures. Therefore, the literature review concentrated on collaborative structures of postmodern organizations where the synergy of collective action and learning through the teammind engages the

multidisciplinary team in dialogic leadership to achieve the project's mission and objectives. These structures are networked or horizontal to enable participatory decision making.

Challenges When the Customer is Part of the Team.

Advocates of total quality concepts promote the involvement of the customer in the product development life cycle. However, experience shows it can slow down the decision making process as was stated by one of the participants. While the customer controls the purse strings and wants to ensure a maximum return on investment, the contractor seeks to generate a quality product, based on user specifications and contractual requirements while realizing a profit. These perceived perspectives were a source of conflict especially when "feature creep" beyond the contractual requirements started to invade the design decisions. This resulted in an implicit level of mistrust between the customer and the contractor team members which can affect the collaborative relationship that an intact team needs to establish in order to satisfy mutual purposes.

On the other hand, having the customer on the team during the decision making process kept them apprised of what features were not being implemented and the reasons why. This disclosure in advance of the design implementation allowed for timely adjustments to the requirements in real-time if there was a problem, which is being proactive.

Also, having the customer present provided the software designers and developers with the subject matter expertise to ensure that the operational requirements of the system were being met in the way the system is intended to be used. In the final analysis, if the customer has to be part of the team and trust

and collaboration are to prevail, the decision making process has to result in a negotiated solution to the satisfaction of both parties.

Communication for Collective Knowledge Building.

Through meaningful communication, information is acted upon and is transformed into collective knowledge which has value, and is needed for integrated product development. As the information flows through the network structure, double-loop learning occurs which results in a cross-fertilization of knowledge through fusion of the different perspectives of the team members. This synergism helps to create new meaning structures to enable collective learning. During this period, the teammind develops an organization's proprietary data which contributes to an organization's core competencies or knowledge base to maintain its competitive edge.

"Peter Drucker has called knowledge, rather than capital or labor, the only meaningful economic resource of the post-capitalist or knowledge society" (in Choo, 1996, p. 330). The study provides glimpses of the knowledge sharing that occurs in such an intact team and the interdependency of the team membership in providing solutions that minimize the need for corrective action in hindsight, which can be costly and counterproductive.

Dispersed Leadership Based on Expert Power.

Developing products in an age of technological sophistication and organizational turbulence is so complex that it requires the intelligence of the collective mind or teammind rather than the power of one. Learning in such an environment becomes a moving target which can be intellectually challenging.

As Heifetz (1994) stated, "the lone-warrior model of leadership is heroic suicide. Each of us has blind spots that require the vision of others" (p. 268).

Therefore, having the right people on the team who are adaptive and can think generatively provides the leadership with the expertise to overcome the complexities of tasks and informational inputs inherent in new product development. This also “facilitates the group toward taking action that helps the group achieve its goals” (Barge, 1996, p. 319).

Some of the team members accurately stated that leadership was exercised when the decision making process forced them to make decisions even though they did not have the opportunity to explore all the alternatives that surfaced during the discussions, because of time constraints. Having the right people and expertise present during the process, combined with following the decision making process through its three stages, helped to minimize the risk of making a big mistake. The team members candidly admitted that during the implementation stage, it may turn out that some of the decisions they made were bad decisions and trade offs, but that they were willing to take the risk to meet their milestone commitments.

Leadership is dealing with change and change involves taking risks. Based on the experience of the team, multidisciplinary teams engaging in decision making under time constraints need to possess superior socio-techno-cognitive skills to function in an environment of ambiguity, dynamism and risk.

Importance of Integrating Theory and Practice.

Researchers and practitioners can learn from one another by creating workplaces that take into consideration the human element in organizational processes. Such processes need periodic evaluation to incrementally incorporate new concepts as they emerge that shed light on the dynamic field of human behavior. The emerging concepts can be used to train teams in building

teamwork structures of cooperation, interdependency and communication that facilitate the development of the teammind.

For example, as a researcher and practitioner who is aware of dialogue, to my surprise, I experienced the benefits of dialogue as defined by Senge (1990) during the interview process. While Participant No. 6 continued to reflect on the decision making process experience, I forced myself to listen and hold my assumption, on conflict resolution. During the course of the reflection, he actually addressed my assumption on conflict resolution without a prompt. For me it was a moment of elation and discovery.

I experienced the enabling strategy of dialogue as the end and the means of the interview process. At other times the concepts of "satisficing" and "bounded rationality" became a reality as the participants related how they made decisions "that were good enough;" or expressed the fact that human beings have psychological limitations when confronted with unrealistic task demands, especially when they were bounded by a time frame.

Organizational Self-Evaluation for Process Improvement.

Postmodern organizations perform self-evaluations so that they can learn from their experiences. According to Choo (1996), if organizations fail to learn from the past they suffer from learning disabilities. Wiz Electronics Company is committed to process improvement and integrated product development and therefore sponsored this research. Hopefully, the results of this study can be used for process improvement and to develop the required socio-techno-cognitive skills of the multidisciplinary team, engaged in new product development.

The implications from the analysis and findings provide the following recommendations for organizations, program management and for future research. As workplace structures change to accommodate the changing nature of work, organizations need to experiment with new collaborative structures to actively engage their workforce in achieving the competitive edge. In addition we need to develop new research methods to study intact multidisciplinary teams in a workplace that is complex, dynamic and ambiguous (Stacey, 1996).

Recommendations

The findings of the study indicate that designing novel information systems in an age of complex technology requires the collective perspectives of a multidisciplinary team who commit to develop a product from a concept that will change the way a sector of society will perform their jobs. In a complex knowledge-based society, reliance on the power of one is "heroic suicide" (Heifetz, 1994).

It is the sum of the collaborative team leadership relationship and the resultant integrated knowledge base of the teammind that will provide the solutions for new product development in a dynamic and complex environment. This interdependence and collaboration of team members for new product development becomes even more critical because technological advancements are challenging our concept of time as organizations strive to survive in a competitive global marketplace.

This study provided the holistic insights of how six members of a multidisciplinary team achieved their objectives to provide a design baseline for the user interface of an information system. It not only looked at the decision making process as a transition from stage one to stage two but it looked at the

human beings behind the process as their “speech acts” transformed speech into action to construct their social reality (Ford & Ford, 1995). Through the voices of the participating team members in partnership with the researcher, this study uncovered the challenges they faced as they attempted to achieve their objectives within the time constraints so that the development of the product could move forward.

Therefore, this study documents a successful process for the Wiz Electronics organization that it can use to improve its engineering processes. It provides the template of the process used by the team to achieve their goals. “Group research should thus yield products that are useful not only to researchers (e.g., journal articles), but equally important to the group being studied” (Frey, 1994, p. 565). Finally, based on the findings it discussed the implications for new product development organizations relative to decision making under time constraints, customer participation on the team, communication for knowledge sharing and the merits of dispersed leadership based on expertise.

How can organizations, program managers and researchers utilize the results of this study? This section offers recommendations that are a combination of participant insights as well as those of the researcher. Some of these recommendations may be applicable across organizations as they substantiated some of the theoretical concepts of current research as discussed in Chapter Four. Finally, I present recommendations for further research.

Recommendations From the Researcher.

As a researcher and a practitioner who is a member of a multidisciplinary team, this study provided me with unique insights based on the literature review,

the data collection and the analysis to make the following recommendations. The highlight of my research experience was to actually discover that there is praxis between theory and practice as articulated in the findings in Chapter Four. Therefore, these recommendations are made to ensure that the collective synergism of multidisciplinary teams is focused towards enhancing the quality of life in the workplace for the team members, while keeping the organization competitive through the knowledge resident in the teammind.

Recommendation 1: Guidelines for program management. The first recommendation offers some guidelines for program management.

A. Use lessons learned from other projects to guide the activities of new projects.

B. Allow sufficient time in the program schedule for meaningful communication. During the requirements analysis stage of a program or during user interface design, is when the customer and contractor define product requirements. This is a critical stage in new product development where shared understandings about the product are established. If these shared understandings are not realized early on in the project and adequate time allotted for this significant activity, it can result in cost overruns and program milestones that cannot be met, especially in a fixed price contract.

In order to have shared understandings, communication in the form of dialogue has to take place. The use of dialogue as advocated by Senge (1990) provides an enabling strategy for decision making and collaboration and its use needs to be exploited in the workplace. It is an inclusive process that encourages all participants to expose their diverse perspectives and then to focus on a common ground, but only after everybody has had a chance to express their

opinions. Although time consuming, it builds trust and engages the team membership in the decision making process.

C. Ensure that members from all relevant disciplines participate in the requirements analysis decision making; when internal agreement is reached among the team membership, present it to the customer representatives. Ensure that the customer also agrees with the decisions made, otherwise negotiate an agreeable solution and document the agreements.

D. Use a template such as in Figure 1 for the decision making process when dealing with decision making in an ambiguous or dynamic environment. It provides the team with a roadmap and team members then know what is expected from them at each stage. Provide training for the entire team on how to use the procedure to arrive at decisions in a meaningful way. The training should include effective communication and more importantly listening skills, as well as critical thinking and analysis skills, because information needs to be processed and digested in real-time. It is through communication and listening that we show respect for each other, build trust and forge a relationship based on collaboration. The customer should be invited to these team building sessions.

E. Through discussion with program management, the team members need to clearly understand what their mission is and then they should be consulted about the resources they need to accomplish the objectives. Participants in the study felt that they were understaffed and the time factor placed unrealistic demands on their abilities to perform the task which affected their decision making. As experts responsible for task accomplishment they are in a better position to determine the resources they need to perform their tasks.

F. The team members need to have enough time built into the schedule to allow for constructing the teammind through shared understandings. This involves discussing and documenting the terminology and key concepts about the product; understanding exactly what the requirements are; identifying and grouping requirements as critical, less critical and enhancements; identifying which requirements will be tested and how; and determining the method to resolve issues which need further discussion or research.

G. Ensure that the team has the right information and are therefore prepared to make better informed decisions. According to Morrelli et al. (1995), through task analysis it is possible to predict the types of information a team will need for new product development, (e.g., technical, coordination and inspirational). Assign this information gathering to individual team members ahead of the decision making sessions so they can prepare for the decision meetings. Certain categories of technical information, in the form of trade studies, ranking of emerging technologies, products, etc., are important sources for informed decision making under time constraints, especially when new technology is to be introduced in product development.

H. The contractor needs to manage the scope of the contract by focusing on the requirements where possible, to minimize "feature creep." Conflicts need to be resolved so that all parties emerge as winners, otherwise it can destroy trust and the collaborative relationship. Although the customer and contractor both want to develop a product on time and within budget, they each bring their organizational perspectives to the decision making process. The contractor wants to ensure a quality product that meets contractual requirements while realizing a profit and the customer wants a quality product that maximizes their

investment. Therefore “feature creep” or enhancements beyond contractual requirements becomes a major source of conflict.

I. Customer involvement in the design decision making needs to be minimized because it slows down the decision making process. The customer should have a substantial role during the requirements analysis stage and then a limited role during the rest of the product's life cycle. They should be available to help clarify the operational use of the information system because of their subject matter expertise. They should also be consulted when the requirements need to be renegotiated because they are either too stringent or implementing them would not be cost effective. The customer can be invited to periodic design reviews so they ensure the design solutions meet their needs. If the customer is part of the daily activities of the development team, “a merging of views” occurs which means that the end-user's real needs can get lost in the process.

Recommendation 2: Adopt more democratic structures in the workplace.

Workplace structures need to be in sync with the espoused democratic principles of our political system and where collaboration is used as an enabling strategy for new product development. We continue to apply old structures to the changing nature of work in a demanding workplace. In most U.S. organizations, even with a highly-skilled workforce, employees still check in their “voices” and cognitive potential or “brains” at the front door of the organization because decision making, “thinking,” and planning are still considered managerial activity in a top-down hierarchical organization.

This is an underutilization of brainpower especially in today's changing organizational environment where multidisciplinary teams create an organization's proprietary data that gives an organization its competitive edge.

Since team members generate an organization's valued asset—its proprietary data—team members are the new power brokers of the postmodern organization based on knowledge and expertise. As a result of this powershift, we need to create structures to make decision making more participatory as well as to ensure that team members share proportionately in the profits realized through their collective expertise.

In my study of and during my visit to the worker/member Mondragón Cooperativa Corporación (MCC) in Mondragón, Spain, I became convinced that organizations might well adopt some of MCC's values for competitiveness and survival which have guided the corporation for forty-one years. In MCC democratic principles of economic and social justice have created a culture of "enoughness." This has propelled the organization's ranking from the tenth to the eight largest corporation in Spain. While most organizations around the world have been downsizing, MCC has been growing. One of their main objectives is to create new jobs to benefit the economy of the communities in which they operate. Even though they host seminars on a weekly basis for organizations around the world who come to study their success story, the humility of management and their culture of continuous self-evaluation for improvement is impressive.

A culture of team structures and an emphasis on self-evaluation permeates the organization where all members actively contribute to the health and welfare of the organization. Employees as owner/members are rewarded by receiving 40% of the profits directly into their individual capital accounts for retirement; 10% of MCC's profits benefits the community in which they operate; the rest is invested in the organization, to support research and development,

training, their own technical university and schools among other activities. From my random conversations with members of the wider community, it is the organization they would like to be part of, but cannot because there are no openings.

Through self-evaluation, Ralph Stayer, the CEO of Johnsonville Foods in Wisconsin, realized that it was the empowered workers who taught him about leadership. Once he involved employees in the decision making process, they turned his failing organization into a profitable one because they were given ownership of the process, trained and rewarded accordingly (Dixon, 1994; Stayer, 1990). Based on these successful ventures, I continue to offer the following recommendations for organizations.

Recommendation 3: Implement remuneration systems based on principles of economic justice. U.S. organizations need to implement remuneration systems that lower the compensation ratio between the highest paid executive and the lowest paid worker, in keeping with a sense of “enoughness” and economic justice. In a leadership relationship power is based not on position but on expertise in a postmodern learning organization. This expertise is resident in the workforce that generates an organization’s proprietary data and they need to be compensated accordingly. This proprietary data are the new product software and hardware solutions that the multidisciplinary teams develop that give an organization its competitive edge.

Recommendation 4: Utilize the brainpower of the workforce. Organizations need to experiment and learn from other successful organizations (e.g., the 3M company), on how to tap the brainpower of their workforce. It is not through directives but through engagement that a loyal and motivated workforce ensures

the survivability and competitiveness of the organization. In a competitive world, we need to develop more inclusive rather than exclusive structures of employee participation in organizations. Participatory decision making takes into consideration the “voices” of the multidisciplinary team or the voices of the organization’s membership as adding value to an organization.

Recommendations for Future Research.

Multidisciplinary teams do more than make decisions. They have to develop a relationship based on trust so they can take risks, exercise group leadership based on expertise and collectively learn while they accomplish their tasks in new product development. This study covered only one aspect of a multidisciplinary team in action and that was of a decision making process under time constraints for a system’s user interface. The following four recommendations for further research address issues that surfaced during the study and represent my insights as a practitioner and researcher.

Recommendation 1: More qualitative research of multidisciplinary teams.

We need more qualitative research of multidisciplinary teams in the workplace using participatory decision making practices for new product development, under time constraints. While research of ad hoc groups in laboratory settings is effective for exploratory work and generalization of findings, it cannot duplicate the complexity of the ambiguous and uncertain workplace in new product development. Intact multidisciplinary teams grapple with real decision making strategies for real solutions in real time, where there are no easy answers and with limited resources. In addition, there is very little research on customer participation on project teams and the introduction of that variable into the system’s design decision making process.

The recommendation extends to conduct research on multidisciplinary teams while in the decision making process as well as in reflection after the process has ended. This way the researcher can compare and contrast the interviews with the participants during the process and after the process to detect any differences in the perspectives of their lived experience.

The narratives of the participants produced the richness of language and behavioral concepts to describe the context of the decision making that cannot be captured through quantitative methods. Quantitative methods are useful when conditions are deterministic but under complex stochastic conditions in which such teams operate, they are less effective.

The literature also indicates that we need quantitative as well as qualitative studies on project teams in the workplace decision making under ambiguous conditions. This same study could be duplicated in many different organizations to detect themes and patterns across organizations. The same study could also be conducted among several project teams within the same organization, to detect themes and patterns in decision making within a specific organization where the organizational culture would be a common variable.

Recommendation 2: Longitudinal research on project teams. We need longitudinal research of project teams decision making in the workplace to parallel the project's life cycle from the analysis of a product to product sell-off. As I write the analysis of this study, the rest of the project team members are attempting to implement the design decisions of the subteam involved in the study, using the design documentation the subteam generated.

This continuing longitudinal research would further assist in determining how the rest of the project team reacted to the design decisions made by the

subteam involved with the user interface design and whether their decisions were feasible. This feedback can help to improve the decision making process during the analysis phase of a project, for example. Such research could be carried out by a team of researchers as a collaborative effort since projects can extend over a one- to four-year period depending on the complexity of the project. This continuity would ensure that all phases of a project were evaluated to obtain a much broader perspective of the decision making process and its impact from the analysis to product sell-off.

Recommendation 3: Research diverse groups in the workplace. This is becoming increasingly important with the changing workplace demographics as more women and minorities enter the workforce. This study was a purposeful sample of six Caucasian men and I can only speculate that the results would have been different if there was a gender mix, because of differing communication styles. The research indicates that women are purported to display more collaborative and expressive communication styles whereas men use more instrumental or deterministic styles, based on socialization. However, the research on gender styles of communication is still inconclusive.

There is very little research on the decision making strategies of organizations in non-Western societies and societies whose cultures favor collectivism over individualism (Miller et al., 1996). The results of such studies could aid in the development of team decision making strategies for organizational workplaces in the twenty-first century. Global connectedness through the worldwide web and the Internet is already changing our concept of creating and sharing knowledge and performing interdependent tasks. This

connectedness transcends national boundaries as global partnerships for survival in today's competitive world become a reality.

Recommendation 4: The concept of the teammind. Collective learning is very different from individual learning because our cognitive abilities to learn and absorb information are different based on our socio-cultural orientation and past experience. During the decision making process, an intact project team has to develop the teammind within time constraints through knowledge sharing. This involves communicating for shared understandings while collectively learning about the terminology, concepts and technology used relative to the information system they are developing. In parallel with this knowledge building process, on the sociological side, an adaptive or acculturation process has to take place to help develop the team's relationship. Developing a team relationship through acculturation serves to speed up the communication process to ensure shared understandings among the project team members for integrated new product development.

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APPENDIX A

GUIDING QUESTIONS FOR INTERVIEWS

1. Describe in as much detail as you can the decision making process that you experienced recently. Tell me about your positive and negative experiences.
2. What type of new information did the face-to-face interaction with the team provide you with, e.g., task-related coordination, knowledge expanding, or inspiration?
3. How was your input considered in the decision-making process?
4. Did time affect your ability to carry on a dialogue or extended conversation with the team?
5. Were you given the opportunity to voice your opinion?
6. Did you convince the team to choose a particular alternative? If so, how did you do that?
7. Did you agree with the decision the team made? If you changed your mind after the team discussion, what made you change your mind?
8. How can the decision-making process be improved?

APPENDIX B
ORGANIZATIONAL APPROVAL LETTERS

Norina Finley
MZ XXXXX

30 October 1996

Dr. XXXXX
Director of Engineering
MZ XXXXX

Dear Dr. XXXXX:

Thank you for taking the time to talk with me regarding research on the decision making process used by the Project Team on Project R. As I indicated to you the research would be beneficial in two ways. The organization would benefit in documenting a decision-making process that was successful and I could also use the process to develop a case study of the strategies an intact project team used successfully in the workplace, for my doctoral dissertation. As I stated to you when we met, there is a lack of substantial research on intact project teams engaging in participative decision-making in the workplace. So this case study will contribute to empirical research and to making the workplace more productive.

You also offered to fund 2 hours each for six people so they can be interviewed during work hours and I appreciate that support. I will let you know who the participants are and when I intend to start with the interviews so I can ensure that the participants charge the appropriate account for the interviews. For your information, the attached is the Human Subjects Proposal to be submitted to the Human Subjects Protection Committee at the University of San Diego, for approval. My Dissertation Proposal was defended and approved in May 1996.

If you have any questions and need further clarification, please give me a call at x25552. I would like your response by 30 October 1996. Thank you for your support.

Sincerely,

Norina Finley

Approval: _____
Date: _____

Norina E. Finley
12243 Mannix Road
San Diego, CA 92129

31 October 1996

TO: Manager of Human Resources & Director of Public Relations
 & Ethics

FROM: N. Finley, x25552

SUBJECT: Human Subjects Proposal for Doctoral Dissertation

Attached is a copy of the Human Subjects Proposal for my doctoral dissertation for your information. My dissertation proposal has already been defended and accepted. This proposal is being submitted to the Human Subjects Protection Committee at the University of San Diego in compliance with U.S. Government regulations for research studies where human subjects are used. As you can see Dr. XXXX has already approved this activity.

This copy of the Human Subjects Proposal is being submitted to you for your approval so I can begin interviewing team members from Project R, in the workplace. This study has no implications for proprietary data. In addition, the name of the organization is being concealed to assure anonymity. I will assign number codes to all individuals participating in the study and require them to sign a document of informed consent giving me permission to use them as participants in my study.

I will be glad to share with you the results of my research as it develops. I believe that engaging in this research during work hours for the individual interviews will not be disruptive.

If you need further clarification on the study, please give me a call. Please sign on the enclosed letter to indicate your approval of this research project. I need your approval by 5 November 1996. Thank you for your support

Approval:_____ Date_____

Director of Human Resources

Approval:_____ Date_____

Director of Public Relations & Ethics

APPENDIX C

CONSENT FORM

University of San Diego
School of Education

Norina Finley is conducting a research study on Project Team Decision-Making Under Time Constraints. Since I have been selected to participate in this study, I understand that I will be a research subject.

This data collection will take approximately three hours over a period of two months. Participation in the study should not involve any added risks or discomforts to me except for possible minor fatigue. My participation in this study is entirely voluntary. I understand I may refuse to participate or withdraw at any time without jeopardy to the study.

I understand my research records will be kept completely confidential. My identity will not be disclosed without consent required by law. I further understand that to preserve my anonymity only group data will be used in any publication of the results of this study. Further, I understand that the company and its location will be concealed. I also understand that management will review the results of this study.

Norina Finley has explained this study to me and answered my questions. If I have other questions or research-related problems, I can reach Norina Finley at 592-5552. There are no other agreements, written or verbal, related to this study beyond that expressed on this consent form. I have received a copy of this consent document and "The Experimental Subject's Bill of Rights."

I, the undersigned, understand the above explanations and, on that basis, I give consent to my voluntary participation in this research.

Signature of Subject	Date
Location	
Signature of Witness	Date
Signature of Researcher	Date