NEW PRODUCTS IN OLD ORGANIZATIONS:

THE MYTH OF THE BETTER MOUSETRAP IN SEARCH OF THE BEATEN PATH

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ABSTRACT

The ability to develop new products for new markets is critical to the ongoing survival of most business firms. Studies suggest that understanding "the market" contributes to the commercial success of new products. Yet, new product development is often an erratic and uncertain process, especially in large organizations. This research examines the process of new product development in large firms, emphasizing how it is that people comprehend "the market," or not.

Eighty people from five large firms were interviewed regarding one of sixteen recent new product efforts they had participated in. The people represent the major functions of sales, marketing and planning, engineering, and manufacturing. In addition, site visits and archival analyses were carried out. All of the products have been introduced; several have since been cancelled, several remain uncertain, and several appear to be successful.

The title reflects the basic findings. Expectations and practices clash, in three ways. First, a complex array of information and insight is essential to the comprehension of a new market. But this information must be linked up in a creative, nonroutine fashion because the market is new. Doing so, however, clashes with conventional market development practices for known markets. Second, people in the different functional units think about "the market" in unique ways. They seek disparate information about it, and interpret the information differently. The term "thought worlds" is adopted to characterize these unique perspectives. Each thought world has an essential contribution to make to the creation of a market comprehension, yet the product histories show that they do not come together very effectively. Third, the organizations' institutionalized routines for product development reinforce the distinctions of the thought worlds, keep them separate, and prohibit creative learning. The successful product efforts had more market information and amalgamated the thought worlds. They also violated the routines, while the less successful efforts became mired in them.

The large firm embodies a discontinuity between the old and the new, between the present and the future. This discontinuity must be managed actively, not overlooked or circumvented. The concluding chapter discusses additional research to push and clarify the implications of this study, and speculates on ways to manage this discontinuity in the theoretical as well as the practitioner realms.

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

INTRODUCTION

Adaptation to market changes is considered essential to the survival of large organizations (Galbraith, 1973; Aldrich, 1979; Lawrence and Dyer, 1983). Postmortems on the recent spate of near or actual collapses of large firms find numerous problems, yet they usually cite failure to respond to changes in markets and customer demands as one critical factor. Organizations are told to "get close to customers" or to "become market oriented" to overcome such difficulties (Peters and Waterman, 1982; Quinn, 1985). But no one explains why organizations seem to have trouble making these changes - there must be more to the problem than the simple adoption of a new orientation.

Indeed, we do not know much about the more general process of innovation in organizations, even though the topic has been examined by nearly all domains of management research since time immemorial. In his review of innovation, for example, Kimberly (1981) notes that two earlier reviews uncovered 4,000 items in the literature on technological innovation (Kelly and Kranzberg, 1978), and 2,000 items on organizational innovation (Gordon et al., 1975). Quite a number have been produced since. Despite this enormous quantity of work, the research tends to be limited; it is inconsistent (Rogers and Shoemaker, 1971), noncumulative (Downs and Mohr, 1976), and restricted in perspective (Van de Ven, 1986).

One reason for these limitations, I submit, is that academics have parsed the subject of the innovation process into their own disciplinary or theoretical domains, chopping it up into discrete and often quite different problems. For example, marketing people dwell on how to measure "user needs" or "market size" (Urban and Hauser, 1980). Management of technology people seek the sources of new technologies (von Hippel, 1977), or study how to more effectively manage technical employees (Katz and Allen, 1985). Strategists determine what business new products should be developed for (Porter, 1980). Organization behaviorists

examine small group processes or career issues (Bailyn, 1985). And organization theorists analyse institutional leadership (Miles and Cameron, 1982), or organizational designs (Galbraith, 1973).

Any innovation may require insights from all of these domains. But because of this fragmentation, our knowledge of the process of innovation in general and new product development in particular is in shreds and patches. This study seeks an integral understanding of the complex yet everyday process of developing new products for new markets. There are two goals for this research. The first is to describe as thoroughly as possible how people comprehend or fail to comprehend new markets, and use that understanding as they develop new products. Since the process as such has not been explored in this manner before, the research is primarily descriptive, but the data can be sifted to look for possible barriers or enhancements. So, the second goal is to identify specific organizational factors and how they might affect the new product process in order to articulate the issues that can be examined more precisely in subsequent research.

Sixteen new industrial product development efforts undertaken recently in five large, established firms are examined to address these goals. All of the products are "industrial." Industrial products differ from consumer products because they are sold to other organizations rather than to a mass market (Ames and Hlavacek, 1984; Lilien and Yoon, 1986). They typically have a higher technology content and a smaller potential number of users, and depend much less on merchandising efforts such as advertising and promotions. All of the products in the study have been introduced to "the market." Some have since been cancelled; some remain uncertain in that whether they will generate enough revenue is unclear; and some appear successful in that they are meeting or exceeding revenue goals. These product groups are contrasted to search for factors which might relate to success versus failure.

SUMMARY OF THE DISSERTATION

The remainder of this chapter approaches the vast literature relevant to the process of new product development in old firms by grouping it into two broad categories. First, the concept of "process" in organizations is summarized using a basic, simplifying perspective

from sociological theory. This process perspective is then used to frame the second category of literature, which consists of three areas of empirical generalization pertinent to the question of how people in large organizations understand new markets. These three areas are usually stated in normative terms: "you must have market information;" "you must have an effective interface between marketing and R&D;" and "you have to manage the organizational tendencies to avoid innovation or ignore customers." The process frame points to more specific questions that remain unresolved by in these three areas. These are addressed by the data analyses of this study.

The methods chapter, Chapter II, contains four sections. The first explicates the interpretive and iterative methodology used to understand how product developers came to define "the market" and the product. Discussions of the sampling process, the nature of the data and how they were gathered, and the various analytic constructs developed and used in the rest of the thesis follow in turn.

Chapters III through VI carry through the three issue areas of market information and interpretation, "interfaces" and integration, and organizational level factors by picking up on the unresolved issues found in the literature review. Chapter III examines the problems people describe having with conventional market research tactics, and then explores two factors that relate to the failure of conventional tactics. These are that "user needs" and "the market" comprise a myriad of distinct kinds of information; and that product developers need some sort of new and different marketing framework in order to pull together the myriad information for a new product.

Chapter IV examines the separate functional perspectives to see how they might affect market comprehension. The analysis indicates that the members of the different functional subunits define "the market" differently, seek disparate information about it, and interpret that information in unique ways. The term "thought world" is used to characterize the singular perspectives of these subunits. It is argued that each perspective is essential to a comprehensive understanding of "the market," yet that their integration would be a tentative and temporary event.

Chapter V brings the temporal nature of process back into the picture. The product efforts are compared in terms of when and how the different thought worlds interrelate. Four

different patterns of relationship - called product enactment patterns - are found among the product histories. It is argued that what the product turns out to be is a function of the enactment pattern followed to develop it. The successful product efforts fall into one pattern which is distinct from the other three in several ways, and these differences are examined. A particularly noteworthy difference is that in the successful efforts the different thought worlds play off one another from early on in the development process. This does not happen in the less successful efforts.

Chapter VI brings the organizations themselves back into the picture by addressing how institutionalized procedures might account for these patterns of enactment. All four of the successful cases violate existing routines, while the others all become mired in them. It seems that organizational routines create new product failures. These routines are detailed to explicate what they are and how they work.

Finally, chapter VII summarizes the findings and speculates on some ways to both research and manage the problems uncovered. The critical conclusions are, first, that the selection and interpretation of market information is an important activity to manage. An information engineering approach that merely specifies tactics to acquire more information would be inadequate. Second, all the information as well as the ability to interpret the various kinds effectively are distributed across the organization into distinct thought worlds. Innovating champions and team work as described in the current literature on product development may be necessary, but, in and of themselves, would be insufficient. An amalgamation of thought worlds seems necessary to a comprehensive understanding of all aspects of "the market." Third, the institutionalized ways of going about product development in these large firms intervene in both these necessary conditions. They reinforce the separation of the thought worlds and call for only certain kinds of market information. The fundamental problems of innovation and new product development in these big old firms arise from these discontinuities.

A REVIEW OF THE LITERATURE

Two general categories of research and discussion provide important leads to answering the question of how people in large organizations comprehend the market for new products.

These are "processes" of adaptation in organizations, and the more detailed analyses of various steps in the product development process.

What Is "Process" in Organizations?

Organization theorists fall into two camps when it comes to process: those who ignore it and those who study it. Some researchers carry out static "variance analyses" (Mohr, 1982). The thrust of this work is to determine how, for example, the "environment" affects the "organizational type" (e.g., Romanelli and Tushman, 1986), or what kind of type or culture is better for what situation (e.g., Ouchi, 1981; Barney, 1986). Others claim that studying processes is more to the point than inferring them from measures of presumed outcomes. A focus directly on process will uncover a more realistic understanding of organizations since they are social inventions that exist and occur in time (Kimberly, 1981; Mohr, 1982). This research draws on the latter school of thought, that "process" is central to understanding organizations and that "typologies" or "patterns" are secondary, being derivatives of process.

But, even when limited to the social domain, the commonsense term "process" carries a multitude of meanings, from the minute by minute description of how people carry out a specific task to the sweep of history over hundreds of years. To study "process" directly, and to attempt to "ground" the analysis in "actual processes," requires, first, a clear definition. Process perspectives in organization theory discuss a variety of issues as will be outlined shortly, but all have two basic elements in common. First, that people generate, produce, or create structures or strategies or shared understandings; and second, that such strategies or structures or shared understandings affect and constrain the meanings people create. These two elements and the relation between them serve as the basis of social "process" for this research.

Recent theorizing in sociology suggests that these two aspects - social actions and social structures - are inherently parts of a more general model - that is, that social action and social structure presuppose each other (Giddens, 1979; Archer, 1982; Barley, 1986) (1). Two different metaphors portray the relationship between these two basic aspects of process. First, according to Archer (1982), Giddens theory: "... involves an image of society as a continuous flow of conduct.. which changes or maintains a potentially malleable social world" (1982:451). Second, Archer's social systems based metaphor for the relation of social action

and social structure is "..endless cycles of structural conditioning/ social interaction/ structural elaboration. Both metaphors speak to a dialectic interplay between action and structure in social situations.

On the one hand, "social action" refers to how people enact (i.e., Weick, 1979) or construct (i.e., Berger and Luckman, 1966) meaning with the use of social signs and symbols. More generally action is social when it takes other people into account (see Collins (1986) on Weber's methods). As Van Maanen explains:

> All human behavior or action is based upon some sort of belief, accurate or faulty, about what is going on in the immediate situation, as well as what it is one wants to accomplish by a given action within the situation (1979:18).

For example, an engineer comes up with a new product design based on ideas of technological trends he may have gleaned from discussions with others in the lab, or from professional journals, or from his education. He negotiates the funds to develop his new idea with "management" (a constructed notion he may share with his work group), based on his past experience with them. He keeps it a secret and bootlegs money if he thinks they won't understand the idea, or he proposes it in an open forum if that is the usual practice.

In other words, meaning, knowledge, definitions, or expectations are situated in the immediate context and interactional order. To emphasize social action is to emphasize two issues. First, people do not operate solely as individuals in a psychological vacuum, but in response to the people and the setting around them. They do not process information in machine-like form (Malone, 1985), and they do not cogitate "decisions" only within the cranium (Kiestler and Sproull, 1982). Both are interpreted into shared knowledge, and that knowledge is situated. Second, "structures" do not operate solely on their own, but rather in their effects on social action. As Hilbert (1986) argues, the constraints imposed on an individual's experience of reality do not derive from an objective ordering of the external universe, but rather come from the activities and responses of other people.

On the other hand, social actions occur within "structures" which may constrain and channel the nature of those actions. Van Maanen explains that such structures emerge and affect experiences:

> Much of our experience can be more or less regularized (institutionalized) wherein reasonably stable patterns of behavior can be framed temporally, categorized, and interpreted with some commonality across people (1979:32).

Others embue certain of these structures with more "body." Durkheim, for example, calls societal level structures "social facts" (Hund, 1982; Douglas, 1986). Hilbert (1986) explains that such "social facts" are external to any individual and constrain their behavior, or exhibit "exteriority" and "constraint" - members of an existing collective confront an objective (to them) social order. It is precisely this exteriority that allows people to share experiences, to generate a mutually understood reality, and to thus make sense of their world. Indeed, according to Durkheim, classification schemes, logical operations, and guiding metaphors come from society, so cognitive processes are ultimately social. Moreover, "society" or structures govern not only behavior, but experiences and meanings.

To emphasize "structure" is also to emphasize two issues. First, there is no intention to reify structure, but rather to recognize that people do indeed reify their experiences. We speak of "the system," "the firm," "management" and what they make us "do." Hilbert makes the point that social scientists should not take these social constructions as givens, thus reifying them, but instead should study the process through which people reify them. Second, people are not free to construct any reality they want in any way they want. Reality construction is neither individualistic nor arbitrary, according to Hilbert (1986), but responds to the sanctions critical to practical living on the one hand, and occurs within a given setting or structure on the other.

I use the construct "structure" differently than many who study organizations. Miller's (1987) definition is typical of the usual use. He defines structure as "enduring patterns of work roles and administrative mechanisms that allow organizations to conduct, coordinate, and control their work activities" (1987:8). This structure is then measured in terms of its properties for "formalization," "centralization," and the like. However, an institution in the sense that Van Maanen uses the term (above), or "social facts" such as categories for thought and classification schemes, or symbols that facilitate the mutual creation of understanding (Cohen, 1985) are also "structures" in my model of social process. Douglas (1986) suggests that social institutions exist for as long as people hold the same orientations regarding the behavior they expect from one another. Note that this kind of structure is not a thing with certain properties, but an outcome of people's actions. I rely more on these interpretive

structures in this research and view structure as a creation of human action. It is best studied, I suggest, in terms of people's experiences of it rather than in terms of morphology.

This model of social process draws attention away from questions based on static patterns, such as whether form follows function, or strategic choice supercedes evironmental determinism, or structure affects strategy. The questions become, as Archer (1982) argues, can we determine when or under what conditions actions are likely to transform the system, and when and under what conditions will action become "rutted" in routine? The perspectives on organizational process developed in the strategy, learning, institutional, and cultural domains address these questions by proposing factors that tilt processes toward social action or social structure. A brief review helps to demonstrate two points: first, that the basic model of social process outlined above underlies these diverse perspectives on it, and second, that a number of factors condition the flow between action and structure.

Some emphasize action over structure. Mintzberg and McHugh's (1985) explication of emerged strategy, for example, indicates that social action dominates the strategy formation process in the organizational form they call the "adhocracy." The adhocracy has complex, unpredictable work and relies on mutual adjustment for coordination. Its strategies emerge in close concert with changes in the environment, catering to the impulses of organizational members, and forming brief periods of consistency or patterns around certain endeavors. The authors recount the history of the Canadian Film Board to demonstrate the ebbs and flows of strategies pursued by an adhocracy.

Burgelman (1983; 1984) provides a close-up look at strategic emergence in one large, diversified firm. He suggests that new ventures in such firms emerge in a serendipitous fashion as operating level personnel continually experiment with new ideas. These ideas are worked into "business opportunities" and then honed into strategies by middle managers, who lobby these cases to senior managers. Top management then rationalizes these new ideas into the firm's overall strategy (or structure, in process terms). Such emphases of action over structure discovered empirically contradict the textbook wisdom that formal planning (or structure) precedes action.

Others find that that prevailing views can constrain social action, as Hall's (1984) analysis of the demise of the Saturday Evening Post illustrates. He merges Weick's (1979)

enactment, selection, and retention processes (social action) with Cyert and March's (1963) political coalition ideas (both structure and action) to highlight the interpretive and political nature of social processes. His model demonstrates how subgroups' efforts to protect their own interests mediate the interpretation of and responses to environmental events. The firm's managers worked themselves into a policy "cul de sac" because the dominant coalitions consistently imposed certain choices and "misattributed" causality. Hall's model of process in organizations is perhaps the most thoroughgoing one available, but it consists of three flow charts with up to thirty elements each - processes are complicated.

Increasingly, such matters of strategy making and policy formation are being defined as problems of "organizational learning" (Jelinek, 1979; Peters and Waterman, 1982; Miles and Cameron, 1982; Quinn, 1985; Burgelman and Sayles, 1985; Imai, Nonaka, and Takeuchi, 1985; Nonaka and Johansson, 1985; and Fiol and Lyles, 1985, all discuss the strategic importance of "learning"). But organizational learning, I suggest, is simply another way to consider the same social process described above - the recursive interrelationship between social action and social structure. This is clear in Simon's (1969) definition of organizational learning: the growing insights and successful restructurings of organizational problems by individuals (action) reflected in the structural elements and outcomes of the organization itself (structure). (From Fiol and Lyles (1985:803), who critique Simon for including both parts). Organizational learning is a useful metaphor for the process I discuss here, because it emphasizes "knowledge" or a shared interpretive order, and how it is constructed, tested, and reconstructed (Argyris and Schon, 1978).

Several indicate that the existing organization-wide "cause map" or "theory of action" - i.e., structure - can become entrenched. Argyris and Schon (1978) distinguish what they call "double loop" learning from "single loop" learning. The former challenges and changes basic assumptions embedded in the prevailing theory of action, while the latter simply adjusts problems to fit the prevailing theory. Hedberg (1981) argues that double loop learning is very rare, and says that "unlearning" is the most difficult for organizations.

Institutionalization perspectives highlight how prevailing theories of action or cultures become entrenched (Zucker, 1977), and thus consider the processes of reification. Kimberly (1979), for example, describes how a new and initially innovative medical school rather

quickly evolved the norms and procedures institutionalized in existing medical education. Numerous small events led to this routinization. Growth in size, for example, was met with structural means to manage internal social control rather than the personal "cheerleading" of the new dean, and the work of students and faculty began to follow traditional precepts rather quickly in order to handle the anxiety and uncertainty the innovative and open initial system engendered. But institutions are also subject to change, as Hirsch's (1986) history of the hostile takeover demonstrates. It changed from a deviant activity to a widely practiced form of gaining control during the 1970's.

Finally, the lifecycle view considers the "rhythms and cycles" of organizational life, and how they affect development (Miles and Kimberly, 1980; Schein, 1985). This view implies that the effects of either social actions or structures depend on the development stage of the organization. Schein (1985), for example, argues that the "natural function" of the culture changes. In an organization's formative stages its culture integrates the members yet it is strongly held and so hard to shift - that is, not amenable to alternate actions. As the firm matures, the culture reflects only the assumptions and values of the older and more conservative members. Countercultures and revolutions become possible in this period because the extant culture is no longer intensely embedded. Revolutions also perhaps become necessary or the firm may cease to respond to change.

The emphases in these process perspectives shift from the general organizational form and its affects on strategic formation, to detailed flow analyses of decisions among subgroups with differing goals and viewpoints, to shared cognitive reframings, to institutionalized procedures, and to cultural elaborations. Social processes are clearly complex phenomena, contingent upon a range of other conditions and occurances. But all of these perspectives also deal with the basic relationship between social action and social structure. The various conditioning factors such as nature of the task or age of the firm are important, but only insofar as they affect this basic relationship. Thus, to understand how people come to know what they know in the organizational setting, and act collectively upon that knowledge (or not), it is important to examine both the immediate construction of that knowledge and the structural constraints on the knowledge construction. Empirical research on the process of new product development is reviewed within this framework. As will be demonstrated, most

of the literature does not deal with both aspects of social process, and thus fails to consider "process" as outlined here.

New Product Development

Schon (1967) distinguishes between "invention" - the process of bringing new technology into being, and "innovation" - the process of bringing invention into use. This research emphasizes the latter, and so reviews work on technological invention only as it relates to the conversion of that technology into a product. The literature on new product development has produced some understanding of how people might comprehend "the market" for new products. These can be grouped under three headings: get the information; manage the interfaces; and make the organization as a whole innovative.

"You Must Have Market Information!"

A number of empirical studies of new product development find that commercially successful new products have more market related data than failed ones (Rothwell et al, 1974; Cooper, 1975, 1979; Rothwell, 1977). These studies indicate that somehow knowing about "the market" is important, and that new product success is not only a function of luck, technological innovation, or advertising. However, these studies also raise several more specific questions that they do not address. First, what is "market information" and "user needs"? Each study uses a different set of indicators to define these variables. Second, how do people get that information and make sense of it, or make it meaningful? Studies typically infer this activity rather than examine it explicitly. And, third, why don't people always get "market information" - that is, are there structural constraints on making it meaningful?

What constitutes "market information" is intertwined with how it is acquired and rendered meaningful. Researchers approach these questions from two different perspectives: academic marketing, and R&D (or Research and Development). Marketing provides often elaborate structures for the acquisition of information, and defines what constitutes market information in detail. Academic marketers structure the sensemaking of a "market" with a rational and scientific model, often based on an operations reserach perspective. Their thrust is on measurement and the specific things that should be measured, but they ignore the possibly emergent nature of comprehension from social construction activities. R&D work

recognizes the creative nature of a definition of "needs," but ignores the possibility of a structure for the data. It is argued below that marketing is almost pure structure but no social action, while R&D is pure action but no structure.

According to marketing textbooks, the process of product development begins with the identification of a market. From this first step, as Corey puts it: "All else follows. Choice of the market is the choice of the customer and of the competitive, technical, political, and social environments in which one elects to compete" (1975:120). Next, different kinds of data about the market are to be developed. The firm should fully understand the "critical success factors" in the customers' business in order to identify the specific problems the users face as well as how important those problems are. Segmentation of the market into separate problem or function based customer groups follows to help sharpen the distinctions around problems and needs. Then the precise "core benefit package" of the product is established for each identified segment or subgroup of "the market" (Urban and Hauser, 1980; Ames and Halvecek, 1984). The product is designed specifically to meet these precisely identified needs. Business plans, distribution systems, and merchandising tactics are then established as the analysis becomes successively more precise.

Marketing's normative view plays down technological uncertainties and complexities, and plays up a diversity of information about "the market." However, questions arise as to whether marketing's prescriptions apply to new markets or industrial products. Most of the techniques have been developed for consumer products, and for markets where needs are already understood. The techniques also assume a stable, continuous environment (Biggadike, 1981), emphasize short-run optimization procedures (Wind and Robertson, 1983), and do not apply either to discontinuous innovations nor to new environmental conditions (Shocker and Srinivasan, 1979; von Hippel, 1986). Von Hippel (1986) argues that users cannot accurately discuss what they do or do not like about a product if they have no experience with it. Thus the sophisticated market research techniques are less valid when perceptions about new, unfamiliar products are being sought.

Marketing seems to fold in on itself around measurement issues which can only work when what is being measured is precisely defined - when the path is already beaten. According to O'Shaughnessy, for example, "...the corporate strategy communicates to

marketing where to look for markets" (1984:14). But what if the product idea is not already part of the strategy? Recall that some empirical examinations of the strategy development process find that, rather than guiding the product development process, the organization's strategy emerges from it (Quinn, 1978; Burgelman, 1983; Mintsberg and McHugh, 1985). Thus the strategy may not be able to "communicate where to look for markets." One major problem with normative marketing, then, is the first step of market definition - there isn't one for new products.

Technology-focused academics carry out empirical work on new product development, and are, seemingly, more grounded in what people actually do. Many claim that product development is an emergent process during which "the market" and an understanding of it are created or constructed over time (Langrish et al., 1972; Mowery and Rosenberg, 1979). Freeman (1982) refers to product development as a "coupling process" between technological possibilities and "user needs." According to Schon (1967), if an innovation involves even some minor improvements then invention is necessary. Invention is inherently uncertain, he argues, so the product's development almost automatically ".. foregoes the apparent certainty or even the objectivity claimed by marketing" (1967:94). Stobaugh (1985) describes the "backing and forthing between demand and supply considerations" (1985:96) as a new polymer was developed. Over a nine year period the project managers considered seven different target markets to be served by four different types of polymers made from nine different intermediate monomers, in turn made from dozens of raw materials via twenty different processes. This complex, iterative effort deviates quite a bit from the tidy, well formed process described by marketing texts.

R&D researchers occasionally embrace the social construction aspects of product development and draw attention to the uncertainty of the information. But they do not examine the construction process itself as an interpretive one, and so also cannot explain how people comprehend the market. For example, Langrish et al. (1972) conclude their study of commercially successful technological innovations as follows:

> Perhaps the highest level generalization that it is safe to make about technological innovation is that it must involve synthesis of some kind of need with some kind of technical possibility.. (1972:57).

One must wonder when they conclude with this nearly mystical synthesis, why they did not examine the process more closely to determine how interpretations are actually made, and, indeed, how they may be structured. The coupling goes on inside a black box.

R&D researchers also tend to define market information very narrowly if at all. For example, Schon (1967) defines market information as that having to do with the overall size and number of buyers, but not specific customer problems. Rothwell et al (1974) seem to mean only product design when they say that an understanding of "user needs" is critical to success. Burgelman and Sayles (1985) say that "needs linking" is essential to new product development, but do not define "needs" nor the linking process. Langrish et al conclude that marketing may not play much role at all: ".. clear definition of a need plus efficient planning fails to account satisfactorily for the majority of technological innovations" (1972:50). However, they define user needs as requests from customers, overlooking the many other aspects that the academic marketing people attempt to measure.

Empirical work on product development in the R&D domain tends to treat "the market" and relevant information about it as something which requires no further explanation, despite multiple meanings for the term. Marketing researchers may slight the emergent aspects of product development, but R&D researchers do not examine whether a failure to structure the process contributes to the confusion they see. And at least implicit in many of these discussions is a sense of technological determinism, or "technology first" (Schon, 1967; Myers and Marquis, 1969; Burgelman, 1983). The myth of the better mousetrap obviates any framework for organizing market information.

Von Hippel (1986) provides a more precise definition of "user needs" and a method to ascertain them. He proposes that firms should search for "lead users." These are potential customers who have already developed a prototype of the product or at least have articulated their needs so that they can discuss them in "real" terms. "User needs" are defined as precise solutions to articulated problems, and his lead user approach includes a method to get at these problems. The approach also has two important first steps which are a part of determining "the market" - the firm must first identify a "precise market" and then establish trends in that market. These, however, are not explicated further, so his method is partly normative.

But the approach does bridge the normative market discoverers and grounded technological creationists.

Since neither marketing nor R&D looks at actual processes of market comprehension, they cannot explain why people do not always get market information. Other research suggests that existing perspectives or understandings of "the market" constrain the new market comprehension process. For example, Bonnet (1986) studied 23 new industrial products. In 90% of the cases, marketing personnel carried out a field test of the product in the premises of existing customers with whom they had good working relationships. Many of these, however, were not representative of the users for the new product, so these tests provided little actual user data. Desphande and Zaltman (1982) examine the more general factors that affect the use of market research done by outside firms. They find that managers prefer comfirmatory research over exploratory, and are less likely to evaluate it positively if the results do not conform to expectations. Desphande (1986) concludes in another analysis of similar data that managers perceive market research as less relevant if it challenges existing institutional arrangements.

In all, then, it appears as if some sort of market and customer data help. But the questions posed in the beginning of this section remain unresolved. Because of the varying perspectives on what "the market" is, what comprises market information is unclear. These studies also leave unclear which, if any, of these kinds of data are more important, or more difficult to get. The conventional market framework or structure does not seem applicable because it assumes that the market itself has already been defined and a strategy exists. Since this is not the case for new products intended for new markets, people who actually develop new products may look only at information they already know about. Or they may rely on existing market definitions. Neither of the research domains - marketing and R&D - really consider the premises of the other.

Interfaces and Integration

Another set of research considers the various groups involved in new product development. There is some evidence that more "effective" interrelations among these functions contributes to new product success (Souder, 1981). Several more specific questions relevant to the study of market comprehension can be posed regarding this subset of work.

First, if different groups are supposed to "interface," what do they interface about? - that is, what is the content or substance of this activity? In particular, how does the profusion of information about the market flow into and between the groups? Why is it that they do not "interface" readily?

As with the literature on market information, researchers of "interfaces" do not address the relationship between the construction of meaning and the context within which that occurs. Most of the work fixates only on the structure side of the coin, and leaves social action out of the picture. An extremely structural view is seen in Berenson (1968), who explains that the term "interface" refers to the boundary or membrane between two physical systems. His model of the relationship between the R&D and marketing units characterizes it as a sequential and mechanistic osmosis of information, materials, and energy across the interface. While this is clearly a metaphor, one must wonder where the image stops and the theory begins, especially since he then derives a mathematical representation of human interaction from the chemical process. But, organization researchers also represent the process in structural terms. They find that groups are "differentiated," and search for mechanisms to "integrate" them.

One of the first empirical studies to consider intergroup interactions over new product development does cast the issues at least very generally in terms social action and social structures. Burns and Stalker (1961) argue that the subfunctions have different expectations and tend to focus on their own tasks. Integration is a problem of sheer translation which arises between people in different phases of the total interpretive system. Indeed, they describe an enterprise in action as an interpretive process in order to "..give prominence to the co-existance within the working community to the large variety of technical and specialist `languages'.... and equally to the way in which things and events may have a large variety of `special meanings' for these different people" (1961:155). These authors do not systematically examine the specific content of the different social constructions regarding "the market," but their work provides a good basis for a more grounded examination of the content and substance of subfunction interaction.

Lawrence and Lorsch (1967) extend the Burns and Stalker work in the direction of the environment. They argue that different functional units must respond to different degrees of

uncertainty in their respective environments. This produces "differentiation" among groups, which they measure in rather general terms as: 1) orientation to formality; 2) interpersonal behavior; and 3) time. Integration is ".. that quality of the state of collaboration which .. is required to achieve a unity of effort" (1967:11).

But these authors never unpack their constructs further. Their discussions of integration concern either structural mechanisms to overcome the differences - even though those differences remain unexplored - or political processes without any content other than conflicting orientations or goals. By implication, then, integration is a structure. Indeed, some researchers since measure "integration" by measuring structures (e.g., Miller, 1987). However, if one examines the data in the Lawrence and Lorsch book, one can infer that these structures work because they generate, facilitate, and perhaps channel the kinds of understandings among the diverse groups that Burns and Stalker talk about. For example, effective integrators in their study are considered more knowledgable, and have more expertise by those they interviewed. Integration, then, can also be conceived of as an interpretive order or context, not only structure in the usual sense such as a liason committee, a boundary spanner, or a project team.

An obvious extension of both the works of Burns and Stalker (1961) and Lawrence and Lorsch (1967) would be to dig deeper into the interpretive order: to examine how or why the differentiated units might view "the market "and the product differently, and how that in turn affects their ability to integrate. What knowledge do the different task units have, how does it flow among the units, and how do existing structural patterns affect the content? This research has not been done. Subsequent work on the different groups in product development has gone off separately onto three tracks: differentiation, conflict, and politics.

First, several studies on differentiation show that the functional groups often have different perpsectives on the product development process. Gupta, Ray, and Wilemon (1985) surveyed R&D and marketing managers in 167 hi-tech firms on how they perceive their "integration." Marketing managers are most dissatisfied over their involvement with R&D in setting goals for new products, while R&D managers are most dissatisfied over marketing's role in finding commercial applications for R&D products. Moreover, R&D managers wanted much less integration than marketing managers. Burgelman and Sayles (1985) also find that

these two groups have conflicting expectations. R&D people, they claim, have an established methodology and procedure which is anchored in the "scientific method," while the business planners use uncodifed methods and work with much more uncertain and uncontrollable resources.

From both studies it seems that people perceive the product development process differently, depending on their organizational role. Moreover, they expect different action from their counterparts, and vica versa. It remains to be seen how these structural differences might affect the definitions or meanings for "the market" generated within each group.

Other researchers have gone off on the second track to examine "conflict" over goals or interests. Link and Zmud's (1986) survey finds a positive relationship between the "complimentariness" of R&D and marketing, horizontal decision making, and innovativeness of the firm's strategy. All of these are very abstractly conceived and very loosely measured. The authors infer from these innocent correlations that conflict arises from intergroup competition for resources, and that in turn leads to distrust and a breakdown of communication channels. But they do not directly observe any of these processes. Ruekert and Walker's (1987) questionnaire study more carefully tests hypotheses regarding relations between strategies, formalization, conflicts, and methods for solving them. Their equivocal results indicate that such constructs are too global to adequately specify what "conflict" really means in the product development arena. The presumption that "conflict" is the problem implies that "conflict resolution" is the answer. But, if conflict is endemic to organizations, to say "resolve it" brings us no closer to understanding issues in the process of new product development.

Third, some researchers get beneath "conflict" per se to consider the political processes involved with new product development or innovation. Schon (1963) was the first to highlight the role of the "product champion" who pushes, shoves, and cajoles the new product through the organization. Since, many others have found this "entrepreneur" role critical to "pursuade and team build" with peers and bosses (Kanter, 1982; Galbraith, 1982), or to convince top management of the viability of a new business (Burgelman and Sayles, 1985).

Work of this type makes clear that political processes are important and that individual action can be essential to move the organization.

This work does not make clear, however, whether any "market defining" is involved. The authors do not indicate whether champions, entrepreneurs, or empowered middle managers find or use market information. One could infer that there is no real need for market comprehension as such because all is political activity. It is plausible, however, that championing which creates a certain kind of shared comprehension is more effective than other kinds of championing. Such possibilities remain unexplored.

In sum, these studies indicate that members of the different units have different perspectives about the task of new product development. But, we do not know precisely what these differences are, nor whether they affect the comprehension of customer needs. What the units should integrate over is also unclear - is it merely some sort of structural coupling that is required, or do the different units need to pool information and perspectives? Related work on conflict resolution fails to examine what it is these units conflict over - "resources" or "goals" can mean virtually anything. It does appear that new product development relies heavily on political activities, but again, the content of those activities remains unexamined. The early work of Burns and Stalker (1961) and Lawrence and Lorsch (1967) point strongly to problems of knowledge and interpretation and learning, but these threads have not been picked up in any subsequent work.

The Organization As A Whole

Finally, a number of theorists suggest that the organization can have orientation that enhances or constrains its product development efforts - that a "structure" affects product enactment (Peters and Waterman, 1982). Marketing scholars describe an inward or firm focused, "anti-market" bias. According to Levitt (1960), firms can have "market myopia" in which they think only about selling and promoting their products and technology. Ames and Hlavacek (1984) argue that industrial firms in particular tend to be preoccupied with objectives that cripple their marketing effort. Such firms concentrate on getting the maximum engineering into the product, on keeping the plant loaded, or on moving the maximum tonnage. Other researchers refer to more general strategic types that respond to

their environments in predictable ways (Miles and Snow, 1978; Miller and Freisan, 1980, 1982; Hambrick, 1982).

That some sort of orientation can arise in a firm seems well established. Relevant questions for this study concern not the orientation itself but how it affects the comprehension of "the market." In particular, how does it affect the information gathered and processed, the integration of functional units, or the likelihood of commercial success of any given new product effort?

Much of the work in organization theory concerns organizational states rather than processes within, describing organizations as entities or configurations unto themselves. However, some work addresses aspects of social processes. The original "organization types" research done by Burns and Stalker (1961) considers in general how the organization might affect the social process of intepretation. The whole process of product development, they say, is one of information use and translation, which in turn is broken down into a series of steps, each of which is itself a translating operation (1961:78).

According to Burns and Stalker (1961), how product development is organized depends on the degree of stability in the technology and markets of the firm. Firms which operate under stable technical and market conditions carry out decisions within the framework of familiar expectations and beliefs. Under this so called "mechanistic" style, the structure is marked by hierarchic control and functional specialization, and "programmed decision making" guides day to day activities. In other words, the structure dictates action and interpretation. But under unstable conditions: ".. the firm's expectations (are) constantly subject to alteration, and the framework of decision, consequently, (is) continually being reset" (1961:86). In this so called organic style, the structure is one of expertise. Through a continuous process of self education, tasks are defined almost exclusively through interaction with others. A "pre-existing common culture.." (1961:118) guides this process. In the organic style, social action predominates, but it is ordered by a shared culture.

One interesting aspect of their work is the possibility that both styles or orientations might exist in on organization. They say that these two management systems are ideal types, and represent a polarity rather than a dichotomy. "A concern may (and frequently does) operate with a management system which includes both types" (1961:122). They also argue

that conflicts over power and status impede a shift from mechanistic to organic forms. In their sample, most firms "spontaneously developed organic practices" (teams, etc.) when they encountered uncertain markets (:fter WWII). But in most firms that thus shifted, efforts to reconstitute the mechanistic order also occured, suggesting that the mechanistic order dominates. In the case of new product development it is plausible that these different approaches to making sense of the market results in inherently divergent interpretations of the product development activity. Important follow-on research would be to detail whether and how these two ideal types might produce divergent definitions of "the market," and how these specific kinds of conflicts might be resolved.

Rather than dig more deeply into the problem, however, other process based work on innovation in organizations advocates that the dichotomy between these different forms be perpetuated. Some industrial economists argue that innovative activities need to be separated from routine adminsistrative ones (Williamson, 1975). Some strategy and organization theorists likewise propose that innovative efforts be broken away from the regular organization, into "skunkworks" (Quinn, 1985), or "reservations" (Galbraith, 1982), or new venture units (Burgelman, 1983). Kanter (1983) suggests that the entire organization be transformed from a "segmentalist" culture to an "innovative" one.

The solutions offered above recognize that something "new" perhaps cannot be handled with the "old" ways. However, they overlook two aspects of social process especially relevant to the larger issue of organizational adaptation. First, if the new is separated from the old, how will the old be transformed? All the authors listed above say that somehow the new activities must be linked up with the old, but do not explain how that might happen. Second, if organizations tend to evolve inward looking, mechanistic routines, then the new innovative structure or culture will eventually become rutted. For example, Burgelman and Sayles (1985) cite a study by Fast (1979), who found that of eighteen new venture divisions he studied, only half existed ten years later. Some became operating divisions, others staff units, and others were simply dismantled. What is to keep the new structure from becoming an old one?

The few examinations of processes within the firm rely heavily on generalized ways of thinking, and suggest that the diversity of ways of thinking must dealt with somehow. But no

study provides any further explication of what these diverse perspectives might be regarding "the market," or how either a mechanistic or organic orientation might affect the acquisition and comprehension of market knowledge. While it is clear that conflicts and power are important aspects of the problem, precisely how these general processes play themselves out in the context of new product development needs to be asessed. The social process model suggests that these organizational orientations must be enacted and recreated regularly to be sustained. Analysis needs to crack into the organizational monolith to see how it works.

SUMMARY

Solutions to the organization level problem of adaptation usually advocate that organizations become innovative or "market oriented," as if such processes are fully understsood and, hence, can be generated readily. As used in this study, social process embraces two fundamental aspects and the relationships over time between them. On the one hand people engage in "social action" through which they interpret information and trends, generate mutual understandings - in this case of "the market," and develop expectations of one another within a specific setting or context. On the other hand the setting itself or the larger social order constrains the social action into certain domains or channels. The organization's existing market, established procedures and practices, and orientation or style may twist or otherwise affect the market definitions and product development work.

The critical issue is not that both social action and social structures operate, but <u>how</u> they mutually interrelate, transform one another, or constrain one another. Examples from several process perspectives in organization theory illustrate these aspects of process. Some emphasize social action - strategy emergence, for example; some emphasize social structure - entrenched theories of action, for example; and some rely on both - cultural elaboration, for example. These perspectives also point to factors which might determine the social action or structure in particular contexts: the nature of the work, the dominant coalition and other political and ideological effects, levels of people within the organization, and developmental stage of the firm, to name a few.

When existing empirical work on new product development is examined using the model of social process, it appears that these studies do not deal with the basic question of how

meaning is generated and how that activity in turn affects and is affected by any structures. Thus, the process of new product development remains fundamentally unexplored. More specific issues uncovered in the empirical review fall into three categories of information, integration, and institutional issues.

First, it seems that having market information helps new product development, but it is unclear how. Since the different studies measure different aspects of "the market," what comprises useful or necessary market information remains unresolved. The academic marketing framework or structure for comprehending the market may not apply to new products, because it assumes that the market itself has already been defined and a strategy exists. It is unclear how market information is actually built into an understanding of "the market."

Second, members of the different units might have divergent perspectives about the task. But what these differences are and whether they affect the comprehension of customer needs has not been specified. More generally, what differentiates these groups with regard to the meaning of the market, and how they should integrate in order to create the product, have also not been examined.

And third, organizations have certain orientations that are presumed to affect both the markets they go into and the products they create. How these orientations do so - in particular, how they affect the interpretations and the integrations of subunits - has not been demonstrated. A number of researchers suggest that innovative activities simply be separated from routine ones. But this solution does not address how the emergent innovative activities either get woven into or transform the existing interpretive order. A fundamental part of the whole problem seems to be how can a large organization somehow embrace both an organic-like and a mechanistic-like form, and how can it shift in and out of them?

ENDNOTES

(1) Social scientists have recognized this relationship all along. It is certainly at least implicit in Weber's work - he describes "verstehen" in his methods, but studies the relationship of the Protestant ethic and capitalism in his work. It is explict in Thomas' and Znaniecki's (1921) lengthy treatise on how Polish peasants become assimilated into American society.

However, Archer (1982) argues that successive theoretical developments in sociology tend to tilt in one or the other direction. Such tilts are especially exaggerated in the organization domain, which uses as offical labels "micro" and "macro." Interpretive sociologists who study individuals in social settings insist that these patterns are mere reifications, not reality, and thus are not worthy of study. Rather, attention should focus on how the individual "actor" creates and recreates his or her immediate reality in every day action. Archer (1982) says that in their view ".. structure betook an evanescent fragility.." and "..was reduced to supine placticity.." (1982:455). Those who study social settings themselves - especially functional theorists, are content to observe what they define as "patterns of adaptation" based on aggragated indicators of the system, and hypothesize about how such structures affect the system's behavior. In Archer's view, for such theorists "..human agency had become pale and ghostly.. ." and ".. the structural or cultural components enjoyed a life of their own, self-propelling or self-maintaining" (1982:451). Each side seems limited when taken alone.

CHAPTER II

METHODOLOGY

INTRODUCTION

The data for this study consist of unstructured interviews with sixty- six people in five large firms who participated in one or more of sixteen new product efforts, discussions with fourteen others in these firms about more general issues, reviews of archival material on three product efforts, and some onsite observation in four of the firms. The intent of this chapter is to describe what these data comprise, how they were collected and analysed, and why. The last point is as important as the others because it helps to identify the choices made, the options rejected, and the possibilities ignored in this study. That, in turn, both explains the limitations of this research and points to potentially fruitful extentions of the work. The general methodology or logic of inquiry is first outlined, and then the more specific methods are discussed.

Because so little is understood about how people understand "the market," the underlying methodology for this research is an inductive, qualitative approach. The methodological goal is twofold: to embrace the complexity of innovation in large organizations and capture it in the analysis; and to understand the process from the perspective of those who develop new products. The study shares a perspective with ethnography: the things one does not know and would ordinarily not ask about are likely to prove the very things that are most important to find out (Kirk and Miller, 1986). Yet this study is also deliberately focused on a particular set of questions regarding the particular problem of new product development. Those unknown things are constrained a priori to fall into a particular area of attention. Additional research which considers this problem from a different domain - power, socialization, decision making, or a clinical perspective, for example - would most likely generate interesting complements to the findings reported here.

Crozier and Friedberg refer to such a focused, interpretive approach as "hypothetical-inductive:" to define, in successive stages, an object of study (1980:260-61). We have no clearly established "how-tos" on this qualitative yet focused logic of inquiry, but several authors explicate some precepts that serve as guidelines for this study. The most general

precept is that "theory" is an ever developing entity, not a perfected end product. Thus, as discussed by Glaser and Strauss (1967), the object is not to verify or validate a theory, but to ground the process of theorizing substantively, in the area of behavior to be explained.

The idea that theory is ever developing leads to the selection of research settings that fit theory rather than statistics, or Glaser and Strauss's idea of "theoretical sampling." Mouzelis (1967) is more to the point: the researcher should strategically chooses a few organizations in order to comb:ne intensity of study with comparative variation of "significant" variables - significant being defined by the researcher. The use of several sites does not add a veneer of respectability regarding the "generalizability" of the findings. The intent is to generate a step toward the gradual build-up of understanding about the processes of innovation and new product development in large firms. This kind of sampling emphasizes getting at the nature of certain relationships, not at their magnitude.

The sampling process circumscribes the analysis. Within that focus, the grounded interpretive perspective calls for data rich in detail and possible contrasts. Such data ideally facilitate two analytic processes. First, they enable the ongoing clarifications and reconsiderations that an effort to grasp complex processes *in situ* calls for. Bailyn (1977) explicates this phase of the research by arguing that both the data and the analysis should meet a certain level of complexity. The data set needs to be complex enough to provide the researcher with input capable of affecting already existing views. Alternative possibilities should be testable, or at least assessable. And the analysis should consist of a continuous interplay between concepts and data in order to hone and clarify the findings. Mintzberg (1979) dubs a very similar process "detective work" - the tracing down (and, I would add, up and out) of patterns and consistencies.

Second, rich and complex data provide the ground upon which to build concepts or constructs that are "real." Mintzberg (1979) argues that the greatest impediment to theory building in the study of organizations is research that violates the organization, that does not measure in real organizational terms. Glaser and Strauss (1967) suggest that analytic constructs should be generated directly from the evidence so that they relate directly to the subject matter. They should not be assumed *a priori* or inferred from "objective" or external phenomena.

The data gathering and analysis for this research attempted to adhere to these precepts. How well can be judged from the descriptions of methods in the following sections: how the sample of firms, products, and people was generated; what the data gathered from interviews, observations, and archives are like; and how the specific analytic categories used in the ensuing chapters were developed.

SAMPLING: THE ORGANIZATIONS AND THE NEW PRODUCTS

The Organizations and Product Selection:

Three thrusts guided the selection of organizations: the gross features of size and age in keeping with the theoretical focus on big old firms; the vagaries of access; and the temporal development of the research. Because of the basic emphasis on processes, it was decided at the start to include more than one firm, to trade off the depth of a single case study against more depth on the process of product development regardless of firms. The industries and core technologies of the firms were also varied deliberately to provide additional contrasts - the results would be more interesting to me if similar patterns obtained despite the alleged affects of these variables (Woodward, 1965; Thompson, 1967).

The five firms ultimately included in the study are all large, over one billion dollars in total annual revenues, and all past their first generation or founder era. All are earning profits. All have enjoyed leadership or large market share in their businesses for some time and so have developed certain "monopolistic" or "fat and happy" tendencies. But those established markets are no longer growing as quickly as before, and most of the people interviewed said that their company needs to move into new markets with new products. This study treats organizations not as entities, but as contexts within which new product development takes place. Organization level issues such as relative success rates in new product development or strategic stances are not being studied, so data about them were not gathered. By agreement with the firms, their identities and those of the products are masked.

Access to the first two firms was gained through an advisor, who had contacts with a business development director at a chemical products firm and a corporate market researcher at a communications firm. These representatives helped to select product development efforts to be studied based on the following criteria: recent but finished efforts (1) that were already,

or were about to be, introduced; (2) that involved new technology and/or new markets; and (3) for which participants were available to interview. The actual selection varied at each place and is described briefly in the capsule summaries below.

<u>Techco</u> is a chemicals products firm that embodies its basic technology in various kinds of products. Techco began with an invention, and continues its "home grown" science and technological thrust. Around 1980 Techco managers decided to move more deliberately into industrial markets because that seemed to be an area of expanding possibilities for their products. They also began to expand beyond their established chemical technology into electronics, and so began to learn about new markets as well as new technologies.

The business manager at Techco gave me the names and phone numbers of each of the other business managers in the industrial products division. I called them and all but one agreed to see me. From there, each suggested recent products which fit the criteria above. People told me of a total of nine product development possibilities: three were old enough that the participants were no longer around, and Techco had superceded the technology with a newer product for one other. All five Techco product efforts eventually included in this study began in the early 1980's, when the firm was beginning to shift into new businesses. In addition to the interviews, visits to two corporate headquarter buildings, one plant, and one materials location provided an overview of the people and their setting.

<u>Opco</u>, several times larger than Techco, is an operating phone company that produces and sells communications services and hardware through several divisions. Communications technologies have been evolving rapidly in the past ten years. With deregulation in the early 1980's their market and the competition have also become increasingly uncertain from any one company's perspective. This research draws on two divisions - voice services and data services - that operate separately within the larger corporation. Both divisions represent very innovative or "leading edge" service technologies in the communications industries.

The corporate marketing research person who was the initial contact chose the voice and data services for the study, and put me in touch with a person at each division. The five specific products included in this study are the voice service, and four product efforts from the data division. I learned of three other new product efforts at the data division, but they were not included because one was only in the proposal stage, one was embroiled in a lawsuit, and

participants were unavailable for the third. Each division was visited for three and four days, respectively, and two days were spent at corporate headquarters reviewing files and interviewing people related to the voice operation. At the voice location, in addition to interviewing and hanging around in the office, I attended a luncheon and training session for corporate wide marketing people. At the data division I was given my own pass and could move freely around the building.

Forty-eight people were interviewed in these two firms regarding ten different new product development efforts. Only one of the ten product histories was apparently successful, and neither firm was considered "market oriented," either by the people interviewed or by reputation (according to consultants who had worked with them). At this point in the analysis, I had glimpsed an otherwise jumbled profusion of market information, sensed a difference in perception by people in the different functions, and discerned some sort of variation in orientation by firm. But I was fundamentally confused, having learned enough to abandon preconceived notions but not enough to fill the void doing so had left. The product development processes themselves at this time appeared to lack variance. The lone successful effort wasan anomaly, and I could not see the forest for the trees, or vica versa.

In the words of a marketing director I had recently spoken with regarding how to deal with ambiguities, I needed to ".. pound a stake in the ground." Success versus failure is one of the theoretical foci of the research. So, I decided to seek additional product histories that were clearly successes or failures, in order to highlight possible patterns around this factor, or "stake." Through the sponsorship of an organization which supports research on various marketing problems, three more firms agreed to participate in the study. They are also large and established, and were chosen to "match" the industries of the first two: two chemical materials firms and one computer equipment manufacturer. (Computers are close to communications since the two industries are merging). The study was outlined to a representative of each firm, and he was asked to pick out two products, one successful and one not, that met the same criteria noted above.

The research proceeded in an developing, rolling fashion. The next two firms visited are described in order.

Saleco is a computer manufacturer. For years it has emphasized relations with industrial customers through its strong sales force, and thus is "market oriented" in that sense. However, competitors emerged in niches of the electronics and computing industry that Saleco did not serve. These originally special niches have grown to become significant aspects of the electronics equipment market, and Saleco is in the process of learning to deal with these new (to them) aspects of the computer market.

A senior marketing person decided to send me to one of the divisions, and gave me the name and phone number of a marketing person reporting to him at that location. That person in turn gave me the names of people to interview for two products. Four days were spent interviewing people at this division site. I also visited corporate headquarters to speak to a marketing person, and traveled to one person's house because he was on vacation and ready to shift into another job.

Compco is a polymer chemicals producer roughly the same size (in revenues) as Techco. Compco is very competitively oriented, and maintains a large sales and applications development field force. The firm is relatively less adept technologically. Emerging, future markets in the chemicals industry are shifting away from "commodity" materials into specialized ones that require more technology, so Compco is learning to develop and merge its technological capabilities with its market orientation.

A senior marketing person selected two recent product efforts to be included in the research and provided a list of people who actively participated in each product for interviewing. I visited the headquarters of the chemicals division for six working days, and was given an office to work from. While there I also visited the plant and was given a tour of the applications development lab.

After Compco, the fourth firm, patterns among the products became evident. In particular, the two additional successful product efforts seemed to be "anomalous" just like the single one from the first two firms. Thus, the fifth firm in the sample, Prodco, was treated differently. Prodco is a chemicals materials firm which produces both consumer and industrial products. A market research person selected the two products for the study, in part because they represent very similar technology and material but different markets and uses.

People were interviewed at Prodco to establish whether their successful effort matched the emerging pattern. It did, thus "saturating" the success comparison, to use Glaser and Strauss's (1967) term for filling out an understanding of the construct. Their failed product occured over ten years earlier and the two people available to be interviewed were vague about details. However, this product particularly highlights the uncertainties of new product development, and its demise was much more clearly an "act of God" rather than an organizational or marketing failure. So, rather than ask for a more recent product, I kept this one for the overall analysis. The failed product effort also saturates the less successful comparisons, so the last two products studied in effect "top off" the data gathering and analysis. On the one hand, the successful effort fleshes out a general model of market comprehension in large firms. On the other, the failed effort makes it clear that no model can completely account for new product development.

Only five Prodco people were interviewed in person and one on the phone. No extensive time was spent at the company itself, so very limited organizational data were collected. And the failed product effort is not included in the detailed analyses reported in Chapters V and VI because only a limited amount of information was available about it. However, this product is detailed insofar as its history was given to me in the discussion section of Chapter V, in order to consider the uncertainty factor.

Each product is described in Table 2-1, which lists the products by company and their status as of the end of the data gathering.

Descriptive Comparisons of the Products

For the purposes of several contrasts in the analyses, the products are grouped into "success" categories as listed in table 2-2. Success here refers to commercial success, making money. These categories are limited in that it may take many years to truly determine success or failure. As noted, all of the products have been introduced to "the market." Those that have since been cancelled or removed for major overhaul are listed in the first column. These are considered "less successful" since they are not making any money. The middle six products, all from the first two firms, remain on the market, but at the time of interviewing

TABLE 2-1:

Description of the Products By Firm

New Products	Status as of End of Interview
TECHCO: chemical products	

CRT DEVICE

electronically tranfers CRT (computer) signals to the device, e.g., a graphics display, enables enhancement of the display, and produces a hardcopy.	introduced several years ago; initial sales slow but are now beginning to grow; device is being redesigned to make it easier to use.

BATTERY

technologically unique, long life battery; originally produced to support another line of products; excess production capacity prompted Techco people to attempt to commericalize new battery for other users.	introduced in early 1980's; primary targeted market interested but not enough to risk problems with distribution of battery to their end users. Cancelled after 3 years.

MEDICAL HARDCOPY SYSTEM

a chemical and mechanical technology that produces a hardcopy from medical diagnostics system; requires that diagnostic systems makers enable an interface with this device.	introduced recently; sales lower than originally planned but expected to pick up; delayed in manufacturing for over a year; competitor now has very similar product but at a lower price.

VIDEO DEVICE

captures television (video) signals and produces a hardcopy; similar to the CRT device but intended for a different kind of market and application.	just introduced; no history; has some technical problems due to poor quality of video signals so are monitoring closely.

FILM COVER

adapts a paper wrap Techco makes for other products to contain piees of professional grade film; film purchased from another firm.	to test market; sales exceeded projections so introduction moved up 3 months.

OPCO: communications

VOICE SERVICE

technology developed in late 1970's; electronically transfers voice to digitalized packets, transmits them over the telephone network, captures them at the other end and reconfigures message; users have a number of options for mailboxes and sending/ retrieval of messages.	introduced as a service in early 1980's; expanded to a number of cities and have built a network; still a net loss.

TABLE 2-1 Continued:

Description of the Products By Firm

New Products	Status as of End of interview

OPCO con't

ELECTRONIC MAIL
technology developed in the late 1960's; technology runs on packet switching similar to the voice product but text is stored and then forwarded.

introduced in the early 1980's; sales growing at a high rate; competition now very strong; earnings uncertain.

DOCUMENT DELIVERY
allows e-mail users to generate documents on the e-mail service and then produce a hardcopy to be delivered overnight to people who are not on the network.

introduced but withdrawn a few months later for complete revision; new service to be targeted at specific users for particular purposes

ACCOUNTING SERVICE
carries out accounting transactions between firms over the electronic network; in particular aimed at retailers to process credit card transactions.

introduced but system failed so are reworking it; withdrawn except for several sites for test purposes.

SOFTWARE DISTRIBUTION
distributes software files over the data network from one terminal to another; also downloads software from a central file source.

just introduced, no history.

SALECO: computers

SYSTEM I
a small stand alone word and information processing computer system.

introduced in the early 1980's and quickly exceeded all projections for revenues; now approaching end of life.

SYSTEM II
a follow-on product to the system I intended for the home and educational market; smaller and less expensive.

intended market "disappeared;" sales disappointing; changes made after introduction but did not help; cancelled after a year.

Table 2-1 Continued:

Description of the Products By Firm

New Products	Status as of End of interview
COMPCO: chemicals	
HARDPOLY	
combines two polymers, giving the plastic material more strength yet at a lower cost than the stronger polymer alone; previous efforts to produce this mixture, both by Compco and other firms, could not overcome certain drawbacks.	introduced into a certain application but material failed the heat test; withdrawn by firm and other market possibilities are being explored.
HOTPOLY	
a new kind of polymer for Compco; has much greater heat resistance and can go into engineering applications.	introduced in early 1980's; took several years to establish sales procedure and develop pilot manufacturing capabilities; now meeting expectations and a full sized plant is being built.
PRODCO: chemicals	
INDUSTRIAL WASTE CONTAINER	
a membrane-like material that holds water and lines large containment areas for industrial wastes.	material failed after about 3 years; lost its strength if exposed to high heat for any extended period of time; product cancelled and Prodco had to pay to replace the liners.
ROOFING SYSTEM	
made of a membrane similar to the industrial container; processed to serve as roofing for flat industrial buildings; replaces asphalt.	introduced in the early 1980's; very successful

their futures were uncertain to the product developers. The products are not generating a clearly profitable stream of revenues, yet the product developers think (and hope) they will.

This category includes the two products that were just introduced at the time of the study but for which no clear sense of success or not was available. This group is labeled uncertain.

TABLE 2-2:

Products By Categories of Success

FIRM	Cancelled	Uncertain	Successful
TECHCO	*BATTERY*	*CRT DEVICE* *VIDEO DEVICE* *MEDICAL HARDCOPY*	*FILM COVER*
OPCO	*DOCUMENT DELIVERY* *ACCOUNTING SERVICE*	*VOICE SERVICE* *ELECTRONIC MAIL* *SOFTWARE DISTRIB.*	
SALECO	*SYSTEM II*		*SYSTEM I*
COMPCO	*HARDPOLY*		*HOTPOLY*
PRODCO	*INDUSTRIAL WASTE CONTAINER*		*ROOFING SYSTEM*

Rather than a categorizing failure, it reflects, I believe, some of the realities of product development wherein success or failure is not always clear. These, too, are considered less successful.

The third column lists those products which appear to be successful - they are or were generating revenues as anticipated. The film cover at Techco had only just been introduced at the time of interviewing, so technically it would be uncertain. However, as noted above this

product struck me as being different from the uncertain or cancelled products. In addition, the test market was much more successful than anticipated, so Techco moved national "rollout" up by three months. More recent reports indicate that the film cover is not selling as well as originally anticipated, but this too may be only a temporary phenomenon. The other three successful products have more history and thus are more clearly successful, although as will be described, hotpoly went through a period of uncertainty after it was introduced also. It is conceivable that several of the uncertain products may become much more successful than the so called successful products, so the inherent uncertainty of new products needs to be kept in mind. However, these categories facilitate some of the comparisons made, and help to elicit inferences that can be tested and honed with on-line and longitudinal data.

"Market familiarity" or "newness" is also an essential factor in this research. "Familiarity" can be considered as both an internal and an external factor. Internally, each new product effort might require activities or involve technologies that the organization as a collective has never done or used before, despite what other firms may be doing. Based on the kinds of difficulties the people interviewed talked about, six internal dimensions of familiarity seemed important: (1) the product's underlying technology; (2) manufacturing; (3) distribution; (4) competition; (5) customers; and, (6) applications or uses. Table 2-3 compares the products by success category on these dimensions of internal familiarity. While each product varies, there are no clear differences by success grouping. The cancelled products were no more or less familiar than the successful ones, so internal familiarity does not account for the distinction between them.

External familiarity refers to the potential availability of market information "out there" in "the environment." To capture a very rough sense for the availability of market information, the products were compared with other products that already existed on the market, as follows:

> 1. Did a product that performed the functional equivelent to the new product already exist? If so, the product developers conceivably could examine those users and markets to help them assess the possibilities for their product. For example, Techco's new battery incorporated new technology, but was intended to replace batteries others already sold in a market that already existed.

> 2. Were potential customers already carrying out the activity that the new product would perform? If so, the product developers conceivably could examine the extent of problems potential users had performing that activity and how important it was to them to do it more cheaply or effectively, etc. For example, no direct functional

TABLE 2-3:

Internal Familiarity

DIMENSIONS OF INTERNAL FAMILIARITY

Success Status	Product	new technology	new manufacture	new distribution system	new competitors	new users	new applications
CAN-CELLED	Battery		XX	XX	XX	XX	XX
	Document Deliv	XX	XX	XX		XX	XX
	Acctng Service	XX	XX	XX		XX	XX
	System II		XX		XX	XX	XX
	Hardpoly		XX				XX
	Indust. Contain.	XX		XX	XX	XX	
	CRT Device	XX	XX	XX	XX	XX	XX
UN-CERTAIN	Video Dev.	XX	XX	XX	XX		XX
	Medical Hrdcopy		XX	XX			
	Voice	XX	XX	XX	XX	XX	XX
	E-mail	XX	XX	XX		XX	XX
	Software Distrib.	XX	XX	XX	XX		XX
SUC-CESSFUL	Film Cover		XX	XX	XX		XX
	System I	XX	XX	XX	XX	XX	XX
	Hotpoly	XX	XX	XX		XX	XX
	Roofing		XX	XX	XX	XX	XX

equivelent to Opco's accounting service existed in a product already available. However, retailers did carry out the activity of checking credit cards and processing

credit card transactions, and the accounting service would basically repackage those activities by doing them all electronically.

3.Did the product require new activity on the part of users? If so, relatively less informtion about the size of the potential market or extent of user problems would exist. For example, the two electronic messaging products at Opco required that users communicate in relatively new kinds of ways.

Table 2-4 compares the success categories by external familiarity. The products labeled uncertain based on revenue streams are also relatively more uncertain in terms of market knowability. However, tnere are no apparent differences between the cancelled and clearly successful products, so external familiarity also does not account for this distinction.

DATA COLLECTION FOR COMPLEXITY

The data gathered within these research contexts are rich in four ways: as a result of the diversity of those interviewed and the open nature of interviewing; from alternate sources; and from the testing of emerging insights across time.

<u>Interviews:</u>

People who had hands-on experience with the product efforts were identified by the contacts with each firm, and then I contacted them personally to set up an interview time. On the whole, their narratives are complex in two ways. First, the people represent the major functions - design and development, market research and planning, and sales and sales support. Several of the cases also included manufacturing or purchasing people since they played a significant role. Table 2-5 lists the number and function of those interviewed for each product effort. Only two people were interviewed for Techco's battery, but they seemed to provide a reasonable summary of events. At least three people were interviewed for all other products. In total eighty different people have been interviewed, producing six-hundred pages of handwritten notes.

The second source of complexity is that the interviews were unstructured to elicit people's own perspectives - in effect I have eighty different theories of new product development. Each interview began with a brief description of the study: To find out about the kinds of user information those engaged in industrial product development rely on in their work, and determine whether any practices enhance or reduce the effective use of such information. The

TABLE 2-4:

External Familiarity

potential availability of needs information

Success Status	Product	functional equivelent already in market	customers already doing activity	product requires new activities for users
CAN-CELLED	Battery	XX		
	Document Del	XX		
	Acctng Serv.		XX	
	System II	XX		
	Hardpoly	XX		
	Indust. Cont	XX		
UN-CERTAIN	CRT Device		XX	
	Video Dev.		XX	
	Medical Hrdcpy	XX		
	Voice			XX
	E-mail			XX
	Software dist		XX	
SUC-CESSFUL	Film Cover	XX		
	System I	XX		
	Hotpoly	XX		
	Roofing		XX	

people were then asked to review the state of the product when they became involved, and to

TABLE 2-5:
Number of People Interviewed
By Function and Product

Function

Firm	Product	sales and customer support	marketing, business planning	engineering and design	manufac-turing	TOTAL
TECHCO	Battery		1	1		2
	CRT Device	1		3	1	5
	Video Dev.		1	2		3
	Medical	1	1	2		4
	Film cov	1			2	3
	OTHERS	1	2			3
OPCO	Acctng	1	1	2		4
	Document		2	2		4
	Software		2	1		3
	E-mail	1	3	4	1	9
	Voice	4	3	1	1	9
	OTHERS	2	3			5
SALECO	System I	2	2			4
	System II	1	2	2	3	8
	OTHERS		2			2
COMPCO	Hardpoly	2	1	2		5
	Hotpoly	3	2	1		6
	OTHERS	1	1	1		3
PRODCO	Indust.	1		1		2
	Roofing	1	1	1		3
	OTHERS		1			1
		23	31	26	8	88*

*figures double count those who discused more than one product

describe their role. The rest of the interview was unstructured, and they were asked to tell their story of the product's development. Whenever they mentioned "customers" or "market tests" I pushed for more details.

Notes were taken in shorthand, and reviewed and clarified immediately after each interview. Stories from several participants for each product were allowed to overlap as much as possible so that I could get several discussions of the same significant events in the life of the product. The interviews lasted from about one hour to over two hours. For all products, after I interviewed everyone I checked back with at least one person (by phone, or, if still at the site, in person) to verify details or clarify any apparent conflict in the events as described.

Each narrative contains five kinds of data used to develop the product histories themselves, and in part the summaries of functional perspectives and of each organization's "routines" for product development. These are:

1. a description of the market information that was available and used when;

2. a description of the chronology of events for the product;

3. a description of and comments on the kinds of activities they usually engage in for product development;

4. evaluations, aspersions, and general comments regarding people in other units, the customers, the corporate staff, senior management, and anything and anyone else the person chose to include in his or her narrative;

5. attributions as to what caused what, and why things happened as they did.

A major problem often raised with interviews about past events is the concern that the person may not recall or may provide a slanted view of what "actually" happened. Recall bias can be overcome if the issues are salient and nonthreatening to the person (Kidder, 1981). The product effort itself as well as the general topic seemed very salient to the people. In addition, the interview was managed by probing for details to facilitate recall. To deal with the "threat" that some involved with the failed products might feel, I presented the study as an effort to learn about a very complicated and difficult process, and cast the people who told me the development stories in an expert role. Several people were clearly hostile nonetheless, but by the end of the interview seemed relaxed enough to invite me to a meeting or show me "secrets" from their files.

The last two kinds of information listed above are detailed to stress that the research deals with how people make sense of what is going on. Thus their own views, however "biased" to some "objective" observer, constitute the critical data. Attribution theory does suggest that people may differentially attribute causes depending on successes and failures

(Heider, 1958; Kelley, 1974). The quandary attribution bias poses for this research is not that people make attributions, but whether the attributions they make at the time of the interview are the same as those they would have made when the product was being worked on. Those people whose stories spanned several products from past to present have stable attributions, so there is some evidence that attributions do not change over time. However, the real solution to this problem, as well as the recall problem, is to do follow-on, observational research in real time. In the analysis reported here, findings on the differences between the successes and failures which might be due to these differential attributions or recall problems are noted.

All the people I spoke with were also assured of confidentiality, so specific identifiers such as titles are not used in the text, and any names are pseudonyms. Although a number of the people are women, the male pronoun is used throughout the text. Usually, only one woman is associated with a product, so to use the female pronoun would identify her comments (and aspersions) to her fellows.

Archives and Artifacts:

Analysis of archival material provides another source of data diversity. I had access to the entire corporate file for the voice service, read what was termed a typical new product business plan at the data division, and was given a copy of a speech given to sales at Techco about the history of the medical hardcopy system. These documents essentially confirmed the people's accounts regarding the how much market information they had, and the organizational problems they encountered. In addition, people showed me overhead slides from their own files (which I copied down whenever possible), held up plans and read off the tabs, showed me examples of the products and detailed quality issues, demonstrated the product or, in the case of chemical materials, how they work/what they do, and gave me advertising materials. All of these artifacts are grist for the mill of description and analysis.

On Site Observations:

Additional data diversity comes from several days worth of observation on site in four of the five firms. Such a limited amount of time hardly constitutes fieldwork, and I did not observe product development itself underway. However, people were seen in their

organizational habitats, and I gathered some sense for the way the firm in general operates and what certain tendencies might be. For example, secretaries and security people were very friendly and easily engaged in conversation at both Techco and Compco, even though one firm is in a rural setting and one in an urban area notorious for the rudeness of the local citizens. Such people at the three other much larger firms' corporate headquarters were glacially polite, yet more open at their operating locations.

Other interesting contrasts became apparent from the site visits. For example, Opco seems to be the most "bureaucratic" firm, and phone companies are renown for concerns over status and hierarchy. Opco's data division had recently moved from a traditionally laid out office space to a new building with an open office set-up. However, the floor is covered in rich, deep carpeting and the office carrels are mahogany, suggesting a tension between the new openness and the old status concerns. Meanwhile, the voice division inhabits a cramped suite full of boxes. But their director spoke to a group of marketing managers receiving special training as corporate "fast trackers" while I was there, suggesting he has some status after all (I attended the talk and chatted with participants). His group was also providing inservice training to three young MBA's, and I pumped them for insights from their relatively fresh and unspoiled perspectives on the firm as well as about marketing in general.

Among the other sightings and scenes encountered, an engineer at Compco tried to show me an example of output from their new and very expensive CAD system (Computer Aided Design). But all we could find on display were diagrams of the USS Enterprise. (StarTrek, for the few who might not know). All manufacturing people in all the firms wore polyester. Almost all technical people (even at Opco data) were casually dressed and their offices/carrels a mess, while the attire of the marketing and planning people varied from casual to full business regalia, depending on the firm, gender, and/or the location. These and other kinds of impressions and snippets form part of my understanding of the firms, the people, and the product development activity, and are woven into the accounts given in this report.

Time:

The fourth source of diversity comes from the thirteen months spent gathering and analysing the data, and subsequent five months spent writing and rewriting the analysis. A rolling, clarifying process was followed, and as possible categories emerged, they were tested

with people in subsequent interviews. For example, when it appeared that people sought systematically different information depending on their function (which did not occur to me until after the initial visit to the second firm), I asked subsequent interviewees to tell me about the kinds of information they found most difficult to get. I also showed several people at the first two firms the emerging list of information types and they commented on it.

As another example, general discussions with market research people over lunch at the third firm visited (Saleco) brought more clearly to my attention the extreme uncertainties they felt they had predicting "user needs" more than a year in the future. This in turn led to a discussion of how they feel pulled in different directions by management. I subsequently probed market research and marketing people at the fourth firm (Compco) to see if they felt the same way - they did. This particular insight helps to underpin the analyses of opinions about market research and of functional differences, reported in Chapters III and IV, respectively.

Following each visit, the notes were reviewed and digested around the surprises and similarities encountered or discovered. In addition to the field notes and interview notes, I produced approximately 200 pages of dated analytical notes on the notes. These constitute a written record of the analytical process itself and were used to reconstruct the flow of analysis in terms of what issues struck me first and how I tried to sort them out, to remind myself why I thought a particular issue bore more scrutiny, and to clarify how I developed the analytic categories ultimately used. I also wrote five "analytic memos" and one extensive outline over a period of seven months, and circulated them for review and comment. And I gave several talks on the findings, which incited additional feedback and comment.

Unlike an ethnography which dwells on description (at least allegedly, but see Van Maanen, forthcoming), considerable effort in this research was devoted to analysis. Thus, this work reflects less a first order account of how people comprehend the market, and more a second order analysis of peoples' analyses of what went on. The implications of the findings are limited to what this kind of data can tell us. The data are woefully poor when it comes to specific interaction episodes at the phenomenological level, and they do not provide an "online" view of the actual process of new product development as it unfolds. An obvious follow-up to this research, then, is to test some of the implications with observational work.

DEVELOPMENT OF CATEGORIES

Analytic categories were developed from these data for the following chapters, outlined below.

Chapter III: Market Information

This chapter examines the basic problem of trying to make sense of "the market," in order to locate where organizational factors might come into play. The chapter begins with a summary of what the people think about market research. Most people discussed "market research," or the more general issue of marketing, in their narrative, because the research was presented as a study of problems in those areas. Those that did not mention these items were asked about them. The first step of this analysis was to lift out these comments from the interviews and scrutinize them to generate possible categories.

Initial categories included such groupings as "it's confusing;" "you need to put the product in their hands," "people have no commitment to a new product" - a mixture of purely idiosyncratic views and more abstract indicators. This hodge-podge was resolved into a two-pronged approach. First, a five category, easily coded cluster of opinion was developed to provide a frequency count of general opinion: (1) you can't make sense of market research; (2) you can't use it for new markets; (3) it is limited or inadequate; (4) it is necessary; (5) and vague or no mention. The notes from each interview with a person who had hands on experience with a particular product were coded as one of these opinions. The more qualitative problems with market research were then examined separately to dig into the kinds of problems people have doing "marketing" for new products.

The second section of Chapter III sorts out the differences in the content of what people mean by "market information." As soon as I went to the second firm, which tends to be more planning oriented than the first firm, I was struck by differences in the kinds of information people discussed. A three-part distinction of design/technology issues, business matters, and applications factors came to mind rather quickly. But the final analytic scheme which breaks these three categories down into more precise subcategories took nearly a year to hone and sharpen. Marketing texts were used to help sort out different kinds of data, so the scheme reflects the diversity they discuss (Urban and Hauser, 1980; Ames and Hlavecek, 1984;

O'Shaughnessy, 1984). In addition, I showed the lists to people I interviewed for feedback and comments and these were taken into account. One person at Saleco commented that the final category scheme leaves out such issues as advertising, preparation of flyers, and other promotional issues. He is right, the scheme overlooks the more consumer marketing types of issues, and only a few people interviewed spoke of these kinds of activities. It is thus slanted and limited.

Each interview was coded for the kinds of information the person discussed, as well as the amount of information with a simple scale: 0 - not mentioned; 1 - category mentioned but no actual data were gathered; 2 - some data gathered; 3 - much data gathered. See Chapter III for examples of types and codes. These codings were done twice (but only by me), and the final results were very similar. To guard against bias between successful and unsuccessful product participants, the former interviews were never adjusted upward, while the latter often were - benefit of the doubt as it were. Thus the measurement is reasonably reliable but not particularly precise. Since the whole measurement effort could be confounded with attribution differences in the interviews themselves anyway, these measures serve only to indicate gross frequency counts. They are not the core of the analysis.

Chapter IV: Differences Between Subfunctions

On a qualitative level the differences in perspective between people in the functional groupings was also evident almost immediately. When asked to tell the story of the product's development, people systematically chose to recount very different issues, highlighting some and almost ignoring others. Although the description of these differences is the shortest piece in the dissertation, it took me the longest to develop a way to capture them. At first, the categorization schemes were confounded with the information itself, until I realized that the groups differed in interpretation and perspective as well as in content. By rummaging around from these differences in the data to discussions of interpretive orders and institutions in the literature, I hit upon the construct of "thought world" from Douglas (1986) which seemed to fit. This concept was sharpened in my mind with insights from Sahlins' (1968) discussions of tribes and Cohen's (1985) discussions of community. It was distinguished and delineated more clearly through contrasts with Becker's (1982) "art worlds."

With this conceptual clarification in mind, more precise categories were developed to sift through the interview notes to find the right descriptive handles. Comments people made about the following were lifted out from the interviews to be considered: how they define "the market;" what they say about people in other units; how they explain the task of new product development; what problems they speak of. From here the final analytic categories that most distinguish the thought worlds came to mind: (1) how each views the future and what each considers most uncertain; (2) the kinds of information each seeks and why; (3) what each views in concrete versus abstract terms; (4) and how each envisions the overall task.

Chapter V: The Product Development Processes

This chapter continues the thought world analysis by examining the effects that different thought worlds have if they dominate the product development process at any time. Here, the product efforts are the units of analysis, and the relations among the thought worlds are the foci of the analysis. To sort out the processes, four periods which roughly define stages in the products' developments were first set forth: idea initiation; testing of the idea and taking the product around for consideration; development, which extends from the point of official approval to product introduction or rollout; and post-introduction. It should be noted that these stages serve as heuristics only, and are not part of the final analysis because they did not fit the actual flows of events very well. Then, the information mentioned by anyone associated with a product was noted for each period, subcategorized by the initial three part scheme: design; business; applications. Interpretations were also noted, and a crude flowchart of events by stage was developed. Finally, the kind of information that was missing by stage was detailed for each product effort. Some of this mad and ritualistic summarizing was just that, since I was unsure what was important in the early phases of the research.

From these analyses, similarities became apparent among sets of product developments, regardless of firm. That is, products developed in different firms followed similar patterns. Several product efforts began primarily with technical and design information, and the technical thought world dominated. These products evolved sequentially, and most of the other market information was gathered after introduction. I labeled this group the "leap before you look" enactment pattern. Several other products began with a plan and were dominated by the marketing thought world. But these products all had problems with

linkages among the thought worlds, and tended to fail upon introduction. Those not cancelled became thoroughly redefined. I dubbed this group the "plan and then plunge and then plan again" enactment pattern. A third group of products shifted their definitions radically during the development phase, prior to introduction, but also had more interaction among the thought worlds. This group became the "feed it or shoot it" enactment pattern. People who worked on a fourth group of products discussed most of the kinds of information from the beginning. These products developed in a "backing and forthing," emergent fashion prior to introduction, unlike the more sequentially developed patterns above. I called this group the "cut it loose" enactment pattern.

These four patterns were initially articulated with the first ten products from Techco and Opco, and the next five products fit into them seemingly well. With some additional honing, these became the product enactment patterns described in Chapter V. More analyses of other products in other organizations would most likely uncover more patterns, or more generalizable patterns. Other research might also find a modal tendency of one enactment pattern for particular organizations, and perhaps for particular strategic types, if a random sample of product developments were examined. This research treats these patterns simply as ways to describe and summarize the product histories and to explicate the impacts of the thought worlds on those histories. Reify them at your own risk.

Chapter VI: The Organizational Routines

Finally, how the organization as a context might affect the product development activities is analysed. Most people spoke at some length about "the company" and how things usually happen there, what "management" looks for in new products, and what processes are typically followed. Many also included a history of the firm in their story, even though I never asked for one. This seemed to them to be an important part of the specific story, or at least they felt it was important that I understand the history for my study. These so called "routines," short for institutionalized ways of going about product development, were in fact the first "thing" I attempted to summarize and analyse because they did figure so largely in the narratives. However, I could develop no sensible hooks and soon gave up.

It eventually became apparent, with some surprise, that the routines smothered innovation. The successful cases all violated the routines, while the less successful ones

followed them. This general finding provided some good hooks into the routines, namely: Did they force the sequential development flow typical of all the less successful enactment patterns? Did they prohibit the interactive mode typical of the successful products? Did they encourage oversight of certain information? Did they reinforce internal, financial concerns over external, customer concerns? Data which would address these questions were sifted from the site visits, artifacts, archives, and narratives, and worked into general summaries of each organization's routines. Chapter VI describes these routines for each firm, and illustrates how they mediate product innovation by contrasting the successful and less successful products' relations with them.

These dry details of data gathering and analysis come to life, at least to some extent, in the chapters that follow.

CHAPTER III

MARKET INFORMATION

INTRODUCTION

The literature on market information, reviewed in Chapter I, leaves unresolved several issues pertinent to the question of how people comprehend the market for new products. First, do people have problems with conventional market research, and, if so, what are they? Relatedly, what constitutes "market information" or "user needs," and is any particular type of data more important? Why don't people always get "market information" - can any particular problems or barriers be identified? The answers to these questions lay the foundation for the rest of the research because they describe the substance of "market comprehension." The rest of the thesis builds from this descriptive foundation to identify and clarify organizational factors that either constrain or enhance these basic activities.

The analysis reveals that the majority of those interviewed consider conventional market research to be limited when it comes to new markets. It does not provide them with precise information, especially about product design and whether potential users might actually buy the new product. More generally, conventional market research does not adequately frame or organize their efforts to comprehend "the market." It seems that to understand new markets requires a creative, building-up process, but standard approaches provide a top down, deterministic process. The kinds of market information people seek are then examined, and nine analytically distinct kinds are found. People who worked on the successful efforts generated more of more kinds of information prior to product introduction, which suggests that all kinds are essential. They were also able to generate a workable framework that helped them pull all the information together, while people on the less successful efforts did not. The basic conclusion is that a complex array of market information is important to effective comprehension of new markets. Yet, people also require a new kind of marketing framework before they can gather and integrate this information - these two go hand in hand.

PROBLEMS WITH CONVENTIONAL MARKET RESEARCH

General Opinions:

As detailed in Chapter II (methods), the people interviewed either discussed the market research they carried out as part of their narrative, or, if not, they were asked to talk about it. To summarize general opinions about conventional market research, each interview with a person who had hands-on experience was coded for one of five mutually exclusive categories of opinion: (1) market research makes no sense; (2) it does not work or apply to new markets; (3) it provides only partial information; (4) it is important to have; and (5) a vague mention,with no real opinion expressed. The first three categories reflect negative opinions, while the last two categories reflect positive ones. People who fall into the very last one - vague or no opinion - essentially know little about market research, and describe it as a simple activity that others carry out. For example, one manufacturing engineer said that the development engineers describe the product in full and then marketing goes out to count how many people want it. Several others explained that market research figures out the colors for the box or carrying case, minor if not mindless pursuits.

The distribution of opinion is summarized in Table 3-1, categorized by success grouping of product. Over all, 56% express a negative opinion, which indicates that they do indeed have difficulty with conventional market analyses. The opinions, however, differ across the product groups. The successful product developers are the most negative on the whole about conventional market research, yet they for the most part feel that it is simply inadequate. Among those working on the uncertain group of products, 34% said that market research either can't be done or makes no sense, much harsher critiques. This difference may in part be due to an attribution effect, reflecting more frustration with product development on the part of the uncertain developers.

Those who worked on the cancelled products appear to have a perversely positive opinion of market research. But this difference goes away when the person's subfunction or role is controlled for. It so happens that a proportionately higher number of engineering and manufacturing people in total were interviewed regarding the cancelled products. The subtables 3-2, 3-3, and 3- 4 break out these subfunctional differences. In table 3-2 it can be

TABLE 3 - 1:

Opinions of Market Research

Success Status of Products

Market Research:	successful	uncertain	cancelled	TOTAL
Makes no sense	0%	11%	0%	6%
Can't be used for new markets	0	23	10	14%
Is not adequate	77	29	24	36%
Is necessary	15	9	33	17%
Vague mention only	8	29	33	26%
TOTAL	n = 13	n = 35	n = 21	100% n = 69*

chi square = 22.28; p = .01

* table inlcudes all who had hands-on experience with a particular product; people are double counted if they discussed more than one product.

seen that the opinions of the business, marketing and sales people about market research are strongly negative regardless of product success group. Among the small number of positive people, few are vague or indifferent about market research. In table 3-3, it can be seen that, in contrast, most of the technical people are positive about market research. Most of these (16 of 22, or 73%) are simply vague. Table 3-4 shows that these group divergences are statistically significant. Differences by function will be taken up in depth in the next chapter.

TABLE 3 - 2:

Opinions of Market Research:

Sales, Marketing Only

Success Status of Products

Market Research:	successful	uncertain	cancelled	TOTAL
Negative categories	89%	83%	60%	81%
Is necessary	11	12	30	16%
Vague mention	0	6	0	5%
TOTAL	n = 9	n = 18	n = 10	100% n = 37

The important point here is the divergence of opinion by group, and the apparent lack of appreciation or understanding for the issues and problems of market research on the part of many technical people.

Specific Problems With Conventional Market Research:

A qualitative analysis of people's comments about market research uncovers some of the reasons they are negative about it. Two broad problems emerge: that market research generates equivocal information; and that it does not frame or organize the market analysis effort adequately for new markets.

The equivocality of market research takes several forms. First, those who say market research makes no sense want a description of the product itself. An engineer associated with the CRT device at Techco indicates that standard market research left a void:

TABLE 3 - 3:

**Opinions of Market Research:
Engineers, Manufacturing Only**

Success Status of Products

Market Research:	successful	uncertain	cancelled	TOTAL
Negative categories	50%	41%	9%	31%
Is necessary	25	6	36	19%
Vague mention	25	53	55	50%
TOTAL	n = 4	n = 17	n = 11	100% n = 32

Table 3 - 4:

Opinions of Market Research:

Statistical Differences

function

Market Research:	Sales, marketing	Engineering, manufacturing	TOTAL
Negative categories	78%	31%	57%
Positive categories	21	69	43%
TOTAL	n = 37	n = 32	100% N = 69

chi square = 15.01; p = .001

> *(Usually) the notion of what the product ought to be is played off against marketing. The problem was, we had no trade notion. We did the obvious and hired consultants. They did traditional market research. Some we paid attention to and some we did not. In the end we bet that this kind of product is needed in the marketplace... Now we have a customer base and can go and talk to real contacts about real things.*

He could not make sense of the data they did get, at least not for his purposes, and so dismissed most of it.

A second aspect of equivocality is that standard market research does not help assess technological trends associated with new products. It cannot "pierce the veil of the future," as one marketing person put it. Those who do business projections for the electronic messaging and computer products in particular cite this problem. For example, a product manager at Opco said: "The theory is that you will get good information from customers. But their thinking is only one to two years out and we need a longer time frame." A planner at Saleco explained that they can't guess what customers will be using more than eighteen months to two years out. Since product development often takes longer than that, they will simply project where the technology is going rather than try to estimate where uses and users are going. In the case of computers, he said they look at faster memory and smaller spaces, and design products accordingly.

A third problem particular to new products is that the results of typical market research efforts do not establish clearly whether potential customers will actually buy the product. A manager associated with the e-mail product at Opco expresses much experience with this kind of equivocality:

> *We found market studies like if we offer this product how much will you pay? not to be useful. Users don't have a good understanding of the product, they don't have the time to discover the diverse ways they can use the product, and they don't understand fundamentally the dollar value. ....We knew from experience that there was a need for this kind of service,..that it would be successful... I am convinced that that statement in In Search of Excellence is true - just get something out there, you'll learn so much from an initial use.*

Most marketing and sales people also had problems with "surveys," saying, for example: "You can't trust standard surveys. People say they'll spend money but in reality they don't." According to a salesperson: "A client base is really important. Once you understand a few applications, it really takes off." Sales will look for innovative companies willing to try a new

technology. "It's like spreading the gospel.." said one salesperson. And another said: "I'll take luck to market research any day."

These product developers have a real struggle with the comprehension of new markets, and tend to feel pushed to operate in a void, with unclear and ambiguous data. They resolve this very uncomfortable state of affairs by focusing on specific, grounded information. A theme running throughout these comments is the penchant for direct, hands-on experience with "the market." Many prefer to go ahead and introduce the product in order to learn what the customer wants of a product and whether they will buy it, rather than do "surveys." The results of market research seem too abstract, they do not adequately characterize customers and their needs for the new product. This finding is consistent with von Hippel's (1986) argument that customers cannot respond to new product ideas if they have no hands-on experience with the product, or at least with the problem the product is to solve. The finding extends the implications of von Hippel's work by suggesting that product developers also need hands-on experience with "the market."

The acquisition of this realistic, experience-based kind of information is not the only source of problems, however. In addition, the "structure" of conventional market research does not fit new products for new markets. First of all, new product developers are confronted with a morass of possibilities which do not fall neatly into a prearranged framework, as this Opco marketer's summary suggests:

> *Generally, its a democracy. We look at what we want to do in five years, listen to users, take a look at the competition, and then make tremendous leaps of faith.*

The usual market research approach does not adequately integrate or make sense of all these sources of insight. For example, a planner at Saleco describes: ".. ideally you do research and find the need and then build the product. But really (the process) is a breakthrough.." Another explains:

> *The scientific basis of market research essentially describes a series of steps. But that is not in sync with the opportunities as they come up..*

Marketing people at all five firms describe a need for an intuition of the market, or a "gut feel" or "organic sense." A business planner at Techco contrasts this with the conventional approach:

> *...the business school model gives you a great presentation with nice charts, but it is very glib. There are nuances to these markets. You need to understand the history and the character of the customers.*

And a planner at Saleco said: "You have to have a commonsense understanding of the marketplace. Then you go do market research."

These descriptions of the process from people in all the firms indicate that a new market is not simply discovered with research. It is produced or created iteratively, through "breakthroughs," "leaps of faith," and other nonroutine procedures. It emerges and develops from a dialogue with potential users. That dialogue can incorporate many issues, and leaps of faith can go off into many directions. But the conventional approach does not frame or guide this dialogue, it does not provide a sense of "the market." Contrasts people make between market research for known markets and that needed for new products for new markets highlight the difference between the two. Standard approaches clarify details, they do not create new knowledge. A planner at Techco explains this tension between the two this way:

> *There are two kinds of market research. We can do some useful data gathering on existing products, on forecasted response to new products in existing markets.. We have an organization that knows how to do that. But they can't test the market for new widgets. They are helpless. They can't identify who might have a need for it.*

A market researcher at Compco also notes that conventional market research cannot identify new markets:

> *Market research is often asked `we'd like some new markets.' But new markets come out of changes in the marketplace.., for example the growth of PC's [the boxes are made of plastic], or the government writes a new law [e.g., on flamability]. Market research is most useful when they say I've found a need, now tell me more about it.'*

As practiced in these five firms, then, standard market research applies to known markets - it clarifies and elaborates but it does not create. More generally, it does not provide a framework to make sense of the new market. So when people try to use these tactics for new markets they cannot generate enough of the right kind of information regarding the product's design, the technological trends, and whether people will actually buy the product. Developers of new products need to create a new template that builds "the market" and serves to hold the information.

A follow-up survey was done to see if the amount of formal education in industrial marketing on the part of the marketing people relates to their opinions of market research. Most do have at least a class in industrial marketing, and no clear patterns are apparent. However, those with some education may be more positive about market research, or at least more aware of the limitations. An interesting follow-up study would be to examine these relationships mroe thoroughly to help determine the benefits of more training in marketing techniques. However, I also would hypothesize that the organizational barriers discussed in the remainder of this report constrain the benefits of education. That, too, requires empirical examination.

To more fully understand these complexities, the kinds of information people are struggling to get are examined.

WHAT IS "MARKET INFORMATION" AND "USER NEEDS" DATA?

A General Taxonomy

As hinted in the comments above, when people talk about "the market" they refer to different issues: the product itself, product acceptance, technological trends, needs, prices, and quantities, for example. A systematic analysis of what "market information" and "user needs" mean to people who actually work on new products shows that "market information" comprises a very complicated profusion of information types - "the market" is a many splendored thing. For the purposes of this analysis, three general types of market information emerge from the interview data (see Chapter II for more details on the development of these categories): - design, business, and applications information.

> Design: Information about how the product should be designed for use - where the plug should go, how high the resolution should be, what the operating specifications and performance criteria are. These data refer to the physical characteristics of the product necessary for it to be used by the intended customers.

> Business: Information about the number of buyers, who are they by group (for example, industry or employee category), how much will they pay. These data help people to estimate the size of "the market," to acertain prices, and determine how much money can be made, all of which goes into the development of a business plan.

> Applications: Information about specific users' problems to which the product might be applied, how certain users work in order to determine what problems they have, how to

get the product to them and work with them. Data in this category concern relations with customers and what their specific needs are.

These three categories address diverse aspects of customer needs: where the plug should go, who in particular will buy the product, and what attributes they want from the product. Although analytically distinct, they all seem important to a comprehension of "the market." Since this study focuses more on commercializing technological possibilities than on technological invention per se, the business and applications categories are subdivided further to capture more of these nuances. Figure 3-1 displays the overall taxonomy.

Figure 3 - 1:

Types of Market Information

I. Design

II. Business:

III. Applications

A. The physical characteristics of the product necessary for use: how it should be built, configured; operating specs; performance criteria

B. Segments: the identification of distinct groups of customers with common requirements

C. Competition: an analysis of their reactions and plans

D. Market Plans: estimates of market growth rates, size - number of buyers over what time

E. Costs: of product; pricing

F. Flow of customers work: how does the product fit into the users' workflow; how do customers operate

G. Specific user requirements: what do the customers require the product to do

H. End user buyers and buyer organizations: what are the processes and politics of getting to whomever makes purchase decisions

I. Distribution: how to get to the end user

A second dimension regarding market information is relevant to this analysis. Not only did people discuss different kinds of data, but also they had different amounts of the various kinds. To capture this dimension, a simple scale was developed to pick up a sense for these magnitude differences, as follows:

> 1. Low: scored when the person discussed the category orsubcategory only in very broad terms without actual knowledge (responses to the question "how did you know" or their own reflections were that they did not have actual data);
>
> 2. Some: scored when the person mentioned having some data - either already available inhouse or collected or verified;
>
> 3. Much: scored when the person discussed actual knowledge of the category in some detail.

Examples of the Nine Kinds of Market Information

The following examples illustrate each of these kinds of data.

Design:

An engineer who worked on the failed document delivery explained that they designed the product with the following data: "All we knew was that we wanted to mail stuff." In other words, they had no specific information regarding what the system should do in particular, and so no details on how to develop it. Not surprisingly, the document system did not do what users were willing to pay for, and so was removed from the market. That design information was coded 1. In contrast, an engineer who helped develop the material for the new roofing system discussed the actual performance criteria of any roofing material in some detail: "We had to develop a product to compensate for all the thermal changes and building movements. Those buildings move like crazy.." (showed me a model of building movement and explained why alternate materials did not work). His design information was coded 3. Notice that the design data is market related in that it refers to how the product should be built in order that it can be used. (One can assume a use rather easily and many in this research did, as will be discussed in succeeding chapters).

The <u>Business</u> <u>Category</u> has four subcategories.

<u>Segmenting</u> refers to the identification of distinct subgroups of potential buyers. The two electronic messaging products were initially aimed at the sixty million office workers of America, which is an example of a nonsegment (coded 1). "Everybody" was their first market. Saleco's system I also could have been intended for this amorphous "segment" of office workers. But a planner who helped develop it showed me a list of six different potential user groups, or segments, that they had established for the machine prior to its introduction, among them accountants, secretaries, financial analysts, and hackers. This segmentation helped them pinpoint more specific user requirements, and they then developed software designed for each. His comments were coded 3.

<u>Competition</u> refers to an analysis of competitiors' reactions and whether customers might switch. For example, this Compco market researcher's comments were coded 2:

> *We did an image study of the competition and us. According to the study everybody hated them and loved us.. They were high handed and arrogant, so we assumed people would just switch over and start buying from us... .*

He and his colleagues had some actual information about the competition in the market, hence the 2, but they assumed that these new customers would switch over to Compco. Interestingly, when Compco did another image study after they introduced hotpoly, customers' regard for them had gone down. A market researcher inferred from this finding that customers were not too certain about Compco's ability to produce this new kind of material. In contrast, a market analyser for the roofing product detailed a long list of issues about the competition that they discovered during the product development: how the competition was distributing the product, handling the inspections of the roofing, shipping to the end users, and so forth. This information helped them to develop a unique roofing product that overcame problems the competition encountered, and that in turn generated sales quickly. His discussion was coded 3.

The <u>market</u> <u>planning</u> provides an estimate of the market growth rates and market size. The following description of planning from a person who worked on the battery was coded 1:

> *We went through the whole business planning process. It was dictated by we find X number of customers who sell Y number of products that use Z number of batteries. What went wrong was our ability to get the customers in the first place.*

Basically, they made up the plan rather than use actual data. Next is an example of planning based on relatively extensive amounts and sources of data (coded 3) which gave the developers more realistic estimates of the business:

> *Peters did the basic market research. We talked to architects, trade associations, ..key contractors to refine our understanding of the market. We knew that the size of the total market was $X.X billion, and that it was growing at X to Y percent. But the sheet portion (of the flat roof market) was just starting, and growing at XX to YY percent..*

Costs of the Product and Pricing: The last business subcategory of market related information concerns the costs of the product and pricing. This information is separated from business planning because it requires additional kinds of data, although costs and pricing would feed into the market planning. An example of assumed prices, coded 1, comes from the director of Opco's voice service:

> *They priced the service based on the mentality of a telephone company - charge a fixed amount up front. Since nobody ever heard of the service before, they weren't about to pay up front for it.*

The following was coded 3 because it implies a more thorough pricing process based on actual information:

> *Samuels was just back from Cornell and he knew all about pricing and positioning. He spent about half his time on how to price the product and all the software. He really understood that you have to buy loyalty...*

Figuring out how much to charge is a complicated yet critical process. For example, several who worked on Saleco's second, cancelled information processor claimed that its price was its downfall.

Applications:

Finally, the applications category contains two pairs of subcategories which are similar. The first two concern the particular problems customers have, or their "needs" in a narrow sense of the word.

The flow of customers' work refers to how the product might fit into the users' workflow and thus implies an appreciation of how the customers operate. For example, the following

statement demonstrates a rather thorough understanding of photograhers' work on the part of the film cover manager (coded 3):

> *Before a print (i.e., for magazines) photographer goes to the field he first takes his film holder and opens his box of film in the dark, feels for the little notch, and loads his film, all in the dark. .. To load a hundred of these it could be two hours of work.. Also dust can be a real problem, and this (film cover) eliminates it..*

This information indicates how important the product might be to the intended user segment. In contrast, the following statement indicates considerably less detail about how "business users" (a global segment) actually communicate. In fact it implies wishful thinking that customers want or need to communicate regularly with people who are not part of a data network (coded 1):

> *The whole idea was a reach for Opco. If you are on the system, you can talk to others not on the system. But we had very little information on what it should be like.*

Specific User Requirements: The second subcategory here is specific user requirements for that specific kind of product. This is distinguished from the flow of work in that it concerns what the product in particular needs to do rather than what the customers do. For example, the film cover manager explains that the most important issue to his targeted customers is that the film must be consistent from lot to lot (coded 3):

> *There are no happy surprises in commercial photography. The end result is very calculated. ... This is the most discriminating market. They would kill for one-tenth of a shade (in the color of the photo). Their whole livelihood rests on the quality of the imagery, and thus on the consistency of the film..*

This rich detail is different from the following recollection of the early days of the e-mail service, when according to one planner they didn't know what the users needed (coded 1):

> *When we first introduced it we had no idea what they used the service for. We'd say òou need to move X bits of data. We'll do it for you for Y dollars.' We'll give you the technology and we don't care what that data is that you want to move.*

As it turns out, some people wanted to "move" orders, or do order entry. But the system could not do that so it did not meet this specific need.

End User Buyers and Buyer Organizations: The last two subcategories deal with information about how to get the product to the customers, but they, too, are distinct. Knowing the end user buyers and/or buyer organizations means appreciating the processes

and politics of getting to the person(s) who make the purchase decisions. For example, Compco sold its existing lines of materials to molders, who are intermediaries between end users, such as Ford or Apple Computers, and the material suppliers. The end users tell the molder what the the specs for the bumper or computer chassis are, for example, and the molders deal with materials suppliers. But the new hotpoly was more like an engineering plastic, and Compco had to now deal directly with the end user's engineers as they were designing their product:

> *Who was the deciding authority on whether the product gets sold or not was a major organizational change for us.. We realized we had to get in with who really spec'd the product (made the decision on the material). (coded 3)*

Another example of information about the buyers comes from the voice service sales people. They learned that approaching the director of telecommunications in firms to sell the voice service usually resulted in no sale. "They don't know where the communications problems are," explained one. Through trial and error they discovered that they should go directly to functional managers. A sales manager, for example, might have a specific need to keep up with his or her salesforce (requirement) who may be scattered around the country across time zones (flow of work). The voice service provides a useful communications tool in such situations, but the directors of corporate communications were not familiar with such needs. As another example, the battery developers' failure to appreciate the processes of buying led to a delay in the product's ongoing development. One said: "We didn't understand that the toy companies have others design their power sources (and thus don't determine what batteries to use) ..".

The distribution information concerns delivering the product to the end user, bundled if necessary with other parts, and refers to a system which might be anything from a direct sales force to a chain of stores. These distribution systems often are very complex organizations in their own right, including perhaps a number of firms, and so can require considerable analysis and planning. The battery people, for example, eventually established buyer relationships with some toy manufacturers, but never could set up a system to distribute the batteries to the toy manufacturer's end users. That, according to a marketing person, was the downfall of the product. On the other hand, planners who worked on Techco's video product

arranged to have consultants in to teach them about the video distributors, how to approach them, how to stock them, and so forth, before they introduced the product (coded 3).

The general three part typology of design, business, and applications emerged from the data, but it is consistent with other distinctions of market related data in the literature (e.g., Lawrence and Lorsch, 1967; Cooper, 1979; Freeman, 1982; Bonnet, 1986). However, these three categories and eight subcategories distinguish applications issues and information from business ones and incorporate the distinctions and refinements made by academic marketing into the scheme.

The most critical implication to be drawn is that to establish "the market" for a new product is a complex enterprise. Not only must the product developers acquire such diverse kinds of information, but they must also link them all up. Each subcategory described above is analytically distinct, yet each relates to or informs others. For example, pricing depends on design which depends on specific needs which depends on segments which affects the prices buyers are willing to pay; the segment analyses do not state directly how the product should be designed, but they contribute to design specifications; competition may dictate distribution systems which affects marketing plans. All of these kinds of trade-offs shift and perhaps even radically change the product and its market as the development process proceeds. "The market" consists of much more than "needs;" or, to put it another way, "needs" are a cover for many more specific yet disparate issues. So, while the structure or form of conventional market research may not fit new markets, the myriad of information embodied in those methods does apply.

DIFFERENCES IN THE INFORMATION BY SUCCESS GROUPING

The next step is to see if the acquisition of all these kinds of market information matters. The taxonomy is used to assess the amounts of information available to the people who worked on each product, and to look for patterns, if any, in the kinds of information. Each interview with a person who had hands-on experience with a product was coded for all 9 categories of market information using: 1 -low; 2 - some data; or 3 - much data. If a person did not discuss a particular type of information that category was coded 0. The coding was done for two time periods: before product introduction, and after. (The point of introduction was

part of each person's narrative.). To develop a score for each product studied, the information codes for the people who worked on it were averaged. If only one person spoke of a particular kind of information that code was used, and if no one spoke of a kind, the category was left blank. This analytic scheme is fairly general, but it is appropriate to the interpretive and exploratory purposes of this research.

Figures 3-2, 3-3, and 3-4 summarize the average amounts of information prior to introduction by each of the nine categories for each product grouping: cancelled, uncertain, and successful. If one compares all three charts, it can be seen that the successful efforts (figure 3-4) as a group have the most market information overall prior to product introduction, both in categories and amounts. The uncertain products (figure 3-3) as a group have a middle amount, and the cancelled products very little (figure 3-2). The three products in figure 3-2 which were pulled off the market immediately after introduction had the least amount of design information, which is consistent with their technical failures. Design data is essential or the product will not even work. The other noticable pattern among the cancelled products is that they had hardly any applications information. Of the three types, this kind may be especially problematic - either it is difficult to get or people are more likely to overlook it.

The charts in figure 3-3 show a different story. The uncertain products as a group have some of every kind of market information, although individual cases vary a bit. In particular they had applications information, unlike the cancelled products. The successful products on the whole have most of each kind of information. These rather even distributions for both groups of products suggest that no one kind of information is more important than another for these products, or to put it another way, each kind is important. Also note that hotpoly was missing information, and in fact had no more at introduction than several of the uncertain products. Sheer quantity of market information does not distinguish fully between the clearly successful products and the uncertain ones.

WHY DID THE SUCCESSFUL EFFORTS HAVE MORE INFORMATION?

People who worked on the successful efforts managed to get more information prior to introduction, even though, as discussed in Chapter II, the markets were no more or less

Figure 3-2

**Relative Amounts of
Information:
Cancelled Products**
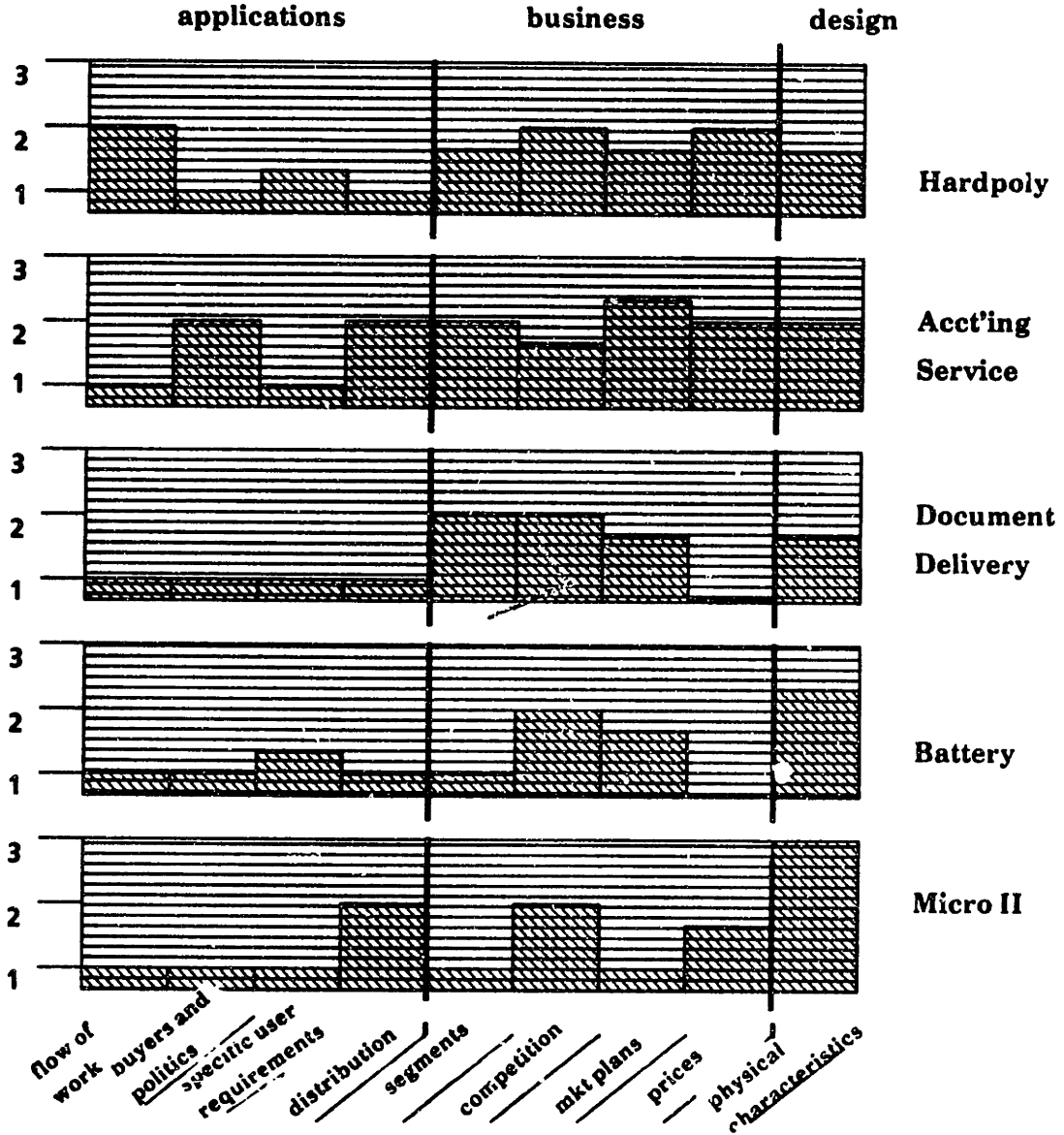
familiar   This finding in general is consistent with existing research. Existing research, however, does explain why people don't then simply get all the data.   The summary of problems with market research found that, in addition to not getting the right kinds of

Figure 3-3:

**Relative Amounts of
Information:
Uncertain Products**
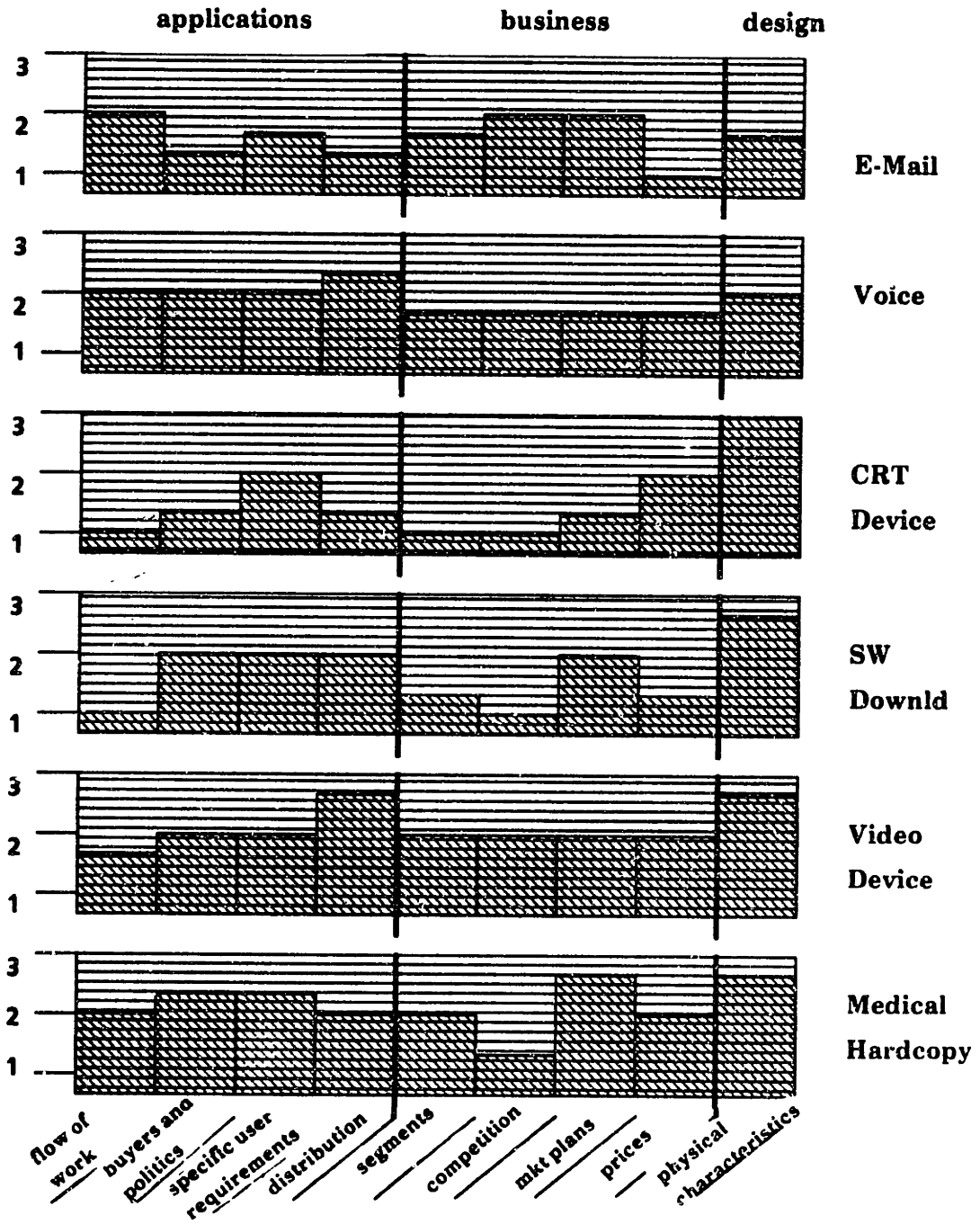
informatior, people had problems guiding the development of their understanding of "the market." Conventional methods failed to provide them with a framework which worked for

Figure 3-4

Relative Amounts of
Information:
Successful Products
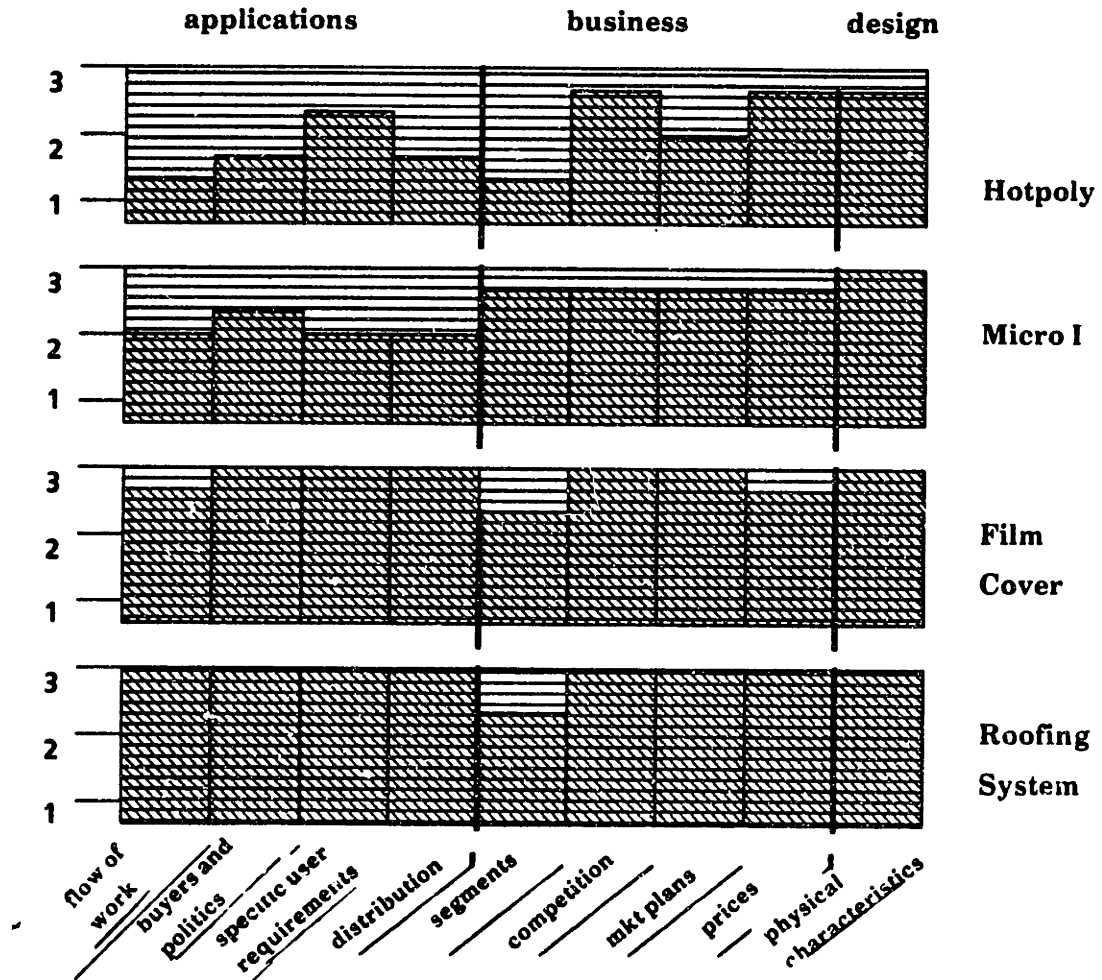
new markets. So, the interviews were analysed qualitatively for how the people defined the market, whether they had problems linking up or synthesizing the information, and/or why they said any certain information was unavailable.

This analysis suggests that the successful product developers generated a structure for their market understanding efforts and thus overcame the linkage void in conventional

market research. The less successful developers did not. The participants in the successful products described a shared "commonsense understanding" or definition of the situation which incorporated the three general categories of market information. In particular, this definition emphasized applications issues. For example, an engineer with the roofing material explained:

> *First, we asked what does a roof have to do? It has to install easily and efficiently, it has to have the ability to keep the elements out, and it has to stay in place. In other words, you have to put it down, keep it on, and make it leakproof..*

The system I people had a similar guiding perspective:

> *From day one we emphasized the applications. Our objective was to capture the creativity of these new applications. ...You have to know what the product is, who will buy it, and what they will use it for. It has to get to the hearts and minds of users...*

Another who worked on the system I said "..we had no formal, written business plan for the system I, but everybody knew what it was."

At the two other firms the shared framework was created more explicitly by individuals. The instigator of the smaller film cover effort at Techco said, when asked what his role was: "..my function was to make things fit." But he also took the plant liason person and the purchasing agent on visits to prospective customers so they would understand these customers' problems. At Compco a marketing person explained that their strategy (as he saw it) was: "..to gain customers in the target market segments with the proper products. It's all circular. It all gets down to getting more customers. That keeps everybody focused." Another at Compco said that everyone associated with the product "recognized that it satisfies a business need" for the firm. They were all committed to it.

However, people with the less successful products operated with a more limited framework for "the market," typically tied to the existing businesses of the firms. Such frameworks seem to have reduced their ability to recognize all the different types of market information and pull them together. To varying degrees in all eleven of these products, people noted that missing information as well as misintegration of knowledge played a major role in their difficulties. Some simply shoved themselves into "the market," as exemplified in this description of the development process: "We were going so fast we began with an act of faith..

We just got up a head of steam and went" (CRT device). Others tried to deal with various bits of data but had problems doing so, as this planner with the software service at Opco suggests:

> *We looked at the numbers of PC's and growth projections and revenue estimates for software, and we had all this data that indicated that this was a good business to be in... We had all these pieces, but they were not all connected.*

A lack of integration or connection is also evident in the metaphors used by other people. Said a planner: "..we could peel the onion back only so far" (accounting service). And according to a manufacturing manager: "..we were worried about getting into a candy store environment where you want everything you see" (CRT device).

Moreover, when certain information was missing or assumed, other kinds could not be estimated correctly. For example, the battery developers at Techco simply assumed that the targeted users would have battery needs similar to their own. "..We never asked about their distribution needs, .. and we never asked the design engineers (in the customer organizations) what their power needs were," said one. As it turned out, those design engineers would not really derive the benefit from Techco's battery that the Techco people assumed was there. At Opco someone someone did carry out an analysis of specific user needs for the e-mail service early on. But, said a planner, the person could never prove clearly that these enhancements would make money - he couldn't link specific requirements to revenue estimates. The planner went on to say: "..Trends indicate changes in the product to accomodate perceived changes in users and their messaging requirements. But these get translated into smaller packages that have cute names, and we lose sight of the overall trend." The linkages among categories of market information seem critical, yet very difficult to make without an overall framework to guide these activities.

DISCUSSION

In answer to the questions posed in the introduction, first, people do have problems with conventional market research. These findings indicate that the problems with conventional market research tactics are twofold. On the one hand, they do not produce unequivocal estimates of the product design, trends, or whether people will actually buy the new product. On the other, they do not provide a framework which enables product developers to build up or create an understanding of this new, unfamiliar market. Second, regarding what

constitutes "market information," a complex array of different kinds of market information seems essential to product development. The successful efforts had more of more kinds prior to introduction than the less successful efforts, and no specific kind seemed more critical in general than any other kind. Third, regarding why people do not always get market information, people who worked on the successful efforts appear to have generated a shared framework which helped them integrate the diverse kinds of information. The lack of such a framework may be the reason why people working on the less successful products did not acquire all the information. An examination of how various kinds of training in marketing techniques enhance or hinder these particular aspects of new product development would both help to clarify these implications. and help to ascertain the benefits of such training.

This analysis finds that both R&D and marketing are partially correct. New product development requires a creative, building process as the R&D studies indicate. Yet the myth that creative design of a better mousetrap will make the world beat a path to your door is incomplete. This analysis also finds that these studies gloss the complexity of "needs." Such terms as "the market" or "needs" are too narrow to properly reflect the actual content of a full comprehension of "the market." So, marketing's call for a more thorough analysis of "the market" seems also to be correct. Yet marketing does not provide a means to carry out such analyses within a creative context. Each of the types of information that seem esential to a thorough market analysis needs to be integrated with each of the others, but in a new way. Conventional tactics produce abstract, ungrounded data and tend to assume a predetermined, fill-in-the-blanks framework for the overall market analysis. They apply to known markets, or already beaten paths.

The mixture of creativity and thoroughness renders the actual task of comprehending "the market" for new products more complex than either literature recognizes. As the basic model of social process outlined in the first chapter suggests, the critical questions concern the flow between creativity or social action on the one hand and social structures or frames on the other. The specific questions for new product development now are: What prevents product developers from recognizing the need to gather the diversity of information? from integrating these data in a creative fashion? from generating the shared framework which facilitates the integration? What constitutes this shared framework? To answer these questions it is first

necessary to examine how people usually do frame "the market." The next chapter takes up this issue.

CHAPTER IV

INTERFACES AND INTEGRATION:

THE SEPARATE REALITIES OF NEW PRODUCT DEVELOPMENT

INTRODUCTION

The previous chapter concludes with a question about framing or defining "the market." People who work on the successful efforts seem to generate a definition they could all work within, while those who work on the less successful efforts do not. The question of why they don't relates directly to the more general questions about "differentiation" and "integration" summarized in the first chapter. "Differentiation" might be a barrier to joint effort. But, to understand how that could occur in the particular instance of product development, it is necessary to examine the following questions empirically: Do people in the different functional areas perceive "the market" differently, and if so, in what way? Does that affect the information gathered? How can "integration" be understood in the face of these differences?

The analysis reported in this chapter extends the implications of Burns and Stalker's (1961) and Lawrence and Lorsch's (1967) work inward to address these questions. It digs into the interpretive order of the people who work on product development. First, the differences of opinion about market research and the kinds of market information discussed by function are summarized. Then the narratives of people in the different functions are examined to contrast: how the overall task is envisioned; what information is considered most essential; what aspects of the process are considered most uncertain; and whether any parts are considered concrete versus abstract. This analysis reveals that people in different functions understand "the market" in strikingly distinct ways. The subfunctions constitute separate sense-making contexts across all the organizations studied. That is, the software engineers at Opco have much more in common with the chemical engineers at Compco than with their own planners or field people.

On a conceptual level, the term "thought worlds" is adopted from Douglas (1986) to characterize these unique sense-making contexts. The term emphasizes the cognitive perspectives reflected in other similar constructs: decision frames, paradigms, subcultures,

for example. However, "thought world" harkens back to Durkheim's ideas on categories of thought and refers directly to the social context of knowledge. Thus the term explicitly emphasizes the social nature of interpretation.

BOUNDARIES OF THE THOUGHT WORLDS

To delineate the groupings of people that make up the thought worlds, the interviews were sorted into clusters based on the similarity of their perspectives on "the market." This created four different thought worlds, based largely on function, as follows:

> 1. Technical: includes the design engineers and scientists. This research emphasizes the commercialization of technologies. The much finer-grained distinctions found between scientists and engineers by those who study the invention of technologies does not seem to affect these people's sense of "the market" (see Pelz and Andrews, 1966; Tushman, 1979).

> 2. Manufacturing: includes materials and purchasing people, manufacturing engineers, production engineers, and operations personnel at Opco.

> 3. Field: includes salespeople and sales support staff who interact regularly with customers, either to make sales or to solve specific customer problems, or to support the sales effort.

> 4. Planners: includes market researchers, business planners, forecasters, and the more generally labeled "marketing people" who analyse and examine certain businesses or segments. Typically these people are "insiders" who do not have day to day contact with customers. The planner grouping is more of a catch-all category because people all labeled "planners" here might work in separate departments, especially in the very large firms.

The third and fourth categories of people in the five firms shade together a bit, because the field support people are often called "marketing." The purpose of sorting everybody into a thought world grouping is to more closely examine the differences in perspective. People are assigned to a cluster to sharpen the contrasts without destroying their actual tasks, using a combination of their official role in the product and what they devoted their energies to. For example, a "business planner" spearheaded the flim cover, but he spent most of his time on the road interacting with potential customers. He also clearly distinguished himself from "market research," and so he is considered as "field." Everyone who handled field support or the development of merchandising efforts was assigned to "field."

DIFFERENCES BETWEEN THE THOUGHT WORLDS

Each person told the story of the product's development as they saw it, but tended to emphasize different aspects of the process. To establish whether these differences are systematic across all those interviewed, this section reports general counts and frequencies. The interviews were coded for what the person said about market research and the amount of each kind of information discussed (see Chapters II and III for details on the methods).

Opinions About Market Research

Because there are relatively few manufacturing people in the sample they are pooled with the other technical people for these summaries. Table 4-1 repeats the same information

TABLE 4 - 1:

**Opinions of Market Research
By Thought World**

Market Research:	Technical	Field	Planners	TOTAL
can't do it; no sense	19%	6%	33%	20%
is in-adequate	13	63	52	36%
need it or vague mention	69	31	14	43%
TOTAL	n = 32	n = 16	n = 21	100% n = 69

reported in Table 3-1, but with the thought worlds controlled for. Most of the field people consider market research inadequate but do not say that it cannot be used for new markets. Most of the technical people consider market research to be necessary, but in very general terms, or are simply vague about it. Essentially, these people think that the information uncovered by market research activities is not particularly important to them, as discussed in

the previous chapter. The people who in varying ways actually do most of the market research activities are less positive about it than are the technical people. However, these opinions relate to relative product success. A larger portion of planners who worked on the uncertain products said either that market research makes no sense or that it cannot be used for new markets and are thus more critical than the others.

Market Information

General differences among the thought worlds also show up in the kinds of market information people discussed. Figure 4-1 graphically displays the median amount of each

Figure 4-1:

Median Amounts of
Information By
Thought Worlds
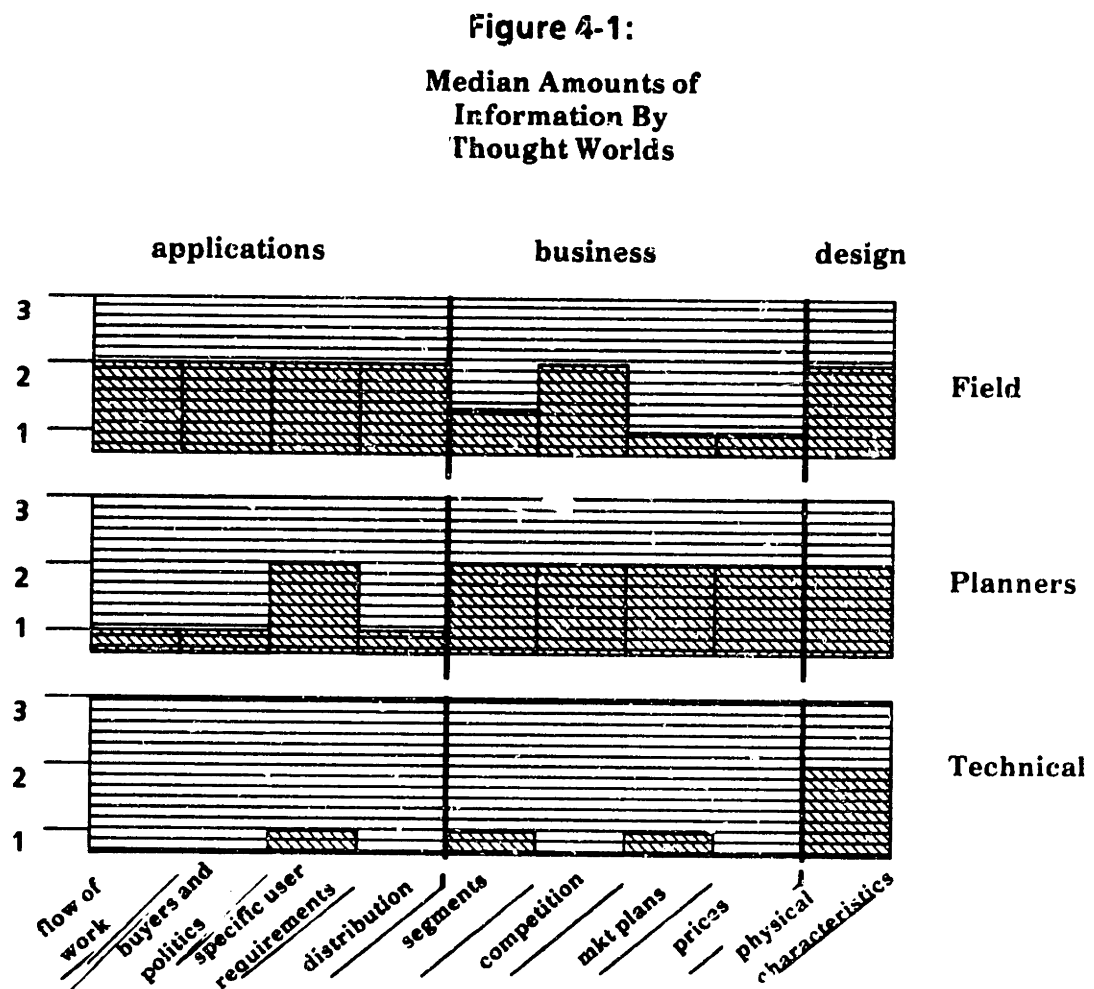
kind of market information the different thought worlds had. Note that the field people do not discuss market planning types of issues or cost and revenue estimate matters very often. They do, however, talk about the four applications issues as well as certain design issues. In

contrast, the planners overlook three of the four applications issues on the average, but do discuss the business and design aspects of the market. And the technical and manufacturing people on average discuss only the design issues.

Table 4-2 takes another look at the kinds of information people in the different thought

TABLE 4 - 2:

**Percent of Thought World Members Who
Discussed An Information Category**

Market Information	Technical	Field	Planners	TOTAL
flow of users work	19	56	19	28% $x^2 = 8.37$
buyers	22	69	33	37% $x^2 = 9.55$
segments	19	50	48	34% $x^2 = 8.00$
competition	30	69	57	41% $x^2 = 7.11$
market planning	19	38	71	41% $x^2 = 13.79$

worlds tend to discuss. It displays the proportion of each group that had at least some actual information (coded 2 or 3) for the five categories of information with the largest differences. The majority of field people discuss how the product fits in with the flow of the user's work, and how to get in with those who make the buy decision. Few planners and technical people comment on these issues. However, both field and planners discuss segments and what the competition is up to, while the technical people tend not to. And finally, only the planners seem interested in the market analyses and growth estimates.

These summaries indicate that market information is distributed across the organization. The thought worlds are differentiated on the kinds of information they have. One reason to "integrate" the units is to pull all these data together. To do that, however, requires some analysis of why they do not integrate readily.

THE THOUGHT WORLDS - THE SUBSTANCE OF THEIR DIFFERENCES

Differences in the interpretive orders of these thought worlds indicate that they indeed approach "the market" very differently - the problem of differentiation does not concern information alone. On the surface, two indicators point to a diversity of interpretation. First, people tend to decipher the same information in different terms, based on their thought worlds, even in the successful product efforts. For example, the following comparison illustrates how a manufacturing and a field person for the film cover can talk about the same thing - the need for consistency in the film - but apply that knowledge differently; one to establish purchase specs (design), and one to plan how to approach the customers (application):

> Design: *I need to know the customers' perceived need for quality. We're not able to get direct answers sincephotographers think in such qualitative terms...I need to know how many units on a densitometer and they say "pink." So we did a blind test and converted the results into specs for the vendor.* (manufacturing)

> Application ... *photographers are very conservative, and theirhabits are hard to change. The film varies quite a bit, so the photographers will buy it by the emulsion number, and test itagainst known standards and filters. If they get it (the shade) exactly right, they will go and buy 100 boxes and freeze them. There are no happy surprises in commercial photography. The end results are very calculated. .. They would kill for one-tenth of a shade.* (field)

The manufacturing person is almost annoyed with the photographers for being so imprecise, at least in his terms, while the field person describes how precise they are in their own terms.

Second, people overtly discuss their different perspectives, indicating that such differentiation is both commonplace and commonly accepted. For example, an engineer with the successful roofing material explains: "While I was busy trying to take a sheet of material and convert it into roofing, marketing was busy trying to understand the market - growth

rates, what did it need..." And a field person at Compco characterizes the separation in almost stereotypical form from his field perspective:

> *Techncial comes and says: "hey, we got this super product. It has the modularity of steel (stiffness); the specific gravity of polyurethene (it is very light), and we can make it for X. So we take these things and say 'hey, that fits just what I'm looking for.' We also say to ourselves: 'boy am I going to make a lot of money.'*

To develop a richer scheme that gets into the interpretive order, people's comments on the following items were pulled out of the interviews: how they characterize "the market," the task of product development, and the cause of problems; other issues discussed; and what they say about other thought worlds. The following dimensions emerge to distinguish the thought worlds:

> 1. those aspects of the new product or market seen to be constantly emerging and changing, versus those considered stable - that is, what is in the future;
>
> 2. the market information considered essential;
>
> 3. the activities considered in concrete terms, versus those considered in abstract terms;
>
> 4. how the task is envisioned.

The four thought worlds differ from one another in striking ways on these dimensions. Each thought world is explicated in turn in an ideal type manner, and then a summary of their differences is discussed.

The Technical People

A marketing person's comment aptly stereotypes the technical people:

> *Whenever we ask for a new product, they say it will take two years and ten million dollars. It doesn't matter what the product is - two years and ten million dollars.*

To the design engineers, reality is just around the corner. Their narratives dwell extensively on all the technological possibilities and trade-offs they must deal with as they design the product. Design issues themselves are ever emergent, and the future consists of more and more technological possibilities. For example, a design engineer working on the cancelled information processor discussed the decision over the disk drive at some length:

> *There is never enough think time. .. The diskette started as a single side, but we had technical problems with that... Also when we started there was no question that we'd do half size; that was a new technology so it had to be single sided. But a guy in the group said in a few months we could fix the problems, so let's take a risk and forget single sided and do double sided. That helped push the technology. When you look back it wasn't intuitive,. and the costs were very inflated..*

As another example, an engineer with the uncertain CRT device explained the optical problems they were having, and how they had to try different lengths and designs of an optical tube during the course of a year to get it right.

Even when the product is defined ahead of time and the technology basically understood, the engineers concentrate on the myriad of design possibilities. A software engineer at Opco illustrates the very real problems of dealing with so many possibilities on an existing system he helped to customize under contract for a user:

> *There were a lot of specs, but these were only detailed conceptually. They wanted "something like this." What ended up as a result is that the specs get interpreted more widely. You end up delivering something they didn't ask for.. I was working with one or two people (at the customer organization). Then they show it to fourteen others who say "Oh My God!! We didn't want that!!"*

As a consequence of this virtually infinite regress of design possibilities, the engineers must have precise design specifications for the product. If not, they may never stop "fixing" it. The engineers' greatest frustration is that they are not provided with precise data - they want to know exactly what the product will be used for. Of the twenty one design engineers or scientists, fifteen said that marketing either launders the data, or does not state clearly what they want. For example, one software engineer at Opco said:

> *The biggest breakdown in the process is in the beginning. The business people who plan it and the marketing people don't seem to state clearly what they are looking for.*

Another explained why detailed specs are critical to his work:

> *It's good to know what the real problem is that's being solved. Many times we are told to solve problems in a particular way, but it is important to us to know why (the users) need it... If you ask me for a piece of paper I could give any of these on my desk, from this small (post-it) to graph paper...*

Likewise at Techco:

> *I need to know the application of the user. From that we can abstract design ideas. If the information is filtered from sales or marketing it isn't good. From a design point of view you get a better understanding of needs (directly from the customers).*

The chemical engineers at Compco expressed similar concerns with detailed design needs. Each polymer has numerous properties, so they require a full description of needs regarding all of these properties. Said one engineer:

> *Salesmen say `just give me the goods.' But if the salesman tells you the machine doesn't work that is second hand information. They don't bother to ask if the temperature (for this process when the material failed) is the same as last time, or if the molder is being run the same... A guy has to go into the lab with awful sketchy information.*

This sample of comments illustrates their very real frustration over not getting the precise design information they require. That a number of technical people say that the others "launder" market research indicates that they assume market research actually produces the design specifications they seek

To technical, the concrete part of the new product development task is the product itself and its design. The product is real, something you touch. Even the software engineers spoke of their "product" in concrete terms. Said one, for example: "We never had a good definition of what the product needs to look like."

However, technical people tend to treat "the market" as an abstraction, to be captured in a "market requirements statement" which details specifications for the product. How they see the customers' "needs" varies by technology, and the differences help to illustrate the arm's length translations technical people try to make as they go from customer perspectives to their own. The software engineers seem to have the most difficulty with "needs" from the customer point of view. For example, one referred to customer requests as "off the wall," another said their responses to a survey were a "barrage of unconnected needs," and a third explained that you can't get them to agree on features. But, in so far as their product is intended to be "transparent" to users, perhaps the users' applications are transparent to them.

The chemists seemed in the middle regarding the "strangeness" of customers. They feel that the customers don't know what they want, but are aware of the chasms between

themselves and the customers. For example, one engineer who serves as a li son between applications and engineering explained:

> *The field guy will describe the application in terms of the end use. For example, he'll say that the user wants to run the tractor through a 180 degree paint oven [the tractor has plastic parts on the door, for example]. But technical needs to have that converted into (standard materials) specifications.*

He said that his engineers need end user needs translated for them.

The hardware engineers tend to assume that customers' applications are the same as the product design. In the extreme it may not occur to them that customers do not want to have done what the product does. Thus to them, "real" market research is to plop the device in front of the users and say: "well, what do you think!"

Manufacturing

Manufacturing people are grouped with the engineers because only a limited amount of data are available to describe their separate pespectives. They share similar concerns with technical about design in general, and have a technological focus, but they also worry about the plant or operations. In particular, manufacturing people think the others do not appreciate their special inflexibilities. The director of operations for the voice service said:

> *Sales and marketing live in the future and my needs are today. They are forever saying "why don't we do this?," or "isn't that easy to do?" But based on limited capacity now I can't do that. It's the same with networking. Sales and engineering wanted to bring up all the nodes at once! We said no, let's test it and do it one at a time.... They know, they hear, but they aren't involved (as closely). And they don't get the 5,000 calls from customers (when the system fails).. There needs to be more interface between those who design the future and those who live in the real world.* (Operations, voice)

A person at Compco expressed very similar concerns, despite the stark difference between a chemical plant and a communications operation. He explained that manufacturing is very concerned that marketing and field will take orders for products they cannot produce. "... The manufacturing guy says: 'I don't like you taking risks you don't know you are taking.'" Such inflexibilities push them to live in the ever present now.

To manufacturing people, critical market information consists of the volumes, which are derived from market size estimates, the number of different styles, and particular

manufacturing issues such as reliability and quality needs. A manufacturing engineer at Saleco explained the product development process as follows:

> *Development [engineering design] figures out the function of the machine. Marketing then says, well based on what the machine does, here's what the market will do. Then we build a facility to sustain the estimate.*

In his world everything is straightforward and revolves around the manufacturing facility. The product is defined in terms of its manufacturability, and how well it is made. For example, one manufacturing engineer picked up a keyboard for the cancelled information processor and threw it into a corner of the room to show how strong and well built it was. "Look at that!" he said. "That's a damn fine keyboard!" The product did not sell very well, in part because of the feel of the keys, however, not how often it could be thrown around.

Field

An engineer stereotyped salespeople as follows, suggesting that he sees them as somewhat alien, despite the intended fun in his comment:

> *Field - you know, those are the guys in the five hundred dollar suits and the alligator shoes..*

Field people work directly with the customers and know what their precise needs are - exactly what technical is looking for. But to field and especially to the sales people, the customers' applications are constantly emerging. Field will not "freeze" them into design specs for technical. With the same vividness that the engineers discuss disk drives, optic tubes, and polymers. the field people describe how they create the sale. It's as if each application is unique. One person with the voice service explained:

> *It's a blast to let it go. I never go on a one on one meeting. I always try to have a minimum of three people (from the prospective customer's organization) and I throw out functions until I find a use... It's the most amazing thing in the world. Usually there's at least one guy who's determined not to like the product. He sits pulled away from you like he won't let you penetrate his shield. But then after ten minutes he pops up in his chair and starts coming up with ideas..*

A chemical materials salesperson also expresses the enacted, emergent nature of his work - he described the whole development process as follows:

> *(Once technical gives you a new product) you go out and try it. You have to learn how to do that, you work with the customers to develop techniques to use the material. So then once you have a customer and a conceptual use of the product, you take that product around to others, and get them to say `hey, I really like that.' You get them to say `let's build a tool for me.' So you go together and build a tool...*

Both comments suggest that each sale is individually crafted.

Since the customers' ever emerging applications constitute the concrete reality of "the market," field wants technical to produce designs on command. Consider:

> *You need to listen to what the customers want; what is he ready to buy? what is he looking for? ... Engineers say anything can be done. But they don't put a time frame on their work. You have to be specific, applications oriented. I want the least amount possible in the shortest time, but they may take three years.... The more they (and operations) are buffered from customers, they tend not to understand the urgency. (field, voice)*

The engineers who never have enough time take too much time to suit field. In fact, field people are most frustrated by what they see as a lack of response to specific needs, and they may read caution as recalcitrance. Said a salesperson at Compco: "You always have alot of people standing around saying `we can't do that.'" The irony is that both technical and field count on the other to do just what the other won't do.

In addition to the different views regarding the most crucial aspects of product development, field does not consider the product as a concrete entity. Only customers' needs are real. For example, one field person at Compco said:

> *What is the product? Well, it keeps changing.. If you look back over three years and try to touch the product you can't. Really you create a notion of the product and say `will this be valuable?' Hell, yes!. Then you say, well how close can we come technologically.... You can conceive of what it might be..*

As one with the new voice service put it; "the concept of the service is negative zero. You have to sell a concept, not a product." He refers to the salespeople as missionaries. Said another: "Success is a state of mind."

A third difference between the two concerns how they envision the task of new product development. To field the task is real, but it is not tactile. To develop a new product is to establish new relationships and to set up new buying-selling arrangements. The relational nature of their work is evident in the quotes above. One more illustrates it vividly:

We know what they need. The market is obvious. But the selling process is complex. Who are they and what do they want is clear. But there are six or eight decision makers. No one says yes but anyone can say no.... The production guy wants to know if his yield will be better.. The quality control guy says `will I have to change my tests?' The salesmanager says `will my customers like the finished product as well?' The purchasing guy says `what will you do for me?'.. You need to work with all these guys and their bosses.

The field people have a very "micro" or immediate and ideographic sense of the market. They define the task of new product development as the development of these relationships. To establish a relationship, they often need an immediate response from technical or manufacturing to adjust or tweak the product to meet that customer's immediate application. But technical dwells on the product itself - the product is real, not the applications, and can't be constantly adjusted. To perform their more tactile task they must be told precise specifications that meet everybody's needs. But field won't say.

Each becomes outraged at the other - not only over "resources" or general political power, but because they do not understand the other. These distinctions are captured in the comments they make about one another. For example, technical and manufacturing fear product proliferation from field. Said one at Compco:

I don't want field coming in with ideas (on user needs) without a sign off from technical. They'll ask for two thousand products..

An engineer at Techco noted that field never deals with the really innovative aspects of product development:

(Field) has a great deal of difficulty conceptualizing new products and new technology. Field never brings you the next generation.

It is almost as if technical thinks field has a character flaw. In contrast, field fears technical's penchant to "soup up" the technology. Said a field person at Techco:

The market wanted a Model T and they got a Ferrari without wheels. Once the idea gets started, its hard to stop them. Technical moves from what the market needs to what they can build...

And another:

Oh no! Here it comes again. Now we've got to try and sell something and it doesn't have the right features. If only we were let in on it earlier. (Techno)

Both sales and technical are grounded, however, in actualities and so can be outraged at each other. It is as if each is looking through the opposite end of the same telescope. They concentrate on the details of either building the product or building a customer base. Technical tends to think that everybody will want the product since the technology is clearly useful, and field tends to think that they can sell it to anybody.

Planners and Market Researchers

Business aspects of "the market" really don't exist for either technical or field, which is perhaps why both look upon the planners with some bemusement. For example, an engineer at Prodco explained what the curious marketers did regarding the industrial liner as follows:

> *I don't know where the marketing group came up with the idea that this was a good market.. Probably from that guy in Detroit.*

The planners are in the middle. To them the business aspects of the market are constantly emerging and changing, and the future as they look out consists of the growth of the business itself, not the technology or the specific applications. The planners describe their plan making activity with the same vivid detail that the other thought worlds use for their tasks. As a planner at Techco put it, "We locate markets and make recommendations if its worthwhile to enter them. And that depends on the margins, or the amount of money you will make." Determining the market in this business sense establishes whether or not the firm can afford to expend technological, manufacturing, and sales resources, so their work is as critical as the others'. But the planners and market analysers do not operate with concrete phenomena that can be touched or talked to. So the group that might be able to weave together the two incorrigibly task focused but diametrically opposed thought worlds of technical and field are themselves mired in pure phenomenology.

It is perhaps even more ironic that, although the work of the planners is very conceptual rather than concrete like the others, they are required to be the most precise. Critical information to them concerns the size of the potential market or user groups, how much people are willing to pay, how often they will pay. Analysing "the business" can be very frustrating, however, since these data can never be established for certain. As one explained:

The environmental scan is the most difficult part. There isn't enough information available. We looked at traditional sources (of information) including market research firms. But the problem is they are guessing too, they develop scenerios. An awful lot of projecting from just a few numbers goes on in this business. (Opco Data)

A market research firm's report regarding voice store and forward technologies demonstrates the striking lack of clarity. It had this mea culpa in its 1983 report:

Our report of three years ago predicted that by this time the market for voice mail services and equipment would be twenty-four times larger than it is..

One simple oops from the external research firm can translate into months of frenzied analysis on the part of a planner. A hair off an estimate can shift revenue estimates from positive to negative. They must have the information they seek, so the planners resort to models. Literally months of manhours are devoted to model building and plan making. For example, several people at Opco spent three months developing a model to predict the size of a certain kind of electronic data transfer market - that is, how many such transfers are likely to occur over the next five years and what might affect this estimate. Their business proposal, which called for a multimillion dollar investment, was then built around the estimate.

Two examples provide a sense for these detailed analyses and how thorough and comprehensive they can be. First, a planner at Techco worked on a preliminary report for the medical hardcopy system that had the following tabs: preliminary product proposal; letter of understanding; product description; product specifications; schedule; market statement; manufacturing statement; warranty; commercial and financial analyses. A later plan included market size estimates, materials consumption estimates, estimates of the amount of incremental business versus substitution of an existing line of materials; and proforma profit and loss statements.

Second, plans to begin planning a new market research program for the voice program at Opco had the following headings:

Industry Analysis

    Domestic Market Size and Estimated Growth

    Market Segment Migration

    International Market Size and Estimated Growth

Product Research

Applications

Adoption/ Penetration Rates

Usage Patterns

Product Integration and Life Cycle

Customer Analysis

Target Customers by Function and End Use

Adoption or Decision Pattern for Purchase

Desired Future Usage

Future Enhancements

Price - Demand Relations

But to do this extensive an analysis, the technical design and applications cannot be considered to be constantly emerging. Planners must in effect "freeze" them or abstract them into more general trends and scenerios. Note that in the listings above there is very little of interest to the technical and field thought worlds as described here. No wonder a technical person said: "It's hard to know what to do with mar¹ ⸴t research." And a field person said: "I'll take luck to market research any day."

The planners' work is conceptual, not concrete, and it separates easily from the concrete knowledge of technical and field. Especially since the latter knowledge is ideographic, micro focused, detailed, and very noisy, the planners may find it easier to plan without any such data. The planning also concerns the organization's strategy, and their task is to push forward or perhaps even create the strategic thrust of the company, yet another ethereal effort.

Planners are aware of the less concrete nature of their work and do feel caught in the middle. Ultimately they can be blamed for having not gotten useful information about market needs, or for being wrong. The following statements express planners' frustrations. These frustrations stem less from being prevented from doing their work by others - as the technical and field people see their problems - and more from the fuzziness of their own work:

> *We are looking at the next generation in electronic messaging.. which will take advantage of all these new technologies - voice, text, imaging... Our technical people say "tell us what the (future) system should look like so we can work on it."*

> *But we need to make sense of a whole range of data - all the decision points, for*
> *example at what point do you need both voice and text? when will the costs be low*
> *enough? when will users be sophisticated enough to use the equipment? what will*
> *our competitors come out with..?* (Opco)

And one at Compco explained:

> *Marketing constantly has to justify itself. ..Marketing is in an ivory tower. Here,*
> *they throw decisions over to marketing, and we usually make the wrong decisions*
> *because we don't have all the facts.. And then everybody says, `marketing screwed*
> *up again.'*

SUMMARY AND DISCUSSION

These four subfunctions inhabit separate thought worlds. Each thought world emphasizes a particular aspect of the overall flow of product development, and focuses on the special tasks and technologies of each of the subfunctions. Table 4-3 sketches out some contrasts among the three discussed at length here.

The questions posed in the introduction to this chapter can be answered by summing up the subtance and nature of the differentiation described above, and what those in turn mean for integration. First, each thought world has a unique perspective, one which seems critical to the total effort. They are thus interdependent from some external perspective (e.g., Thompson, 1967). Technical, manufacturing, and field have in common a grounded, concrete sense for the activity of new product development, but each emphasizes a different portion of the work. Technical and field in particular do not conflict so much as they do not connect. Since each is so focused on its own realm of detail, together they ignore any systematic overview of product development. The planners do have this overview - necessary it seems to allocate resources. But since they are so conceptual, the myriad of actual details which so fascinate the other thought worlds do not fit into their plans. The potential synthesizers stand too far apart from the realities of the others.

A comprehensive understanding of user needs is fractured into distinct and separate everyday worlds. These differentiated groups affect market comprehension in two ways: the information itself is distributed across the organization; and the ability to interpret that information is distributed across the organization.

TABLE 4-3:

The Thought Worlds Compared

INDICES	Technical	Field	Planners
Future	*technological possibilities and design issues*	*specific applications needs*	*the business; growth and size*
Critical Focus of Work	*design of product*	*creating the sale*	*estimating margins*
Information Required	*needs from design view*	*needs from use view*	*needs from general abstract view*
Nature of Task	*tactile*	*relational*	*conceptual*
Product Is	*real*	*a concept*	*a plan*

The substance or content of these differences cannot be divorced form their nature. "Differentiation" refers to distinct definitions of the overall task of product development. The thought worlds are not merely structures or containers into which one might pour market information, or indeed cause to "interface." They are frames of reference or interpretive orders. To say that these groups conflict over goals or resources, which is how many organization theorists characterize this situation (e.g., Pfeffer, 1981), is to seriously underplay these conceptual differences. The people do not merely conflict over resources, they operate under different categories of experience, different social orders. In fact each thought world seems capable of delving deeper into its own world of experience regarding new product development to the exclusion of the others. Each group does something different, expects different things from the others, characterizes their interdependent activity differently - in

sum inhabits a different reality. Moreover, these groups do not only respond to different environments. They interpret a common environment - customers - in unique ways.

This explication of the thought world differentiation helps to explain what "integration" would consist of. According to Lawrence and Lorsch, integration refers to: "that quality of the state of collaboration that exists among departments that are required to achieve a unity of effort by the demands of the environment" (1967:11). But, first, if differentiation consists of separate socially generated and shared cognitions and categories, the "state of collaboration" becomes a joint comprehension. Integration would have to include a context or setting, another social order, which would facilitate translation of knowledge across the gulfs of unshared and perhaps not easily recognized experience. Second, one can infer from these strikingly different thought worlds that the subfunctions will not "naturally" intermingle, or link up, or integrate. It is hard to imagine how these people can achieve a "unity of effort." Rather, they seem to require more of an amalgamation which would both allow each thought world to exercize its own peculiar view, yet encourage each to look up from its own unkowns at least occasionally. There is no overarching theory of customers, or indeed any "theory of action" (Argyris and Schon, 1978) which automatically pulls every one together.

These disparate thought worlds constitute a major organizational constraint on the comprehension of new markets. Together, they offer the possibility of dealing with all the information, but it seems that they don't come together readily. The next chapter takes a detailed look at what happens to products when only one or two of the thought worlds dominate the development process.

CHAPTER V

PATTERNS OF NEW PRODUCT ENACTMENT:

RELATIONS AMONG THOUGHT WORLDS AS THE PRODUCT IS DEVELOPED

INTRODUCTION

Chapters III and IV examined two critical components of the process of how people comprehend the market for new products: the profusion of specific kinds of data that comprises "market information;" and how "the market" and the product development task are perceived in systematically different ways, depending on thought worlds. This chapter puts these analytic constructs back into context by examining the processes people followed as they develop their new products. The chapter also addresses the problem of how the thought worlds might "integrate" or amalgamate, given that they are so different, as discussed in the previous chapter.

Each of the fifteen new product development efforts was examined for the following: what information was acquired and used when, when did each thought world participate, did the thought worlds interrelate or not, and did those kinds of relationships shape the nature of the product as it evolved? This analysis generates four distinct kinds of relationships among thought worlds, called patterns of new product enactment. These patterns characterize how the products and their markets develop.

It is important to note that these patterns are based on retrospective analyses. It cannot be determined whether these particular flows of events could have occured another way, because data on the opportunities unchosen are not at hand. The sins of immaculate perception are heightened with the use of hindsight. One cannot say that had a given product only been developed another way it would have succeeded, or that people made obvious errors. The successful cases fall into a single pattern, and one might infer that it is "good" or "better" to amalgamate thought worlds in that particular way prior to product introduction. But each development sequence may have been the most effective possible under the conditions then prevailing for that particular case.
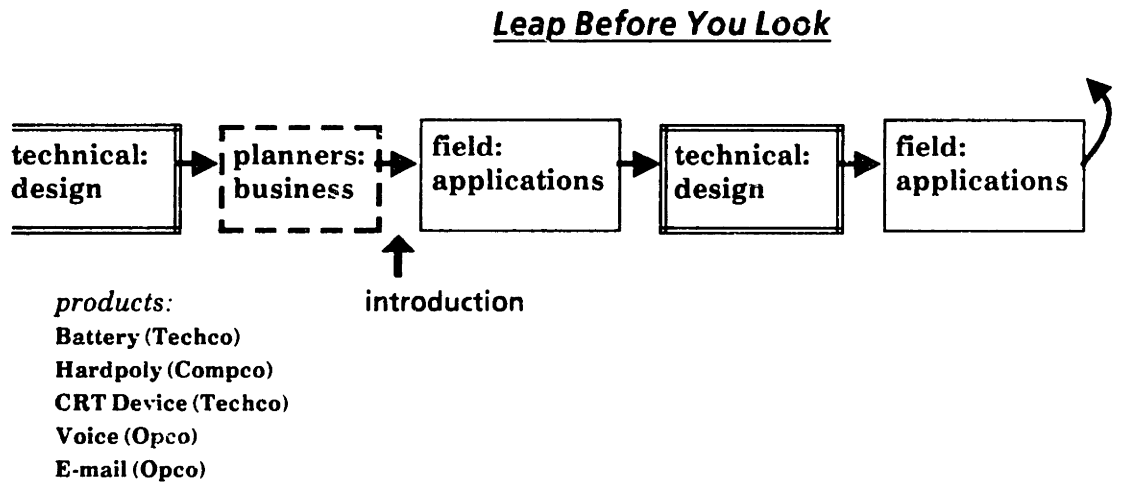
The descriptions deliberately emphasize the problems people encounter during the development process, particularly with regard to the acquisition of market information and the amalgamation of thought worlds. A discussion section then builds on the lengthy descriptions to draw four critical inferences. First, each thought world has a particular and essential contribution to make to the new product's development, so their "integration" or amalgamation is important. Second, the descriptions show that new product development is inherently uncertain, so thought world amalgamation does not guarantee commercial success. Amalgamation does, however, help the developers to deal more effectively with uncertainty. Third, a comparison between the successful efforts and the others indicates that effective "integration" or amalgamation comprises an experience-based learning context, not merely a "structure" or certain kind of organization. But, fourth, the institutionalized ways of going about product development may prevent people from generating this creative context. The successful efforts - which did pull together all the information and perspectives - systematically violate organizational routines, while the less successful efforts become mired in them.

ENACTMENT PATTERNS

Four patterns of market enactment emerge from this analysis, as displayed in figure 5-1. The schematic flows depicted in figure 5-1 illustrate what kind of market information was gathered when, which thought world played a role when, and the manner of relationship between the thought worlds. Each pattern lists the products that followed it. The patterns contain products from different companies, and so are not company specific. The four patterns decribed here are all variations on the relationships of thought worlds, and constitute ideal types. Any particular product development might contain aspects of each pattern, so these highlight the more dominant flow of development.

Briefly, the first three patterns include the less successful cases: the "leap before you look"; the "plan and then plunge and then plan again"; and a combination of both, or "feed it or shoot it?". Each illustrates a slightly different way that the thought worlds are disengaged, which in turn restrains the creative dialogue between them. In the leap pattern, the products are initially defined as a technology and then proceed in a sequential manner through the

Figure 5-1:

Patterns of Market Enactment

Leap Before You Look

| technical: design | → | planners: business | → | field: applications | → | technical: design | → | field: applications |

↑ introduction

products:

Battery (Techco)
Hardpoly (Compco)
CRT Device (Techco)
Voice (Opco)
E-mail (Opco)

Plan and Then Plunge and Then Plan Again

planners: business → technical: design

planners: business → field: applications

planners: business → technical: design ⇕ field: applications

introduction

products:

Document Del. (Opco)
Accounting serv. (Opco)
System II (Saleco)
Medical Hrdcpy (Techco)

other thought worlds. The curved arrow at the end indicates that the remaining products in this pattern are beginning to circle around to coordinate the different thought worlds.

Figure 5-1 continued:

Patterns of Market Enactment

Feed It Or Shoot It?

products:
Video device (Techco)
Software dnld (Opco)

Cut It Loose

products:
Film Cover (Techco)
Roofing (Prodco)
Hotpoly (Compco)
System I (Saleco)
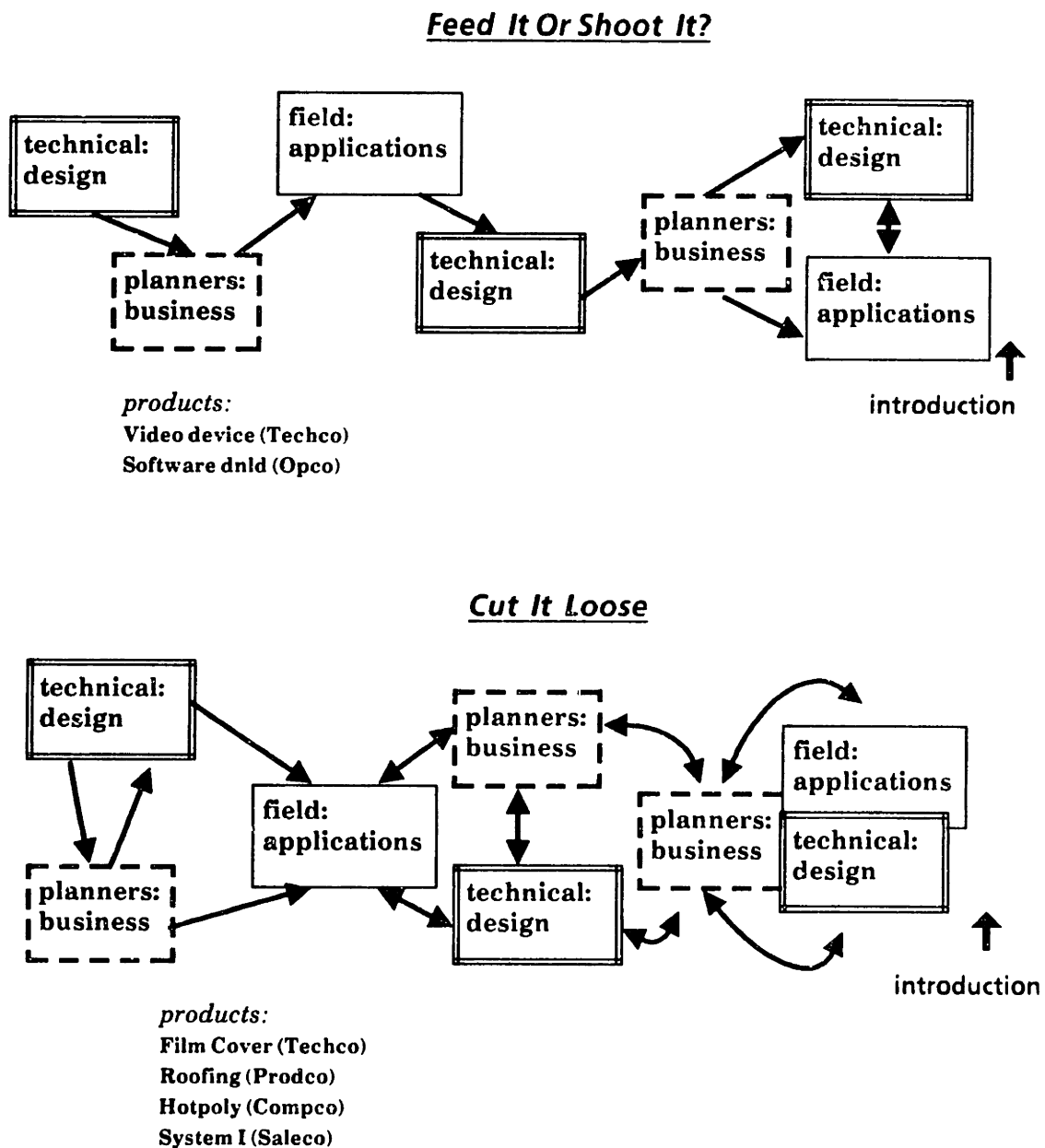
In the "plan" pattern, the products begin conceptually as a plan, and then split into the two separate thought worlds of application and technology. The products then "plunge" at or just prior to introduction because they either do not function at all or fail to meet any

application needs. They are concepts, not technologies. After the plunge, the surviving or to be reintroduced products enter a more circular pattern of enactment which iterates among the different thought worlds. The "feed it or shoot it" products oscillate between two thought worlds, and are redefined as existing products before introduction. Finally, the "cut it loose" pattern depicts the successful cases, in which all thought worlds interact from the early development phase onward.

The "Leap Before You Look" Pattern

Five products exhibit the "leap before you look" pattern. Four of the five leap products began in the engineering or design lab as technological possibilities - as a lithium based power supply; a software driven electronic recorder; packet switching; and a mixture of polymers. The fifth, the voice service, began as an idea on the part of a planner to use a new technology, and then shifted to a search for and installation of that technology - voice store and forward switching. In effect these product developers took a running leap into "the market." For three of the products, at least one person said in hindsight that they took a technology to market, not a product. And the marketing director for the CRT device explained: "we just got up a head of steam and went."

Initial Development

The initial development of these five products illustrates how the technical thought world overshadowed the others until after introduction. As described in the previous chapter, this thought world sees the product as a concrete entity, concentrates on its design, is bemused by planning, and assumes that users' applications are what the product does. These products, then, were solutions looking for problems when they were introduced. Four of them were also what others consider "skunkworks," and three took over two years to introduce. They did not lack for championing, entrepreneurial spirit, innovativeness, or time. But their designs were based on assumed applications and cursory planning. The future possibilities of the planner and field thought worlds were assumed or frozen, so no dialogue among the thought worlds occured. The overall focus of people's attention during the preintroductory phase of these leap products turned inward on the technology that the firm could muster.

The planning tended to be empty modeling, devoid of substance. For example, people working in the cancelled battery selected the target market by looking for the largest battery users - toy makers. A planner described their efforts:

> *We went through the whole business planning process. It was dictated by we find X number of customers who sell Y number of products that use Z number of batteries. What went wrong was our ability to get the customers in the first place.*

In other words, they made up the figures.

An engineer with the CRT device explained that usually they play what the product ought to be against marketing. But, since they had no "trade notion" for the product, they just skipped that step and went on their own "gut feel." The early plan for the voice service consisted primarily of a model based on responses to mailings that announced the new product. "We assumed a model .. we would send out 100 letters, get 10 responses, and out of that we would sign up 3 new users." In addition, small to medium businesses were preselected as likely segments or markets. Salespeople were hired to execute this model, like adding water to seeds. The e-mail people likewise projected revenues based on a model of how many units of service a salesman can sell per month.

Along with the limited planning, the field thought world was shunted aside. No one examined how the product would fit into the actual flow of users' work, nor established how to get in with buyers to make sales. There was no thought of developing relationships with the projected users. Rather, true to the technical thought world, in all cases it was assumed that the product would sell itself because of its intrinsically neat technology. Initial distribution plans comprised a search for customers who had the proper attributes to buy the product - high use of batteries, information intense organizations, need for presentations, for example. Indeed, the three electronics based products were essentially competing for the same "market" - the 60 million office workers of America. The test market plan for the voice service illustrates this lack of field thinking:

> *There is little basis for identifying the prime target now, so we will go wide. We will build awareness, let the customers select themselves, and then focus our marketing and sales efforts on those customer segments who demonstrate the greatest acceptance of the service.* (test market plan, files).

The <u>cancelled</u> <u>battery</u> <u>product</u> never did shift out of the technical thought world, so its story illustrates how the this single thought world limited the product's definition. The product began as a byproduct. To support another line of products, Techco required an energy source that had a long shelf life and did not leak. These special attributes were not available from battery manufacturers, so Techco developed and ultimately patented a new kind of battery. In the early 1980's they had some excess battery manufacturing capacity, and were also looking for new products, so a group of Techco people began a venture to commercialize the new battery as a separate product. To determine the market for their product, they looked at who uses batteries, and picked one of the largest users - toy manufacturers. They felt their product had obvious advantages over the four doubie AA alkaline batteries then being used, especially that since it was leak-proof, it could be shipped with the toys. The major drawback was that the toys would have to be redesigned because Techco's battery was a different shape.

The product team talked to the whole chain of people involved in toy manufacturing, from the designers to the power circuit makers. As one recalls with a certain chagrin:

> *So here we were, poor old chemists with a high quality battery... flying around the country talking to these toy designers... They were very excitable... They loved the battery.*

This comment exemplifies the technical thought worlds's approach to market analysis - show and tell of the technology. They discovered that their battery did not deliver enough power, and so made yet another technological breakthrough to increase its voltage. But, rather than establish user needs or segment the market more precisely, they concentrated on pushing the technology.

They did not fully assess the extent of the problem they were proposing to solve for the toy manufacturers, nor what the major concerns of the toy makers in fact were. The applications or use needs and problems remained abstractions. As the planner put it:

> *We should have learned more about what went into the design of products that use batteries. We finally realized that what battery to use is such an afterthought. We might have done it differently... You need to consider the procedure people use so you can sell them on it. We went out and said here's the product and here's what it does, but we never got to the right people.*

They also never clearly identified who made the purchase decision, as implied in the comment above. Relations that field would emphasize were overlooked.

This next comment picks up the chemist's story of their odyssey, searching for the person who really decides about which batteries to design into the toys:

> *So, finally we went to the circuit design people and asked them 'how do you select batteries?' They would point to this fellow over in the corner. We went and asked him and he says 'I leaf through this catalogue that lists all the batteries available and I pick one.' We said 'but don't you realize that that isn't the most effective way to pick a battery? You can't tell from that book whether the battery is optimal.' But he said 'I can get what I need.'*

The chemist was almost offended that the battery selection was not optimal. But he was attributing his own very exacting needs for an energy source to the circuit designers. Typical of his technical thought world, he expected them to see the technology as he does. It turns out that the excitable toy designers who loved the battery did not have anything to do with battery selection.

Toy manufacturers did not have major problems with the batteries they were already using, as the comment above indicates. And they were not particularly interested in shipping batteries with toys, since that would require a price increase in their products. One manufacturer was willing to redesign several toys to try the new battery, but insisted that Techco first develop an established distribution for it (one can get AA batteries almost anywhere). However, store owners were not willing to carry the battery unless it was used in a number of products - a catch-22 situation. The Techco developers made several attempts to establish a distribution system, but these never worked out.

The product truly excited a number of people because it is inherently "neat." "There were alot of people who wanted to do many things with this battery," said the planner, so Techco received considerable encouragement from a wide array of possible users. Unfortunately, none of these other ideas really panned out. It is, of course, difficult to say which of these many straws broke the back of the battery product. After about four years of effort, during which they did generate upwards of several millions of dollars in gross revenue a year, Techco decided to get out of the commercial battery business. However, it seems that the singular

focus on the neat technology made these developers more vulnerable to the many complicated aspects of new product development that inevitably crop up.

The Handoff:

Once developed to fulfill assumed needs, the other products were handed off to another thought world.

The hardpoly story illustrates a disengaged handoff. Hardpoly potentially fits into a certain niche of the plastics industry because it is relatively more hard than similarly priced polymers. This kind of polymer had been kicking around in the industry in fact for some time, but no company had been able to overcome two important drawbacks, namely it did not hold color very well and it did not flow smoothly in the molding equipment. A Compco engineer overcame these drawbacks by "messing around" in the lab. When he casually showed a small sample plaque made of the revised material to some field people, they liked it and right away envisioned a number of possible applications they could sell it in. However, the technical people had no particular application in mind when they prepared the sample quantity, and so did not bother with other properties perhaps necessary for applications, for example heat resistance (in layperson's terms, when will it melt or break?). Technical wanted field trials done to learn more about possible uses in specific applications. They would use those trials to establish other properties for the polymer.

Compco formed a project team for hardpoly made up of representives from all units, and a plan was developed to ascertain applications and thus other properties to be developed. But, according to the team leader, they never really did much together. Everybody was busy with other work, and never followed the plan. The product's development stopped at the technical thought world where actual applications remain in the abstract. During this time technical concentrated on some problems with manufacturing. The polymer required new process machinery according to some engineers, but others wouldn't believe that. "A lot of energy in technical was bled off dealing with this manufacturing problem," explained a field person. So these other properties and their configurations were not worked on much.

This polymer in fact was fundamentally different from Compco's existing product lines. It "didn't follow the rules," an engineer explained. Chemical materials are sold with a long list

of specifications which describes their properties in detail. For Compco's major product lines, a high measure on a hardness spec relates directly to a high measure on heat resistance. But hardpoly's properties were such that the material was very hard, but it would "break" in a way that was both unfamiliar to Techco's field people and very undesirable to Techco's customers.

After a year of what a field person called "wailing and gnashing of teeth," field got tired of waiting. They needed a new product with greater hardness than Techco's existing lines because they saw competitors encroaching on their customer base. As noted above, hardpoly as configured in its sample quantities was very hard but did not have the heat resistance necessary to certain applications. Field did not realize this, extrapolating from the spec sheet in the same way they do with the existing product lines - hardness goes with heat resistance. In any case, true to their thought world, they treated the product as a concept while focusing on applications. They introduced it with a big splash into a certain industrial application. In a trade show, bowling balls were dropped on a sample of the material from fifteen feet in the air to demonstrate its hardness.

The polymer failed its initial application trial with a big splash - it "deformed" (i.e., shattered) at a much lower temperature than field expected or the application required. Field was apoplectic. They said technical told them it would work, and they were very embarassed by the failure in a major customer's shop. Technical was apoplectic at field's apoplexy, and insisted that they never said the polymer would work in that kind of application.

Both sides' explanations of the problem reveal a chasm between thought worlds. One engineer said it was all a miscommunication problem. When asked how that happened, he explained:

> *It was selective listening. Field hears only what it wants to hear. We have very aggressive field people, and some have no technical background. They speak on different wavelengths..*

A field person also explained that people didn't listen to each other. In their staff meetings, he said: "there's a tendency to beat your chest - the system rewards success." And as far as he was concerned, technical usually said "we can't do that" so he figured they were simply crying wolf again. "You have to be proactive," he explained. A planner remembers being in a

meeting when technical did indeed say that the polymer wasn't good for that application, but field insists that never happened.

Both thought worlds assumed the other would follow usual procedures - that field would carefully test a new product, and that technical would only produce workable products. So, even when they met together, the separate thought worlds dominated interaction, and understanding did not go with the handoff from technical to field. Others attributed the cause of hardpoly's failure to a variety of issues: no actual market need; poor design; not enough attention to the development process; poor planning that let field get their hands on enough quantity of the material to introduce it. This profusion of attributions suggests that the thought worlds remain rather separate on this product. Hardpoly was removed from the market, and a task force set up to explore other applications for it.

The three surviving "leap before you look" products did not encounter an applications failure and continue to exist.

Techco's CRT device electronically captures what appears on a computer screen and produces a color enhanced hardcopy of it. The product was developed by Techco's engineers as a peripheral device for the PC market that would use Techco's chemically based hardcopy technology. The CRT group brought someone to handle field issues on board prior to introduction, and he established a distribution system. It did not flow smoothly at first since they were unfamiliar with this computer market - "we were all arms and legs over it," said the field person. But they also got a very large order from an OEM (original equipment maker) who would bundle the device with its own software. This order took the pressure off Techco to get an unfamiliar distribution system working smoothly right away, and they have relied on OEMs since for a considerable portion of their business.

They also formed an interdisciplinary team to monitor the device's progress right after they introduced it, and so have been slowly amalgamating the thought worlds. According to a manufacturing person, they met every Monday morning at 7:00 a.m. "It was a great way to ruin your week," he said. But they hashed out problems slowly, and learned about such things as distribution, users' applications, the product's design. An engineer explained its current status (as of one year ago) two years after introduction as follows:

We have over seventy-five percent of the market for these devices. That's the good news. The bad news is that its a very small market.

True to its technical only beginnings, the product has problems w'th applications because it is too hard to use, so they are redesigning it to make it simpler. An engineer said they are still looking for the right niche in the graphics design area to make big sales. Two other engineers attributed the slow sales to field - that they didn't know how to sell the product. But the field person is very positive about the device. He explained in very relational terms that they have an installed base problem - users first have to buy a computer and learn to run it, and then they have to learn about composition for graphics purpsoes. And finally they are ready for the CRT device. He showed me albums of the hardcopy produced by the machine, and walked me through a demonstration. As I was leaving his office, someone stuck his head in to announce that they might get a big order from a very large firm interested in distributing the devices among its staff.

The spread of attributions again suggests that the thought worlds have not yet pulled together entirely into a shared definition of the product and its market. However, there are indications that the product will become clearly successful. A few months after the last interview a favorable review of the machine appeared in a nationally distributed paper on computer equipment. The commentator criticized it for being hard to run, yet extolled its "fun technology."

The two electronic messaging services likewise seem to have overcome their shaky starts and may end up eventually as "clearly successful." However, they make for an interesting contrast, and illustrate sharply how thought worlds affect the nature of the product over time. The e-mail product was handed off from technical to a planning thought world, while the voice product was taken over by the field thought world.

<u>During</u> <u>the</u> <u>1970's</u> <u>Opco's</u> <u>e-mail</u> <u>developers</u> had worked on a terminal access to a government sponsored data network. This network was the precursor to the data networks now available which allow computers to communicate. Opco's data network uses "packet switching" technology which chunks digitalized bits of a message into "packets," sends (switches) them over the telephone networks, and captures and reconfigures them back into the message at the destination. The early terminal access to the first government network

consisted mostly of scientists and "hacker" types who would send reports and notes to each other, but their usage was the precursor to electronic mail.

In the early 1980's Opco's data division decided to develop the terminal access capability of their data network into an electronic messaging product that they would sell to various industrial users for communications purposes. They wrote the code for the basic e-mail service in a few months and introduced the product. The initial development of the service seems to have become legend at Opco data, in fact. According to several engineers, they "locked three guys in a lab and threw raw meat over the transom." Most people, including the planners, seemed quite proud of their technological breakthroughs.

But a field person who had to work on sales was less than reverent about the original design:

> *The system was nothing but scotch tape and bubble gum. .. We spent a year catching up to everything we said we had... The salespeople didn't know how to sell this ..*

During that first year the product remained in the technical thought world. It was even advertised as "packet switching," which created some confusion among potential buyers who needed to communicate with their sales people, for example, not switch their packets. "That was probably a mistake" said a technical person. According to an engineer who joined them later: "The people trying to sell it had the hardest time."

In the first few years there was some effort to redefine the product in "field" terms. One person spent some time interviewing senior people at large companies in the area to see what their potential applications for this kind of electronic messaging might be. Among the possibilities turned up were on-line access to various data bases and distribution of financial data for a chain of stores. These applications required that the basic e-mail system be enhanced and reworked in order to provide these specific applications. However, the data division did have an installed base of network users, and they were able to generate what they considered to be enough sales for the general electronic messaging capability from among these customers without making these enhancements to the system.

Planners became more dominant in the product's development. They concentrated on both revenue generation and strategic development of the technology - standards for

electronic messaging were being developed by international groups and the data division worked extensively with these bodies. According to a planner, the field person couldn't prove that if those specific features various users requested were added Opco would definitely make more money. "The business people in us said if we loose hard dollars due to nonperformance (of the technology) versus the soft dollars of these user requests, we'd be foolish." So, he said: "our (limited) resources were sucked to enhancements that generated hard dollars." They concentrated on those enhancements that particular users contracted with them to make.

The planner also said that for several years they really did not know what the customers used the service for. "It's a philosophy of customer autonomy. We give you the capabilities, but how you use it is up to you." This planner thought world continues today. The system is considered a commodity and they say that specific needs of groups of potential users are very difficult to determine. "It is very hard to do a more focused analysis on specific use needs," said one; "We didn't have the luxury of going out (to users) and then sitting back and trying to understand (particular) industries," said another; "..this is an unknown business.." said a third. Instead, they have devoted most of their resources to the more strategic effort of keeping their basic technology up to date. In fact, several enhancements have been made, but most spoke of them as trivial. They remain convinced that the technology will someday take off, and in the near term concentrate on responding to what the competition does. However, they are planning to add more marketing people to work on this product and develop more applications-based enhancements.

The voice service also began with a basic technology of voice store and forward switching, in another division of Opco. The two technologies are similar except that one sends and stores text and the other voice (the electronic messaging industry is working on a voice-text interface). Neither requires the hardwired technology of telex machines, for example. In the first two years of the voice product's preintroductory development specific applications data were not gathered, and the product itself was defined as an "eminent technology." Opco purchased a voice store and forward system from a vendor that was one of the first to develop the technology, and configured it as an internal memo system.

With this basic technology in hand planners played a dominant if brief role. Because this was a new kind of technology, the product's first developer said that market research would be

of no use - users would have no commitment to the product and would say they would buy it when in fact they may not. Instead, a year long test market was planned to ascertain "customer acceptance." Recall that the voice service market test was based on a simple model: send out so many letters and get so many hot leads. They planned to just add salespeople and stand back. The test was developed by Opco's corporate marketing staff, who would also gather their usual planning data. Weekly reports from the test site were preformatted to include such data as the number of users, customer contacts made, merchandising tactics such as direct mail and advertising, and expense and other revenue data. The test market plan assumed away most of the uncertainty concerning applications and user groups by expecting customers to identify themselves.

The test market began in January, 198X. "Missionary" field types were hired to run the test market, on the condition that if the test failed they would be out of jobs. The system itself was configured in an inflexible manner, and was priced in the same way all communications services were then priced - pay up front. Small and medium sized businesses were targeted as likely users, and in accordance with the test market plan, 40,000 letters were sent to these businesses in the test market area. "We thought we would have a line of customers waiting at the door.." said the product director. As of April only a beauty salon and a few pizza parlors had expressed passing interest. Nothing went according to the conceptual plan set forth.

The field people running the test wanted to keep their jobs. "So, we threw the test plan out, and went to see the customers to find out why no one wanted the service," said the test manager. The field people took over from the corporate planners, and proceeded in the relational yet grounded and ideographic manner of the field thought world. During the next several months they learned that no one understood the concept of the service, small companies really had no need for it, and that customers needed "call answering" and "group send" capabilities (neither part of the initial design). They also learned that the service helped to solve problems communicating with people dispersed over wide geographic and time zone areas. But it did not solve the problems of internal office communication, because it did not really fit that flow of work. The field people arranged to reconfigure the system as a set of specific applications to meet these needs and requests. They also arranged for free trials of the service to overcome "buyer resistance."

These applications-driven reconfigurations fundamentally changed the nature of the product, shifting it from a technological concept to a bundle of specific application possibilities. Contrary to the originally very orderly plan, the salespeople went to specific users and sold specific applications - anything to anybody. Said a sales manager: "Any time we found an application we'd sell the hell out of it." They continued the regular reports in the prescribed format, and, since Opco corporate didn't ask for any synthesis of the emerging applications, none was made. The planning and field thought worlds remained fully separate. By year's end, the high energy field group had exceeded the number of customers projected in the test market plan, but by sheer happenstance.

It took Opco's corporate management another nine months to decide what to do with the service. Part of the problem, I suggest, was the lack of any orderly plan. Whether one was even possible is another issue; the point is that one was expected. According to one senior manager, the market test was only a theoretical success - its director "backed into" revenue projections by estimating the number of users needed based on desired revenue. These abuses of institutionalized practices will be explored at length in the next chapter. Suffice it to say here that Corporate finally decided to continue the service. They also agreed to let it run separately from any other division - they cut it loose, which probably explains its continued existence. But corporate still worries about their lack of plans, while the field product managers still don't worry about them.

The voice division continues its field oriented approach to the market by developing applications to meet specific needs. "We see ourselves as niche marketers," said the product manager. According to the engineer (who works very closely with the sales director): "We build what we call an applications processor, not just a voice message processor. Because the customers are not sure what they want, we have to adapt." Numerous product enhancements have been made, based in large part on customer requests. They are working on a number of very exciting technological advances, and have forged a strong link between the user functions gathered by sales and the product design, with the field orientation in control. Not surprisingly, they now offer 80 different configurations of their basic service, and operate in a multitude of market segments.

These two similar electronic messaging products evolved in very different ways, and are now different kinds of products in different markets. The e-mail people have a commodity which they sell to large users. The voice people have a truck dispatcher, a repair person organizer, a commodities price distributor, a sales force management tool, a twenty-four hour communications device, a tourist information service, a consultant contract updater, an employee scheduling process.... which they sell to anyone who wants it/them. But the voice people do not have strategic aspects of the technology as firmly in control as the e-mail people. In fact they require major new investment to replace the original equipment.

So, while each product's development may have been the most effective for it, this comparison indicates, first, that the thought worlds played an important role in that development, and, second, that each thought world has a particular impact. Indeed, all of the "leap before you look" products still on the market continue to evolve. Yet in each of the three remaining cases, the thought worlds are beginning to pull together to define the products more comprehensively. The sequential nature of their initial development seemed to leave them open to shocks of unanticipated events, shocks that at least two of them could not overcome.

Plan and Then Plunge and Then Plan Again

This set of products began with a plan, as depicted in figure 5-2. The other thought worlds

Figure 5-2:

Patterns of Market Enactment

Plan and Then Plunge and Then Plan Again

products:
Document Del. (Opco)
Accounting serv. (Opco)
System II (Saleco)
Medical Hrdcpy (Techco)
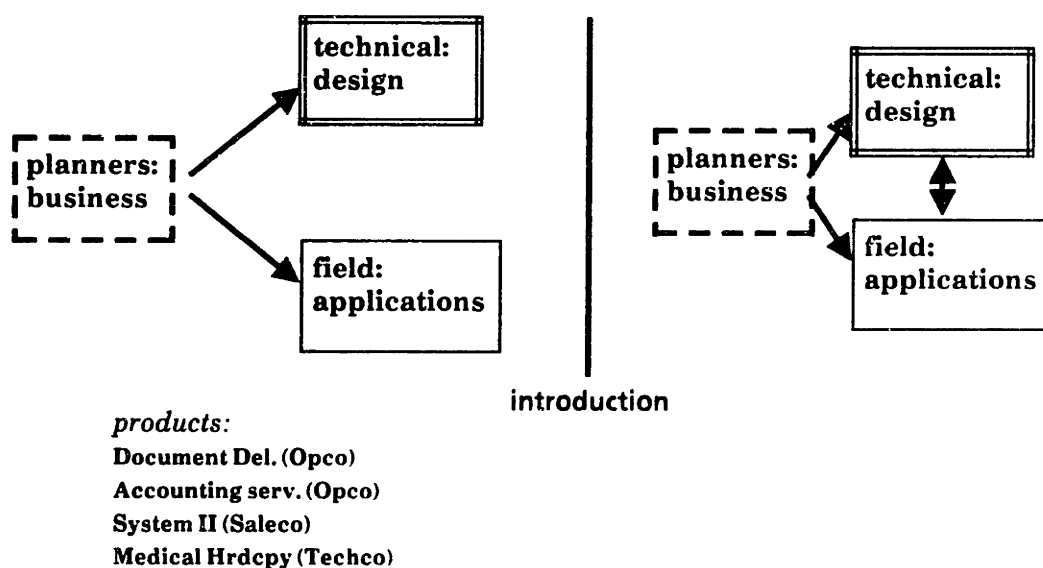
played some role in most of the "plan" cases prior to introduction, but they did not interact back and forth in an iterative fashion. Rather, the plans became set, and then design and sometimes applications issues were dealt with. The planner thought world concentrates on business analyses, including estimates of market size and growth, and tends to be conceptual rather than concrete. Planners also emphasize strategic aspects of product development, such as how the new product will strengthen product lines or help move the firm into a lucrative business. So product development in these efforts was motivated by the desire to "do something" in a business area, instead of the possession of a "winning technology" as with the "leap" products. In all cases in this pattern the product was defined as a strategy, and the market as a business. Neither took on a concrete existance. So, lacking the more concrete emphases of technical and field. the products either did not function when introduced or the

presumed market did not materialize. Each product exhibits a variation of the "plan" enactment pattern.

Opco's document service was initiated for two related strategic reasons. First, competitors were doing it. Second, Opco wanted to expand their network capability and allow users to communicate to people not on the network. They said that if they didn't provide this capacity to "reach" off the network, large customers might purchase their own equipment and run their own closed system ratner than use a service. In addition to these strategic reasons, a government market analysis indicated "one hell of a market," according to a planner. The report projected that electronic to hardcopy (and back) communications would dominate the next major era of business communications. This study simply modeled the growth over time of various electronically produced messages and did not specify particular user needs. That is, it did not explain why so many business communications would be handled electronically, nor why people would switch from current techniques. The planners, however, were satisfied that "a market" existed for this service.

Opco people negotiated with several different vendors for over a year to provide either the software technology for the document output or the delivery capability. From the participants' narratives it appears that senior management grew tired of the planning and analysing, and decreed in March of the introduction year that Opco would have a document service by the end of June. They decided that rather than purchase a system, Opco's engineers would write code. The customized electronic document output generator would then be combined through contract with a national mail delivery service to provide overnight delivery of the hardcopy generated.

Once this plan was set, the concrete design issues were addressed, and the software engineers became actively involved. According to one, they were given no rationale for the service, and no applications information. He said: "I heard about it March 20th, and was told to get it done. I cranked code like never before." The outcome met "the letter of the request," he said, but "..required that the user follow a tedious set of steps to format a document." Meanwhile, how they were to coordinate with the contracted mail service was a jury-rigged affair consisting of envelope stuffers and delivery vans who would take the documents to an

airport terminal. The delivery service company also had very limited experience with overnight deliveries.

When this admittedly hurried system was tested, in addition to the software limitations, the planned overnight delivery took two weeks for certain cities. Moreover, few customers signed up, so after a month or so they cancelled this system to develop another one. Reasons given for this snafu vary, but are related. The engineer who worked on the code said he couldn't understand why anyone thought their e-mail users would want anything like that. Moreover, "we got hung up on its got to be deliverd overnight." As far as he was concerned, planning: "..did not interact clearly with the market to see what they would like." A planner for the product said it was a technical failure because management was not willing to invest the resources necessary to produce a workable system. Someone associated with the delivery vendor whom I had occasion to meet explained that they expected the financial industry to become large users, but these businesses seemed uninterested.

In any case, the planning and technical thought worlds were disengaged, and a field perspective played little or no role in this hurried design. Now, having quickly put their first entry out of its misery, Opco data people have shifted to more precisely identified users and applications. They are developing facilities to process mailing lists, customer logos, and geographically dispersed deliveries with another company. When reintroduced, the new service will attract customers who have particular mass mailing needs. Their initially sweeping yet abstract strategic rationale for this service has been redefined into a specific and focused product.

Opco data's plan for their accounting service was more focused on a specific set of potential customers from the beginning - certain large retailers. An accounting system would process all the transactions involved with a credit card purchase electronically - check the credit card clearing house, update the card holder's and the merchant's accounts, etc. - thus eliminating considerable paper. Again, two strategic issues prompted the new service. First, Opco data was selling a hardware device which enabled retailers to check credit card purchases over phone lines. But their device had fallen behind its competition technologically and Opco needed to decide on their future in that business. Second, data network competitors were beginning to offer accounting services. This coupled with general trends toward

increasing automation in retail accounting suggested the presence of a large potential market.

Opco's solution to both strategic issues was to bundle the hardware device with a new service. Opco's planners developed fairly thorough plans regarding the size of the retail market which would use the service, its growth rate, and even how to distribute the service. The plans were not based on any specific field information, however. When asked if they talked to customers, a planner said:

> *No. We knew this is what was needed. We could see the competition doing it... We could see that the logical cycle was to do the whole thing, so we decided to go.*

In addition, the design for the accounting service came through the purchase of a small company that had developed a system with a small, limited customer base. So the plans, design, and applications were all separated.

Opco introduced the product and signed up several large users. But when they moved the system to their operations headquarters they had problems. It did not run with Opco's software, nor would it run properly on their machines. "We had duplicate transactions running through the system," said a field person. "That didn't give us alot of credibility." Each of the following explanations for the early stumble comes from a different thought world, and suggests different attributions for the initial failure. According to the engineer, they did not have enough specific design data:

> *We didn't understand the application in total...It was fine for the one man company (who developed it)...We had a difficult time trying to figure out how to operate the service. It looks very nice theoretically, but the more relationships you have, the more complex the recovery is. The whole chain of events starts to break down.*

The field person explained that they did not have enough applications information, expressing an apt metaphor for a lack of thought world interaction:

> *One person came with the product and had a good understanding of what kind of customer would benefit from it. But more people (here) should have known. We needed a brain transplant.*

The planner explained the problems in terms of disorganization:

We weren't successful in fully integrating within the organization. This is a new product. It's unique. It requires different distribution, different billing... a myriad of things has to work well. It's difficult for a small organization to do that. Things fall apart, but you don't see the pitfalls.

But together, these explanations indicate that their thorough plans were not enough. The specific design was not fully tied to how retailers and banks operate on a day-to-day basis. Design and applications did not connect much, similar to the document delivery product. This more general comment from the engineer indicates why thought world separation reduces information comprehensibility:

There has been too much of a trend toward categorizing information, and only giving people what they need to know. We categorize people into roles, but we all need all the information. There are little shades of meaning that get lost in the requirements statement we get from planning.

The service was quickly removed from the market except for on going tests to examine where the system falls down, and to work out the linkages with the way they run their existing processes. They are using the experience to clarify what they did not know about the application and the operation of the system, and plan to reintroduce it.

The third product in this enactment pattern, Saleco's second information processor (system II) was a newly designed, smaller version of the successful system I. Systems with similar technology had already been introduced by several other firms, so the technology itself was not brand new. But "the market" for these smaller systems was still developing at the time, and Saleco was among the first to develop certain business applications for these systems. The basic plan for the system II was to continue the momentum begun with their first entry, and to expand Saleco's newly discovered (to them) and lucrative business for such computers. Building on such demographics as the number of college educated people and households with incomes over $40,000, along with educational institutions' needs (already established by competition), it appeared to them that a smaller, less expensive version of the system I machine would open up the home and educational user groups for Saleco products.

Once this "obvious" market was identified, it was not really questioned again, and the plan was set. It was converted into product design specifications, which, as this engineer notes, became a "firm charter:"

> *We had a market requirement statement. .. It lists the markets - education, business, home, whatever - it's like a snapshot of the user. It was a firm charter from the beginning. ..the product was tailored for the low end (home) user.. The keyboard was designed deliberately to be coke resistant and peanut butter proof...*

Computer systems comprise many components and parts, so their development requires a complex orchestration of many separate activities, from software to distribution. The business plan thus also became an internal organizational blue print to coordinate the product's development. The group mounted and pulled off a very complex new product introduction in less than fifteen months. During this period, they enhanced the basic processor technology with improved monitor resolution, graphics capabilty, and new disk drives, among other things. They also developed an innovative assembly facility with robotics from "scratch." They had excellent teamwork within manufacturing, and no communications problems as the whole product system was being developed, according to the participants.

But, when system II was introduced, people complained that the keyboard was mushy, that the memory size was too small, that not enough software ran on it, that it needed two disk drives, that the price was too high .. Saleco spent a year adjusting the machine to meet these complaints and sold quite a number. The initial complaints with the product perhaps reduced the number of people who would buy it, or perhaps the home market would not have materialized anyway - it hasn't yet several years later. In any event, the apparent size of "the market" after introduction was not adequate to sustain their manufacturing costs, and since the machines were popping out of the new assembly facility at eight a minute, Saleco decided to shut down the plant and cancel the product.

What happened? An engineer explained:

> *..We didn't get the system into real scenerios and test out our premises. We were overconfident.. We all thought we were very smart. . We made a lot of decisions daily to change the product based on what we thought we understood about the market place.*

From the thought world analysis, applications were assumed, so the design was based only on the conceptual strategy. This concept embodied considerable force, however. Most of the participants said in so many words that they got carried away with themselves, as implied above. A planner indicated that perhaps some simple focus groups would have picked up the

keyboard problem. He said, however, that "we would have been disappointed (with the negative feedback), but we would have gone on with it anyway." An engineer pointed out that the product design and manufacturing process creates considerable momentum of its own. Others thought that the price was too high, or that they ended up with too much "bad press."

Another noted that they in fact had some data which indicated that the home market might not be a good one, at least for Saleco, but that got lost in the cracks of the headlong rush. More generally, he said that they had carried the autonomy of the individuals involved with the first system too far - key people began to leave, and there was "no group think," as he put it, with the second effort. Things fell apart conceptually like the other products in this pattern. Such a lack of structure was unexpected - people seem to have assumed that everything would fall into place, but it did not.

Techco's medical hardcopy system is the fourth product in the "plan and plunge" group, and a lack of structure seems to have played a role with it, too. The so called hardcopy system produces a copy of diagnostic images that appear on sonography and other medical equipment. This product also began with a strategic emphasis. Techco had an existing business selling hardcopy products in the medical diagnostic industry, but anticipated that competitors would enter their business with a better quality, lower cost system. This meant they had to do something to protect their business. But more to the strategic issue, those who developed the plans for this new product said they wanted to move Techco away from its tried and true hardcopy technology because of that technology's relatively high cost, and into another approach. This product was intended as a "bridge,' as they called it, to use the old technology but reach into new applications while new hardcopy technology was developed.

Techco did have a field sense of immediate needs and operations in the diagnostics industry, and a former salesperson played an important role in the development, so this product began with more applications information than the others in this enactment pattern. The medical system planners presented a preliminary proposal to management which contained a reasonably thorough review of the number of units to be sold and estimated revenues. But because a go decision meant millions to be spent in design and tooling, they spent a year developing and working on the business plan, and researching technical feasibility. Technical and manufacturing both said they could handle the design and

development. The product developers projected trends in that industry (for example that more and more clinics were beginning to use diagnostic machines), and carried out various examinations such as focus groups to test people's willingness to pay the higher cost.

Despite their familarity with the applications area, the product embodied considerable unfamiliarity for Techco. It applied existing basic hardcopy technology, but required new design and assembly processes. Also, they planned to work directly with manufacturers of sonography equipment; these manufacturers would build in some hardware to operate the medical documentation device that Techco would make. This was the first time, one said, that Techco would rely on this complicated chain of equipment makers to deliver a product to end users.

Unanticipated manufacturing problems stretched the development stage out to two more years. By that time the market had changed considerably - in particular, hospitals and clinics had become very cost conscious. As anticipated, competitors had developed similar products, yet their alternate means of producing hardcopy from diagnostic equipment had become much better than expected, wiping out Techco's advantage. Techco's product, while still of better quality, now also costs more than ten times per unit than competing technology.

The primary mislink with this product seems to have been at the more strategic, general level of commitment - not enough people at Techco were committed to the idea of shifting out of the tried and true technology. Two people suggested that since this product was different from Techco's usual development approach, particularly in that it relies on OEMs rather than their own hardware, other groups, including field, did not take it seriously. One of the planners who helped to originate the idea had prepared a display of the competitor's documents and kept it in his office. What he had originally anticipated and what prompted the entire product development exercise in the first place had come to be. Others indicated that the mislink was more tactical, in particular that manufacturing caused the trouble. Said one: "they didn't do their jobs."

The product has been introduced and is selling in the medical market, but at a lesser rate than anticipated. Techco will continue its marketing effort in that business, but is also actively seeking other uses. The chemical part of the product will very likely become successful as an addition to their general line of hardcopy products, being transformed from

its original purpose as a strategic bridge to an enhancement of existing lines. This effort illustrates rather well that products will shift due to unanticipated events and changes, inside and out, and how frustrating that can be for product developers. One of the particular sets of hardcopy material wasn't done yet when interivewing finished. One said: "manufacturing was so burned out over the first two (materials) that they won't even say when the third will be ready." He went on to note:

> *... you generate a certain amount of enthusiasm for a new technology. When you can't deliver on that enthusiasm you get burned out.*

These cases indicate that a general sense for "a good business to be in" does not assure the linkages between the technology and the applications. Like the "leap before you look" product developments, the dominance of one thought world overshadowed the perceptions of the others. Except for the medical hardcopy, these product developments assumed applications issues rather than explore them thoroughly. The products were based on the conceptual planners' view of "the market," and so either did not function at all or went to the "wrong" market. All of these products also ran into disorganization problems, in which the coordination among the specialities of the functions did not proceed according to plan or expectation. These development efforts all exhibit an inward focus, with the attention of the participants drawn away from what is going on "out there" among targeted user groups and competition toward internal organizational issues.

Feed It or Shoot It

The third set of products began with two thought worlds, and each had some information (see figure 5-3). These products are also the only two in the study for which post- introduction data are not available because they were just introduced, so the observed oscillation may be an artifact of their shorter histories. With that caveat, both show this general pattern: they do not have a clear leaning to a technology or business as with the first two groups of cases; they do not fall apart; but they do encounter what could be termed "intense hesitancy" from senior management, and then undergo a metamorphosis prior to introduction.

Opco (software downloading) management felt that one of the keys to its future would be that PC's would become like telephones, spreading to most business people's desks by the mid

Figure 5-3:

Patterns of Market Enactment

Feed It Or Shoot It?

products:
Video device (Techco)
Software dnld (Opco)

introduction
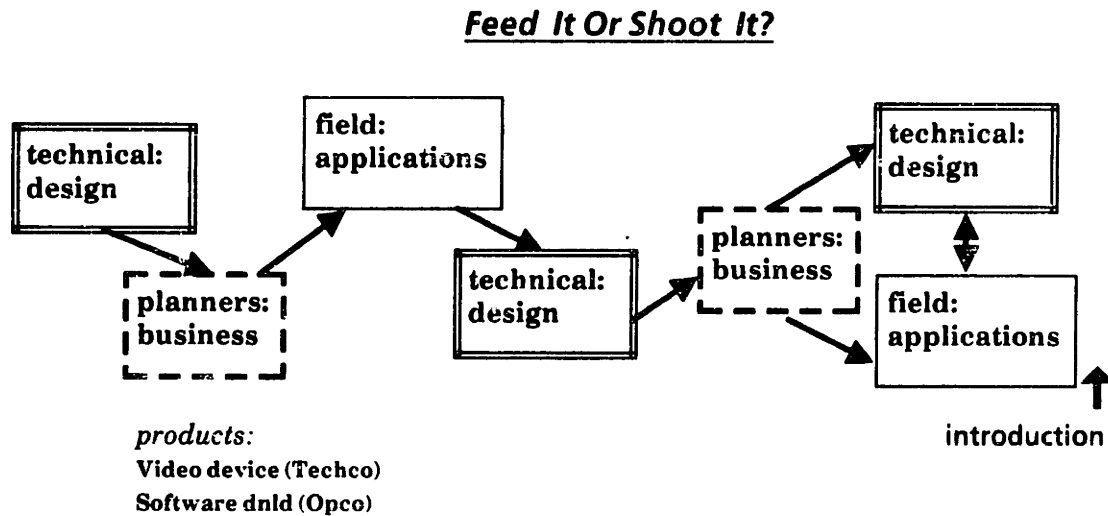
1990's. A need of this new kind of telephone would be the distribution of software. So, the data division began to look into the software distribution, or downloading, business. Said one planner:

> ..*No one had figured out the key to success; there were several big obstacles. (But) we suspected that there was a demand for software downloading...*

The product was thus initially defined as a rather vague strategy, and its "market" was opague.

Opco data acquired downloading technology by purchasing a small start-up company. This company already had a limited customer group of small businesses, so Opco planned to target this user group as a way to begin this vague future. The initial service plan was to build a library of software packages, and then rent the software for a modest price per use to small businesses. It was assumed that small businesses would prefer this to purchasing software they might use only occasionally.

The planners had very little information about the actual software related problems of small business people at this point, and were estimating the business based on broad trends in PC use. No field based market analysis was carried out. For the next year they worked on the business plan but could not agree on the definition of the product or its market. Said a planner:

> *We didn't know much. We knew a lot of pieces but they weren't all connected. We had research firms' estimates of the size of the market, we knew the technology.. We started playing with iterations of the financials and usage all through last summer, but we didn't get to a point where we could get a consensus that the usage estimates were correct.. We were still struggling with what the business is and still did not agree that we all knew what we were talking about.*

Note that he discusses the market planning issues more than any others. However, they were plagued with considerable uncertainties, illustrating the oscillations and trade-offs that occur with new product development. Other firms had introduced this kind of product, but failed. Opco planners could not ascertain whether the failure was due to their technology - these other firms required a hardwired link while Opco could run the service over its data network to users' telephones. Another competitor tried to market a downloading service to software retailers, thus eliminating the need for inventory. But, because people apparently wanted documentation and other tangibles, that business failed. Opco's senior management was worried about the focus on smaller businesses, a market segment they had not been in before. The person in charge of the product found this year of hesitancy very frustrating, and said in exasperation: "Senior management has to think about the crossover between the decision to keep feeding it or to shoot it... They support the idea but don't allocate enough money."

Then the software downloading developers discovered that the first tier of software distributors would not allow them to rent software - "they were negotiating with us in bad faith," said another. This prompted them to redefine the product and its market, and they explored needs in their existing user base of large corporations. They found some interest in large firms for internal downloading, both for distribution of software to dispersed units of the firm and for internal management of software available to staff. The product group then "repositioned" the product entirely. "We went from it being an end user service to being a revolutionary way to manage software." The product itself was enhanced to facilitate file

transfers (e.g., sending a particular spread sheet file over the network to another terminal). The shift to a known business area both assuaged their uncertainty and helped them to focus on a real problem in a real market segment. According to a marketing person:

> *Because we had all three [the product,specific needs, and the capacity to meet them] we decided to first bring it to our installed base and make it successful....Then if the third party software idea hits, we'll be ready.*

At the time of introduction, however, they still did not know the extent of downloading needs within large companies, how many different kinds of software the people use, and how often software packages are updated. In this case the applications aspects of "the market" remain essentially unknown at introduction, and the product itself remains a technological possibility looking for a conceptual market. This is not to say that such an approach is not the best way to reach their future goals. But one must wonder what would become of the product if Opco voice's field people got their hands on it.

The video device at Techco also had a clearly discontinuous start but seemed to have come together more fully by introduction than the software service. As an outgrowth of their work with the CRT device, an engineering group had developed a multi purpose, modular, and expensive device to transform both crt and video signals into very high resolution hardcopy. A market test with the prototypes failed to turn up much interest in a device that expensive, and the project was cancelled. But one of the engineers continued to push the video module of the do-everything device, based on his observation of an increasing video (VCR) use in consumer markets. At the time home VCRs could not capture stills of frames, and television signals were of such poor quality (they produced only so many spots or pixels per screen) that a stopped frame of video had blurred lines running across it. But he and another engineer felt that the VCR industry would soon move to improve their machines. So his initial idea was to build a "dirt cheap" hardcopy device for the consumer market.

At the same time, industrial market planners in Techco's video business group saw an increasing use of video, "across the board" as one put it, from company training films, to the security and identification business, to news and advertising. In all of these user segments they felt there was a need to get a still hardcopy from the television video, but at a reasonable price. So, when the engineers demonstrated their new "dirt cheap" consumer video device to a large meeting of Techco senior managers and marketing people, the industrial marketing

group liked it. (According to one of the engineers, the consumer group thought the idea was too radical for their market). The product was redefined as an industrial one for a wide array of potential users and uses.

They began market tests. Both the engineers and the marketing people demonstrated it with over seventy potential industrial users around the country, using high quality video tape and "industrial strength" VCRs. The response seemed quite good, and the Techco people acquired a fairly good sense for the immediate functional needs of those who worked with video. But the test did not resolve all of the questions, especially those regarding number of buyers. The video device's output was not up to Techco's usual quality standards. The television signals were still of limited quality and the document produced had blurred lines unless very high quality video was used. Because of this, said an engineer, they had some trouble estimating whether the poorer quality in this product than originally planned would result in a large enough buyer group. Moreover, they said that senior management was concerned about Techco's image as a vendor of only high quality documenting procedures.

Because of these uncertainties, management was very reluctant to invest in retooling to make the "dirt cheap" chassis for the device. But to produce it with present chassis tooling (from the CRT device) meant a significant increase in price, making the market potential even more unclear. They decided to build the device with the more expensive chassis. This plan meant that they would also reposition it again and aim it at users who used very high quality video and/or had frame holding equipment. The "frameholder" captures a still from a video signal without the lines, but is an expensive component.

Then two things happened. First, a VCR manufacturer offered to make the device and include a frame holder at very little cost (they saw this device as an opportunity to expand their own markets). Second, a competitor introduced a similar product, which indicated that they thought there was "a market" for it. According to one of the frustrated designers: "That kicked everyone who was hesitating in the butt. Their price was low, which also created some thinking ..." Techco decided to go with the cheaper option, and formed a venture with the other manufacturer. They have just introduced the device to familiar video markets, and continue to work on the technical problem caused by poor signals. Techco may eventually
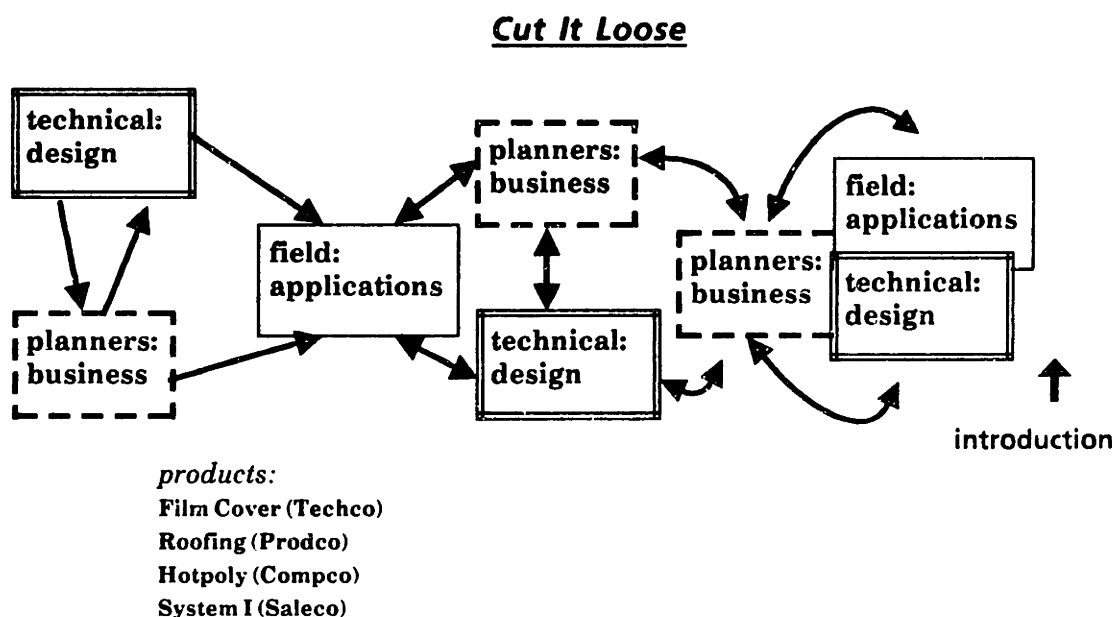
move a similar product into the consumer market place once the technical issues are overcome.

Both cases resolved their uncertainty by redefining the product for known user groups. In both cases it also appears that the products will continue to evolve and change, if they survive, as markets are created and established.

Cut It Loose

The four clearly successful product development efforts all followed the enactment pattern depicted in figure 5-4. This pattern differs from the others in three ways. First, no

Figure 5-4:

Patterns of Market Enactment

Cut It Loose

technical: design

planners: business

field: applications

planners: business

field: applications

planners: business

technical: design

technical: design

introduction

products:
Film Cover (Techco)
Roofing (Prodco)
Hotpoly (Compco)
System I (Saleco)

one thought world dominated, so the product's definition was not only a technology, a plan, or an application; it contained elements of all three perspectives. At the same time, however, the initial definitions were more simple than the complex technologies and strategies of the efforts described above.. Second, the separate perspectives were woven together before product introduction. Business plans specified applications; applications were based on planned segments of the projected market; designs were either precise or "open" to change, but not fixed. Third, each thought world's uncertainties - in particular their separate futures - were played off against the others, as the two-way arrows depict. For example emerging technologies were resolved with emerging applications rather than assumed applications.

Since no thought world assumed or froze the contents of the others, the products and markets in these efforts tended to be created over time, not determined ahead of time. The trading back and forth of perceptions produced more learning among the participants regarding their activities. While exhibiting their own thought world's viewpoint, members of each one also discussed the issues of the others.

Techco's film cover was developed by a business planner who had a background in commercial photography. He thus embodies business, applications, and design knowledge personally, although he leans toward a field oriented market developer perspective. When asked what his role was, he replied: "my function was to make things fit." He described the work of commercial photographers who "shoot" magazine layouts such as catalogs and advertisements in rich detail. These photographers use box cameras and "cut film," four by five inch or eight by ten inch pieces of high grade photographic film. These pieces must be packed in light proof cassettes - those boxes we see photographers shoving in and out of their box cameras. A long shoot might require over one hundred packed film pieces, all of which must be packed in a darkroom. Film packing might take up to several hours of time, and it allows dust to get into the film.

Techco produces photographic chemicals in a light proof cover but does not manufacture photographic film. The film cover idea was to purchase sheets of this film from a photographic firm, cut it, and prepackage it into Techco's light proof paper wraps, thus overcoming the packing problems faced by photographers. He tested the idea with friends at the plant to make sure the machines which packaged the other supplies could process the cut film, and they could with some slight adjustments to the size of the film.

Such a lo-tech product violated Techco's usual patent laden approach to product development, however, so the developer kept his idea sub-rosa for several years. However, during this time he picked up information about how these photographers work, what they needed in a film product, and whether they might be willing to shift from a supplier that at the time had nearly 100% of the market. In particular he learned how very concerned photographers are over consistency of the film - they often have to "reshoot" parts of a layout and need to be sure that the shades of color, for example, from the next day would perfectly match the previous day's work. If not, the entire set-up has to be done over. The product

developer bootlegged time on the assembly machines through friends at the plant to generate samples to give out for trials and get a sense of these photographers' acceptance.

The developer recounted a story which exemplifies his analysis of applications issues, especially the relationship and buyer concerns. This sort of film is processed in special labs, but Techco had no experience with film labs. The photographers in St Louis (a test market site) told the developer that if Joe the technician at X lab approved the film, everyone would consider buying it.

> *Joe knows more about E - 6 (emulsion process) than anyone, they said, so if Joe blesses the film, we'll all use it. So I went to the lab with a local field rep. At first the owner wouldn't talk to us because we're from Techco. He was 6'4 and 350 pounds, a real garbage can mouth, ... and he throws us out. So I shouted back from the parking lot "you'll look like a real xxxx when our product is out." He caught up with us as we were getting into our car and said OK. He took us back to the color lab and let us see Joe. Joe put the film to the ultimate test - the Budweiser beer can. They're real particular about that shade of red in St Louis; it has to be just so. Joe exposed the film and says its the best stuff he ever saw. We got there at 3:00 in the afternoon and didn't leave until 7:00.*

However peppered with hyperbole, this rich, ideographic sense of applications needs was incorporated into the planning process. Joe and his boss epitomized the issues around buying and brought them to life. This vitality infused the development process.

The developer recruited two others to play important parts in the product's development - purchasing and manufacturing liason. Each operated out of his own thought world but each also discussed the more comprehensive nature of the product's devlopment. The film cover developer contributed to their broader views by taking both of them on field trips to visit commercial photographers, thus expanding their usual roles, and both described these users in their narratives of the product's development. The purchasing agent discussed at length the ins and outs of his thought world - negotiating an agreement with a suspicious film supplier. The agent explained that the idea for the film cover product had "come out of marketing" but he felt his role was important because he was able to contribute rather than just carry out a narrow version of his specialty:

> *This was an opportunity for me to get in on the product side (and not only the after the fact purchasing). And Tailor and I talked quite a bit about procurement. It wasn't a we - they thing.*

The plant liason managed the specs for film testing and organized the manufacturing of the product. He had more reservations about the product at first because as he explained it was different from Techco's usual way of doing things. However, he said that as he got involved and saw the results of focus groups and market research he grew to understand the market for this film. He also felt actively involved in the product's development and gained a considerable comprehension of these commercial photographers' needs.

The film was a bootleg product for most of its development. It never did get fully formal and official approval, but senior management gave it verbal approval. The product sold out in the test markets several months sooner than anticipated, and so is being introduced ahead of schedule. According to the purchasing agent they may expand their work and do the same thing for other kinds of film. If the product continues to be as successful as it appears to them to be now, they may build on this experience and grow into new markets.

Prodco's roofing business is a much larger effort than the film cover and illustrates a group amalgamation of thought worlds instead of a one person embodiment of them. The roofing system comprises sheets of a flexible, water-proof material that are installed on the falt roofs of commercial buildings. Prodco had some experience with the technology in the sheeting because they had been supplying material for several years to another vendor who packaged it and resold it. However, Prodco people had no direct knowledge of the construction or roofing world. And the roofing world had very little idea of this material since at the time the vast majority of flat commercial roofs were made of asphalt. The use of such flexible material for roofs was still only a small niche of the total commercial roofing business because the material was more expensive than asphalt. But, following the oil crisis of the early 1970's, asphalt had become more expensive and was of less quality than before (refineries were "cracking" the crude more thoroughly).

A Prodco planner felt that the firm shouldn't only supply material to a vendor but should get into the business themselves. He developed a very thorough plan regarding the size and growth of this aspect of the roofing market using data from architects, the construction industry, and roofers' trade associations. The plan incorporated both design data from their earlier supplier role and applications data from roofing contractors to define the specfic needs that Prodco would try to meet. He tried to sell it to management for over a year, and finally it

was approved. Management also decided to pull the new roofing business out existing divisions and set it up apart, where more management time and attention could be focused on it. At this point the three thought worlds began to be fleshed out together around the plan. The engineer said:

> *They pulled me and two others into an office and said 'we're getting into the roofing business. You do the technical work, you do the marketing, and you handle the administration and sales.'*

They began with a very simple product idea. "You start off with a model T, a system everybody knows," said the engineer. "Then you talk to a lot of people, and see if you have to make a change, what would they like." The field person explained the same thing a bit differently: "We started small in the beginning. What ever needed to be done we did it." Simplifying ideas perhaps helped or allowed them to learn, like the simple process of being cursed at in parking lot in St Louis.

The participants also emphasized learning from potential users. The engineer described how he learned by spending considerable time on the road working with professional roofers.

> *It's like what Colonel Saunders says: 'We do chicken best.' Well, we do (material) best. I know what it can do - so it's a matter of marrying the technical knowledge to roofers' needs.*

He also described roofing as a "black art." "A roofer is a guy who comes out a of a bar in the morning, lives dangerously all day, short changes people, and goes back into the bar at night." As with the film cover developer and Joe the emulsion man, this engineer developed an ideographic and rich sense for the everyday lives of users.

Design and production issues were resolved based on actual needs. First, the material itself had to adjust to building movements and the thermal shifts, and still remain leakproof. And installation was a problem - a competitor was making huge sheets: "They weighed a ton and you had to put it on the roof with a crane · God help you if the wind kicked up!" said the engineer. So the Prodco developers looked into other ways to install the roofing system. "You can hold it down with rocks, or you can glue it on .. but that's like laying ten by a hundred foot sheets of formica." The engineer worked with a small contractor and adapted that person's mechanical system which also let them produce small rolls of material. This eliminated the

need for the huge sheets and allowed roofers to install the system fast and relatively easily, and still have leakproof roofs.

A field person explained that from his perspective:

We knew the numbers [although the planner had laboriously developed them] and we knew how to make the product [although the engineer claimed they had much to learn], but we sure didn't know anything about the day to day aspects of the roofing business.

His concern was to set up a sales and distribution program that also met roofers' needs - to work the relational side of the market issue. "Traditionally we hire young people right out of college and train them, but we had no one to train them in this business," he explained. So they hired experienced people from the industry, and "developed relationships," as he put it, with established roofing distributors. He pointed out that: "We learned quickly from these distributors. They were in the business for a long time and weren't bashful about telling us what they need." He explained that their extensive distribution relationship also gives them a way of "reading the market."

Perspectives of the three thought worlds, then, are evident in the product's development. The people manifested their own thought world, although they were clearly aware of and open to the views of the others. The engineer said:

The three of us worked very closely together, and we all learned at the same time. I call the marketing guy my technical assistant, and he calls me his marketing assistant. ..Each of us could see things in a different light.

They seemed to pull together their different views by building on them - how design affects the market, which determines specific needs which affects distributors which affects design. "You have to understand that you don't know everything," said the engineer. "You need to go back to highschool." It's not so much integration as a refusal to segregate ideas. In addition, they each seemed to have expanded their own perspectives a bit and felt that they actively contributed to the development.

The roofing product was introduced several years ago, and the business has grown to many millions in annual revenues for Prodco. The original threesome has expanded into a larger group, but they continue their collegial interaction. This has become more formalized into semiannual "innovation review" meetings which include all functions "several layers

deep." They continue to develop enhancements to keep their products from becoming commodities. The roofing group also remains separate organizationally from Prodco's regular businesses.

Compco's hotpoly began with a general application orientation and a strategic emphasis, but they also had all the parts, at least in general. A member of each thought world describes the kind of information they had at the beginning but from his own perspective. According to a planner, the product was a top down decision, a clear strategic shift for Compco. He also explained that the product came about because they saw a need. Customers were asking for higher performance from their technology, and hotpoly is a material up in the hierarchy of thermal plactics. A competitor had developed this particular material and was the sole source of it. Compco did not invent the material: "our culture is built on responsive service. We are good at developing and commercializing, but we don't invent." Moreover, he said that "we were also able to secure the basic technology plus we had access to the petrochemcial feedstocks."

A field person's description also captures this multitude of reasons, but he begins with the field's needs:

> *The product was not forced down. We got all this input from the users, and that was filtered up - 'we need something like this.' Then we explore the technology. Everyone recognizes that it satisfies a business need. All my people tell me.*

The technical person explains the same process from his perspective: "It was the market we had the most experience in, so we said why not advance our technology." He went on to explain that they are good at blending and mixing resins are are used to a fragmented market. "This product fits our capabilities," he said.

Each describes a complete definition of the product and its market, stressing their fit with Compco's abilities, their strategic importance, and how Compco can meet customers' requirements, but from his own viewpoint. Each thought world contributed.

Compco entered into a joint venture with another firm to develop a pilot plant for the material. This allowed them to work out the technology both for design and manufacture, and begin small scale production to make enough material to "develop" their market - to create and grow it. One missing piece, however, was a real hands-on sense for specific applications

or competition issues, and this allowed them to make two incorrect assumptions. First, despite their own very aggressive attitude toward competitors, they anticipated no problems from the competitor - the one with the monopoly. A market researcher recalls that they did an image study: "The competition was seen as being arrogant and high handed, everybody hated them. And everbody loved us." Rather than worry about the competitor, they were concerned that big buyers would rush to their new product and buy out the pilot plant (because everyone loved Compco). If so, they wouldn't be able to develop the whole market properly.

What happened instead was that the users did not all rush to buy the new material from Compco at first - buyers had to be assured of quality and reliability. And the competition responded by drastically reducing prices, thus altering the initial marketing task from holding back hords of customers to competing nose to nose for their business.

Second, Compco developers assumed that they would sell this new product to the same users in the same way as their existing lines, and so paid little attention to the relational needs for field, and, as it turns out, <u>with</u> field. Then they discovered that this new product was indeed very new. It fit into applications that they in fact were not experienced with directly. And instead of selling directly to molders, they learned they had to approach the end users' technical people and work with them to actually design the parts. That is, instead of just going to a molder who produces the computer outsides for Wang, for example, they had to go to Wang's design engineers.

In addition, technical and marketing were "dedicated" to the new product - people assigned to work only on it, but nothing special was done with field. So, when hotpoly was first introduced, field saw no reason to sell it, several said, especially since they could make much more money selling the old product lines. And they were not used to working so hard for just a small purchase. According to a planner, field had grown to expect the customers to call on them since Compco's main lines of materials were well accepted, so to sell a product with zero market share was a major culture shock for field.

Compco then adjusted the incentive system, brought in new people, and organized their applications development engineers (who had been set up recently) to handle the technical design work for hotpoly. All the field adjustments took about two years, but they have worked

it out. The pilot plant's output is selling at "what we should have expected in the beginning," said a planner, and they have come to appreciate the actually quite new (to them) users and applications for this new product. A small market development team shepherds the budding business, working out sales, production, and other problems as they come up. Compco people also have a task force meeting every Friday among the managers of all the functions to keep tabs on the new business's progress. "If there's a problem with a user, I know about it by Wednesday," said the technical director. Compco has been able to recover from their early oversight of field, perhaps because they did have the other market related issues of business and technology more thoroughly covered. They have now broken ground on a multi-million dollar processing plant to go into full production. Chemical plants make only one kind of material, so, as one planner said, failure is now out of the question.

Finally, Saleco's system I began in parts, in several parts of the firm. But these parts came together quickly. As noted, this kind of computer had already been introduced commercially by other firms, but the potential uses for and users of such systems were still evolving. Various Saleco people had been proposing that they get into this business for a number of years, but the projected revenues and returns never seemed large enough. Like many of the established computer manufacturers, Saleco continued to hover on the banks of this new computer business, sticking toes in occasionally but not taking the plunge. Finally, a planner projected that enough users would buy such a computer to make a big enough business for Saleco.

To make this big enough business projection, the planner built his plan in part on applications among business customers, so the initial projection began with a link to applications. "I remember looking at an add for (a spread sheet program)" he said, "and thinking to myself, this is the key." The planner took his "pitch" around the company with his boss and generated interest among management. He used a competitor's machine to display his projections, thus also displaying the applications possibilities at the same time. He stressed that trends all pointed to this kind of processor as an important growth area, and that the competition might grow into Saleco's main business if Saleco did not enter the market. Very senior managers approved the business idea. However, Saleco had no way to

sell the machines, because their existing direct sales approach would be too costly. So a "channels" task force was set up to look into the distribution problem.

Meanwhile, Saleco employees at their small systems division had been pushing some sort of small computer for years. One field oriented person had been attending electronics shows of small machines for several years, and even had what he referred to as his "pet system." Several engineers had put together a servicable machine using off the shelf parts. When the business plan and the channel task force's ideas were approved somewhere at corporate, the project was assigned to their location. The small systems people's field notions and design ideas joined with the plan. The planner explained that these people were waiting in the wings, and within a few weeks of approving the plan their machine came to light. But according to them, they were waiting for the corporation to finally see the light.

A small group, including the planner who made the initial projection, was formed to develop the new product. They were separated from the rest of the company and allowed to manage it as they deemed appropriate. The task group generated contributions from all the different perspectives of the thought worlds from the beginning with a simplifying yet vivid definition of the product and its market. According to the field leader of the project:

> *The first thing was to define what the product was, who would buy it, and what they would use it for. .. You have to get into the hearts and minds of the users. ..If you can't explain the product in thirty seconds, you're dead.*

From day one he said they emphasized the software plan, in particular the business software applications called for in the plan which were just then emerging in the industry - word processing and spread sheets. Another planner put it another way, and explained that they emphasized third parties such as software writers and retail stores. The applications or third party locus dictated what they term an "open system design." That is, the product itself was designed so that third parties could write or build parts for it. The final design was not new to the world, but as one put it, "a good, solid next step."

During this year of development the design team continued to learn and develop their product. They used an assortment of "user" inputs from focus groups, interviews, and the third parties. As one explained they learned to deal with the retailers rather than assume or expect them to behave in a certain way. "They were hacker oriented, so we thought if we

could deal with these people and reach office workers we'd have a good distribution system." Another pointed out that one large retailer was "very crisp" about how they would handle Saleco's product.

The following comment illustrates the kind of learning that went on, and also exemplifies the grounded and realistic sense of market issues which seems important to all the successful products:

> *I remember our first focus group. It was a riot. There was this man in a green t-shirt, long sideburns with a flat top, jeans, a big silver belt, and cowboy boots. He happened to be the president of the local micro club. It's frightening when you realize that on the other side of the one way mirror, there was a room full of men in (conservative business attire). We had to understand that that guy out there was our new customer. It took a leap of faith.*

In other words, they had to break out of their usual way of thinking, and make new kinds of connections among the aspects of "the market."

But the process was not all sweetness and light. According to one they encountered considerable disagreement between manufacturing and engineering, for example, because engineering kept making changes as the line (for manufacturing) was being designed. He said: "Each group clearly thought it was the key to the project, and Samuals (the project leader) in no way discounted that." And he noted that they had "many scary Saturday morning meetings, when we knew we didn't have (it) together." The different people did not ever come to understand each other fully, but the group as a whole, through its leadership, amalgamated the views. That seems to have enabled them to create the new product and its new market. The system I was introduced a year later into their new retail arrangements and became quite successful.

DISCUSSION

Four inferences are drawn from these data: that the thought worlds need to come together; that the process is inherently uncertain; that amalgamation constitutes an experiential context or environment; and that the organization's usual procedures prohibit such a context.

The Thought Worlds

When the development of new products is conceived of as patterns of thought world interaction, several implications obtain. First, the descriptions suggest that each thought world has a particular and peculiar contribution to make to the product's development. It could be that certain market related issues can be understood only from a certain perspective. For example, field's relational stance appreciates the ins and outs of figuring out who is responsible to buy the product and how to get to them, while technical's tactile approach comprehends matters of design. Or perhaps people's tasks motivate their views, like Lieberman's (1956) union stewards who became foremen, and adopted the pro-management attitudes. These possibilities remain to be examined in subsequent research, although I would hypothesize a combination of both. The data in this study do indicate that all the thought worlds are important, and each has a contribution to make to the development of a product and the concurrent creation of its market.

Second, when the thought worlds remain separate over time, especially as with the "leap" and "plan" patterns, they tend to assume away or "hold constant" the realities and uncertainties of the others. That is, technical people need precise applications data to design the product, and so will assume them when left to their own devices. Planners hold constant the design and application data into concepts as they figure out the market size. And field, once they get involved, keep changing the design to suit specific customers' particular needs. When one thought world is able to assume away the issues and problems of the others, it's members turn inward to concentrate on the potentially infinite regress of their own particular thought world. In the last enactment pattern the thought worlds played off one another, addressing issues that keep cropping up with knowledge or specialty rather than presumption. Amalgamation of the diverse thought world perspectives may be important for two reasons: it overcomes the penchant to focus on only some of the issues; and it facilitates the creative, emergent aspects of market development described in Chapter III.

Third, the patterns suggest that what the product and its market ultimately become is a function of the development process followed. Had any of the "leap" products begun as plans, for example, they may have become different kinds of products. Or had another thought world assumed dominance the product would be different, as the comparision of the e-mail

and voice services suggests. The ongoing emergence of these new product. 's also affected by the relative contributions of different thought worlds. This inference is perhaps obvious, but it does have important implications for the management of new product development. The complications of the process of new product development cannot be eliminated or programmed away, at least not entirely. But some of these complications arise from the thought world separation and so are manageable, at least theoretically. People can learn to pull various perspectives together, as the successful efforts indicate.

Inherent Uncertainty

These product descriptions also convey a more general finding - that ambiguity and uncertainty stalk the process of understanding a new market and developing a product for it. The implication that this finding suggests is that one cannot design a fool- proof product development process that works every time. Unexpected events turn up - distributors won't carry the product, manufacturing can't make it after all, the competition comes up with something much better or takes your design but manufactures it more cheaply, and so forth. Prodco's failed product brings this point home. As explained in the methods chapter, this product effort was not included in the detailed analysis because it took place over ten years ago and people's recollections are too vague. However, the general story highlights the problems of uncertainty, despite the apparently adequate planning and information gathering.

Prodco had been manufacturing industrial plastic films and "sheeting" for about thirty years - for example swimming pool liners. As an outgrowth of that, they began to sell such vinyl type sheeting to other firms who fabricated the pieces together and resold them as industrial pool or pond liners. The sheeting was waterproof and resisted corrosion from various chemicals and other wastes, and could be placed into the ground to make large containment areas. However, the particular material Prodco was using could not be exposed to the sun, and so had to be buried under twelve inches of soil. This process increased the costs of the pond liner product significantly.

Prodco was looking for another material they could process into sheeting that did not have to be buried. Various possiblities were developed by other chemical firms, and one in particular looked promising. However, Prodco could not process it on their existing

machinery, so continued to search for a material that would run on their equipment. Shifting manufacturing was not considered to be an option. Eventually another chemical firm developed a chemical material that was both processable into sheeting on Prodco's equipment and appeared to have "outstanding" properties, as a planner put it. The material could be exposed to the sun, it resisted the corrosive wastes, and it had high tensile strength. Since it was new, of course, no one had actually lined an industrial pond with it to test it over the long term, but it had been subjected to many laboratory tests, including long term sun exposure.

At the same time, according to a planner, they carried out an extensive market analysis at least of the traditional kind. There appeared to be quite a number of potential buyers and thus a large potential business. It is conventional in this business to guarantee the material over its expected life - in this case twenty years, covering replacement should the material fail. Since the material appeared outstanding and passed all their tests, and was thoroughly tested by the supplier, they guaranteed it. The new sheeting material was introduced in the early 1970's, and sales grew at a healthy twenty-five percent per year.

The first failure occured in California about three years later. That particular pond held only river water about three feet deep, but with a considerable amount of mud. According to the planner: "It started to crack along the water line. We were astounded... You had to see the holes to believe it!" This new material which withstood all manner of waste could not handle California mud. Upon investigation, they learned that this mud, which was very dark, heated up to over 190 degrees in the California sun if the water level in the pond dropped down, exposing the mud. Of all the tests they ran, they never tested for extreme heat resistance under such conditions. It turned out that the material held 5,000 pounds per square inch at normal temperatures, but dropped to 100 pounds per square inch if heated above 160 degrees for some length of time. It is perhaps only fair that this particular industrial pond belonged to the firm that sold Prodco the material in the first place, but Prodco had to honor the guarantee.

Prodco cancelled the product and spent considerable money replacing all the pond liners they had sold. With hindsight, the planner said they jumped into the business faster than they should have. The engineer said they never should have guaranteed the material for twenty years. Prodco also perhaps did not have a thorough understanding of industrial pond

applications since they had always worked through fabricators before. The planner said one of the things they learned from this experience was to not get into businesses where they do not have direct control over the end use. The attention focused on whether they could manufacture it also may have biased their judgement. The planner noted that the company has a tendency to sell what they can make rather than work back from a market analysis. However, they seemed to have had a considerable amount of "market information," indicating that data alone does not assure success. And one cannot really say that they should have anticipated this particular problem ahead of time.

Uncertainty may never be fully overcome, no matter how thoroughly "the market" is understood. Indeed, some of the uncertain products described above may ultimately become more successful than those labeled clearly successful here. This analysis indicates that having more information and amalgamating the thought worlds can help to handle that uncertainty, nothing more. An understanding of "the market" is constructed and created by people who work on the product development. This can be done with only a single thought world's insights, or with a broad array of input. The latter appears to be more fruitful. Thought world amalgamation seems to provide more checks, generate more trade-offs, and raise more nagging yet easily overlooked problems about distributors, manufacturing, software compatability, and mud.

What Thought World Amalgamation Consists Of

If thought world amalgamation is critical, especially for handling uncertainty, it is important to articulate what that "amalgamation" is all about - one cannot simply amalgamate unless that process is described further. The discussion in Chapter IV regarding the thought worlds indicates that their amalgamation or "integration" would be difficult since the diverse perspectives are like oil and water.

A comparison of the successful "cut it loose" products and the others highlights the properties of this amalgamation. First, in the successful efforts, no thought world dominated, but rather each interacted and pooled their information prior to introduction. In constrast, one thought world did dominate in the less successful efforts, and the interactions were limited. Information was scattered. Second, the definition of the market was based on applications for the successful efforts, but it did include the other perspectives. The definition

began simply, and "grew" into a more fully configured one. But the market definition for the less successful efforts tended to be based on an internal technical or planner perspective, and was more complicated from the start. It also became fixed. And third, the successful participants seem to have learned from realistic experiences with actual, real users that they all shared. The less successful participants did not adjust their views, and did not draw much on actual, shared experiences.

In sum, the successful efforts relied on a simple guiding idea or "commonsense understanding" of "the market," one which perhaps made sense to everyone, despite their diverse perspectives. Moreover, their market information was grounded and realistic, not specialized, jargoned, or abstract. The different people in the successful products participated in or or contributed to the product's development, and did not lose the "little shades of meaning" that the software engineer at Opco said got lost when information was specialized. The thought world "integration" consists of an experience-based context or setting within which creative and emergent processes, interactions, and uncertainties are allowed to occur. This situation or environment may the the product of a certain structure, but the enviroment itself is the goal. Drawing on the literature reviewed in Chapter I, the "cut it loose" products exhibit aspects of Burns and Stalker's (1961) "organic" style, wherein special knowledge and experience are contributed to a common task, individual tasks are "realistic" rather than abstract, these tasks are continually redefined, and control and communication are structured in a network and communal fashion. In Burns and Stalker's contrasting mechanistic style, specialized knowledge is separated into discrete parts, the overall task is an abstraction, functionaries concentrate on improvement of the means they follow, and control and communication is structured hierarchically. The less successful efforts seem mechanistic.

What amalgamation is does not describe how it happens. That can be approached by examining other factors which might account for the differences between the successful and less successful product efforts. These are: simple attribution errors in the data; differences in the products or amounts of resources available; team work and leadership; and other organizational factors. The so-called attribution bias refers to the tendency of people to make "self-serving" attributions for the cause of a phenomenon (e.g., Staw, Mckechnie, and Puffer, 1983). The attributions made by people have been included in the product descriptions above.

In a number of the less successful cases, people attributed the problems encountered to their collective selves instead of in a self serving manner to external uncontrollables. Given people's relatively open discussions of problems encountered, there is no reason to conclude that all attributions made are somehow false or biased. However, people's discussions of the organic type context for the successful efforts may relate to attribution bias, and so must be examined further in additional research before clear implications can be drawn.

Regarding relative familiarity or "ease" of assessing "the market," recall from Chapter II that several of the uncertain products were more unkowable, so future research needs to consider whether familiarity affects relations among the thought worlds. However, there are no systematic differences between the clear successes and the cancelled products on familarity, so this does not account fully for these differences. In addition, all of the cancelled products had at least one year's time prior to introduction, and four of the six uncertain products took more than two years development time prior to introduction. Relative time or resources do not distinguish the product efforts.

One might also argue that leadership and teamwork account for the differences, and it is true that the successful cases enjoyed both. But several less successful efforts also had leadership and teamwork. These just did not include all the thought worlds all the time. Leadership and teamwork are perhaps necessary but the substance and content of the contributions and joint efforts also need to be taken into account. One can imagine a well led team that overlooks most of the market issues.

One difference does stand out. In all four successful efforts the product developers were "cut loose" from the existing way of developing products. They were organized in separate project teams in three of the cases, but more than that, they violated the usual product development processes and procedures, and broke most of the established norms for doing things. In contrast, all of the less successful product efforts to varying degrees attempted to follow, or were forced into, the firm's usual approach to product development.

At Compco this different organization involved the entire firm from top to bottom. It included a new technical team (with many new hires), a separated marketing group, major use a new kind of field presence - application engineers to work with end users to help design

products (developed a year previously), and a weekly morning long meeting of everybody. This was all planned ahead of time. Said one senior person:

> *You need to baby (the new product). People in the main business are rewarded for how they do their old job. You must put such tremendous effort into selling the new product and you get a small payoff. ..It may take days and weeks to get a customer to buy the first box.*

At Saleco representatives from all functions formed into their own separate business unit. As one participant explained, this was a "different twist" - to put all the elements in one place. Someone who did not participate in the system I at Saleco explained:

> *The unique thing was they cut the system I team off from the culture. A few top executives decided to play Daddy Warbucks. They disconnected Samuals from the normal procedure of building business cases....*

The product champion at Techco for the film cover was a bit more devious since he could get no official support for his idea for several years. He did eventually get a verbal approval from senior management, but they dropped the formality of a written preliminary product approval plan. He also did not follow the corporate quality check procedure. "I went into the test market with no documentation. My career was on the line." He claims to have made up a "marketing evaluation approval" form which he gave to the vice president of quality control to sign. And as already described the roofing team at Prodco were also separate from the main business. They had their own charter and own division, hired their own sales people, and organized their own procedures.

None of the successful development groups had to answer to "the corporation," meet standard performance rates, or accomodate other demands of other business units or senior managers. The following comment from a participant on Saleco's system I product effort describes this separateness. Note that he explains it as an experience or a context, not as a matter of control, or of structure in the conventional sense of the term:

> *It was like when you go on vacation - you put your bathing suit on and don't take it off for two weeks. With the system I, we had our bathing suits on for a year.*

The implication of this finding is that the thought worlds amalgamated in part because the people got out from under "the organization." The flip side is that the organization's usual procedures prohibit amalgamation, force segmentation instead, and preclude creation and the

iterative trade-offs to handle uncertainty. If the "cut it loose" product efforts are organic as Burns and Stalker (1961) describe that style of organization, then perhaps "the organization" is mechanistic. The mechanistic style is inhospitable to creation and uncertainty, and chases out the "alien" mode of integration. The next chapter examines this implication.

CHAPTER VI

THE ORGANIZATIONAL CONTEXT:

EFFECTS OF THE INSTITUTIONALIZED WAYS OF THINKING AND DOING ON

NEW PRODUCT DEVELOPMENT

INTRODUCTION

The previous chapter concludes that the successful "cut it loose" products were organic in nature - the participants created the product and its market by pulling together the diverse information and thought world perspectives. But to achieve that, it seems that they had to escape the organization's institutionalized ways of going about product development. The less successful product efforts did follow the procedures in part, but did not generate as much information about, or integration around, their market and product. This chapter examines these findings and implications by addressing those questions about the organization found to be unresolved in the literature review. These are: How does an organization level orientation or management style affect the kind of market information gathered and the way the thought worlds interrelate? How might a large, established organization incorporate innovative product efforts in with routine activities? Each organization's routines for product development are first summarized, and then how the product efforts either coincided with them or escaped from them is illustrated.

The methods chapter describes how this analysis proceeded. To review briefly, people's narratives typically included discussion of the decisions made, procedures followed, organizations developed, and more generally what they "usually" do. Such discussions in each interview were coded for the following indications of how the perceived routines might have shaped the product's development: do they emphasize or encourage sequencing; what are the important decision criteria (e.g., revenue, strategy, fit with other products); how was the product idea "sold" around the company; did they routinely apply any generic product standards (e.g., quality, reliability); and, what other organizational barriers were mentioned for each product. An account of each firm's routines is built from these summaries of its employees' comments. In addition, related aspects of the firms' histories as described by

people interviewed are woven into the accounts. These analyses do not constitute full blown cultural summaries, but rather focus only on those institutionalized ways of doing and thinking that concern product development.

The basic findings are that the routines deal with known markets - they eliminate uncertainty by eliminating the emerging future possibilities of one or more of the thought worlds. They seem to be more mechanistic than organic in essence, despite their matrix structures and project teams, because they foster specialization and organization, and thus separate the thought worlds. This process effectively shuts down the creative iterations among thought worlds which seem important to a comprehensive view of the new product and its new market. Each organization shows a strong tendency to apply its routines to all product efforts, thus treating new products like old ones.

ORGANIZATIONAL ROUTINES

Each organization in this study is unique, and has its own way of product development. Two of the firms are "market oriented," and two are very technologically innovative. Two of the firms are very flexible and decentralized, and one puts NASA's complex project management to shame. However, as will be described, each one's routines sequence and separate the thought worlds. The implication is that any orientation, be it a "market orientation" or a "technical orientation" may be unbalanced or unidimensional. Thus it may overlook important information and preclude needed learning.

Compco

Compco produces chemical materials and plastics. The people interviewed referred to their firm as a "market driven," aggressive, applications focused company. Their marketing department occupies the floor directly below the executives, suggesting its relative status, and one person called it "the power floor." Their aggressive applications focus emerged from Compco's early days as a new materials provider when they provided a solution to a customer problem. About thirty years ago Helena Rubenstein cosmetics invented indelible lipstick, which became quite popular. The new cosmetic wreaked havoc at AT&T's Western Electric, however, since the lipstick also stuck indelibly to the consumers' phones. Western Electric

searched for a plastic material that resisted the lipstick, and Compco's new materials did the job. Compco's materials had several other desirable properties and fit into an array of other applications. One of the firm's planners explained that from this start: "For years we were preoccupied with growing our main business." Their original material and related enhancements are now used in a variety of durable goods in addition to telephones, from sewer pipes to power tools.

Two pressures seem to have encouraged Compco 's strong market and field emphasis - the way applications are created in this business and the nature of the competition. Plastic like materials replace wood and metal, but all plastics cost more than metal. One replaces a metal application by showing users an economy in manufacturing if they switch from metal to plastic. Injection molding, for example, eliminates the need to machine metal parts and weld them together, so the overall price of the manufactured part goes down. The seller needs to understand how the user works to explain these economies - to be field oriented. A product manager summarized their focus as follows:

> *If you're not in the inside [in the customer's shop] with a product and talking on a daily basis with their engineers you're not going to have a good feel for their needs. And also you can tell by the way their requirements change what the competition is doing. You need to get in with a material, get your foot in the door.*

In addition, the plastics industry has a number of firms vying for business, so Compco has become very competitive. A Compco planner explained that automotive manufacturers, who constitute an important market, establish materials for production three years in advance. The competition for these very large orders of materials is "like a bunch of vultures." When they try to get a contract with an automotive firm, Compco only has "one or two shots in trying a material," according to a technical person, because the "window of opportunity" to test out their material is small, and the competition is ever present. Thus, he explained: "field is under a lot of pressure to hit a time window for a particular application .. If we're late (the customer) won't even look at the material." Speed and quick turnaround have become standards.

The way Compco approaches their technology and operations complements this field orientation. An engineer described the firm as "master mixologists" - they are good at melting and blending raw materials, but are not strongly technical. "Our culture is built on

blending things in many different ratios and putting in other additives .. we're a responsive service oriented company." And another technical person explained: "That's the kind of company we are. Give us a sale, and then we'll work weekends to produce it." All of this has been done, according to another, with the same manufacturing technology, which has shortened the development time. When asked if they would invent something, a planner said no - Compco is very good at taking existing applications away, not good at new applications, he said.

In the process of establishing themselves in this market their product development efforts have become rather highly organized. They control the technical uncertainties in product development by confining their activities to a certain range of polymers, and by sticking to a certain manufacturing technology. Within these ranges, application possiblities are given free rein . "New" product development has become routine. One engineer explained:

> *We have a hundred grades of XX. If we bring out a new fire resistant variety that*
> *also is more resistant to florescent light we don't need to treat it as a new product.*
> *We just announce it.*

As part of this now institutionalized mode of product development, ideas for "new" products come from field. Another engineer explained:

> *If the salesperson works with a customer, and the material doesn't work properly,*
> *they call in a technical guy to change it. You know 'eye of newt and hair of frog'...*
> *We see if it works and if it does we give it a new name.*

They have become collectively very knowledgable of their main set of materials. Product development is almost automatic: field comes up with the idea through customer problem solving, thus already establishing a market, and technical develops the necessary material if they can.

One field person outlined the flow of their market enactment with this diagram of their typical organization for product development. It'a all geared to hitting the small window of opportunity they face in making sales:
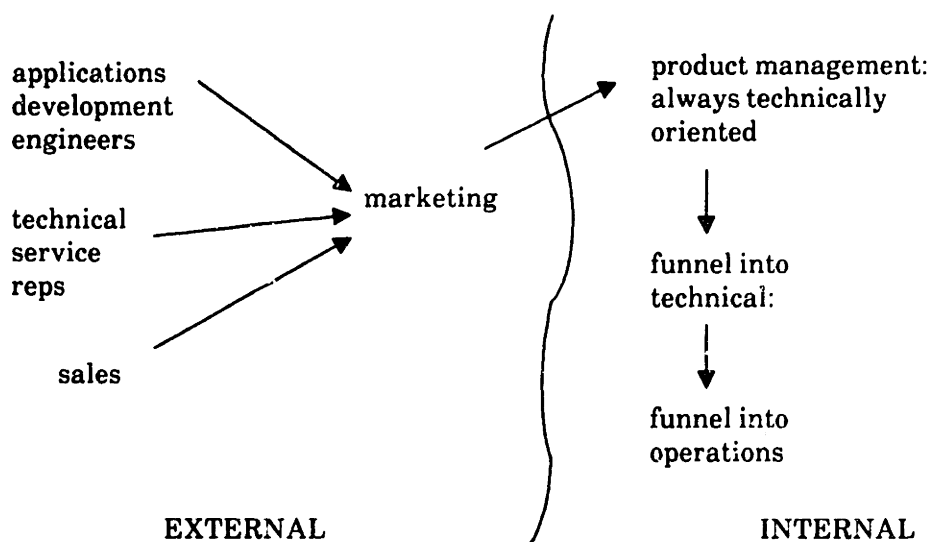
The left side of the line represents the external world and the right side the internal, he said. Note that the flow of ideas or input, as he sees it, is from left to right. Marketing is outward looking and puts things in terms of people and their needs, he explained, while product management is on the inside. They are the ones who translate market ideas into technical terms. Another engineer explained: "Normally, we [in technical] do finished products only." The diagrammer noted that they have a built in adversarial relationship between the two sides - marketing always wants new products and product management always says they don't need them.

This procedure is well institutionalized, and it coordinates the thought worlds seemingly rather effectively for their established businesses. They do not need to recreate a framework of understanding each time. Market knowledge has become routinized, and attention is focused on a very important issue for such a capital intensive firm: do we really need another grade of material? Market research per se is confirmatory, and rather cursory in any case since they already know the market. "Integration" has become a coordinative routine.

Field proposes, technical disposes. But the failed hardpoly was developed by technical on their own, contrary to routine. An engineer with no particular application in mind wanted to see if he could solve certain of the technical problems with the material involving flow and color stability, and he did. As discussed in the last chapter, hardpoly is different from Compco's regular lines of material. When the engineer casually flashed sample plaques of hardpoly in front of some field people, the latter had some applications in mind that this

material seemed perfect for. Another technical person explained: "Field is under great pressure to hit a window,.. so when Carter flashed those plaques he made, field said 'Oh boy, let's go and sell it.'"

Despite its unusual beginning, hardpoly was treated like just another grade of the main material. Compco set up a project task force as outlined above. They developed a plan which consisted of dates when various people would do various things, for example work out some technical issues, do field trials with half a dozen customers. According to the technical person in charge of the project team they ".. did no fancy market research." From his perspective market research consists of :"Somebody goes and develops an application and gets their plastic used." This was just another task force, following typical procedures used for all enhancements to the basic material. The people were assigned to it in addition to their regular duties, and no one, according to the task force leader, felt any priority pressure.

Because the material was assumed to be "normal," attention focused on its apparent abnormality - it could not be manufactured with existing equipment. Said an exasperated engineer:

> *We need to make it on a specific kind of equipment.. The development work had lab equipment but not production equipment. I had to spend lots of my time proving we can't make it on our equipment. Engineers (with the main material) couldn't understand why we couldn't make this stuff...*

So, instead of determining what properties are needed to fit the material to certain applications and then whether the material could be fixed that way, technical concentrated the little spare time they had on this manufacturing "problem." Meanwhile, field needed something and thought this was a finished product developed in response to a request from users or field, as usual. So they put it into an application which required, in addition to the hardness, a higher heat resistance than the material possessed. It failed. One other person said: "We have a very good system. But it broke down in this case." The system broke down, I suggest, because it wasn't suitable for this new product. But the process is so thoroughly embedded in everyday practices and thinking that people fall into it. Indeed, it is important to note that each product development, even if it is "merely" a well understood enhancement intended for a known market, requires a complex orchestration of perhaps hundreds of people and millions of dollars worth of equipment and processes.

In contrast, Compco deliberately separated hotpoly from their institutionalized ways of doing and thinking about product development from the beginning. They pulled it out of the routines. The product was defined as new and special, and according to one not directly involved with it, the company made sure everyone was committed and understood its strategic importance to the firm. They also concentrated on their relatively weaker part, technical, and set up a team of engineers who would work full time on this material. New people were also hired in technical and in marketing. But, as described in the previous chapter, the revamping was not thorough enough. The one part they did not deliberately change up front - the field organization - caused considerable problems and delays. In time these units were also reorganized by assigning some new tasks to new units, training, and developing new incentives for all.

Insights from one of the new people illustrate quite vividly what these changes were all about, and how they are more than simply restructuring or redeploying people. Despite the magnitude of the change effort and clearly articulated commitment from senior management, he encountered the pervasiveness of the organization's existing routines:

> *Getting a new business started is like giving the company cancer. At first, we were very small and off in a corner and nobody cares. But as we started growing we started causing changes - in the accounting system, in scheduling hourly employees at the plant, in capital purchases, in service requests, in lead time requirements.. The people who schedule the plant - I had to beat them up side the head with a two by four.*

His comments also imply that the people were not only being deliberately recalcitrant or wielding power. They were also doing their jobs, and were confused over the new activities. The following comment suggests that the cognitive and experiential components of work are also critical:

> *Where people are dedicated [devoted full time to this product] it ran like a Japanese watch. But when you share people's minds (with other tasks) you have problems. I had an attack squad of two people. We would work with people hour by hour until they understand why we are doing this.. what is the strategy, what is the commitment... You take them right back to first grade.. Once they are indoctrinated it's no longer different and frightening. It's just one of the things that they do. The transition takes six to nine months, and it's always upsetting.*

Once the established routines are taken away, people do not know what to do, at least not collectively. Reorganization, then, also means the recreation of a collective understanding. This person also said:

> *Everybody keeps talking about assimilating hotpoly within the organization. It will happen, but it won't be the same organization.*

Saleco

Saleco, a computer manufacturer, is equally "market oriented," and also emphasizes close working relations with customers. Saleco built up several niches of the computer equipment market during the past thirty years, and has maintained its share of them. One senior person explained that until about five or ten years ago, most of their customers used Saleco products in data processing installations. These were almost turnkey operations which comprised "self contained" equipment that needed little adjustment by the customer. So, for most of their history Saleco dealt with customers through a highly knowledgable sales force that worked directly with users to manage their information systems. The sales force embodied applications knowledge - those selling to the chemical industry were chemical engineers, for example. Their installed base of customers was small enough that the sales offices could maintain indepth profiles of all accounts. They could track "product deficiencies" and evolutionary needs of this installed based in considerable detail. Another planner explained:

> *Saleco grew up as a company that sold through direct sales. We knew who the customer was, where they lived, what their business was, what their needs were, everything about them.*

And a third said: "Saleco is a high customer contact company, not a marketing company."

A reflection of their sales orientation is embedded in some of their lingo and interaction norms. The Saleco people all referred to interactions up the hierarchy as "pitches." And a number of people interviewed had overhead projectors in their office. During the interview they would either roll out from behind their desks to flash up a slide, or at least hold one up.

Because Saleco product developers knew so much about their installed base of users, they could anticipate "new" needs in these businesses quite well - a simple matter of more "feeds and speeds" said a planner, referring to input, processing, and output of the systems. Another

explained that market research consisted of going out and talking to ten users to see what the wanted, or to ask them if they liked a new system idea. Product development became evolutionary and fairly highly organized. According to a planner, they would look at the price - performance curve, and the driving objective would be to come up with a new product that sits on the line further down. "We would know what the product requirement is, and must invent nuances on the technology to do it." The other issues would follow readily - production, service, installation are all easily extrapolated from existing systems.

> *The market requirement would be in a fairly narrow corridor - a given volume, price, and revenue expectation. Technical is given a narrow planning corridor, a small risk, and a good certainty of demand.*

He likened their product development process to the catering business: " When you want to expand, you just add more rolling carts." Another explained: "For the past twenty-five years, we added economies of scale to the same old products."

In addition to this evolutionary mode of product development, Saleco's product development process itself is extremely complex. They put together computer systems which may comprise over thirty distinct sub products, whose joint development must be managed interactively. Moreover, many of these subparts must fit with existing products - new software must run with old products also, and so on. Another planner explained:

> *It takes fifteen people to develop a product around here. Five to work on the product and ten to deal with the rest of the corporation.*

Compco routinely coordinates thought worlds around the critical trade-offs of manufacturing, while Saleco routinely coordinates them around the mulitiude of specific tasks, in a multidimensional matrix structure. Again, "integration" is a structure or shell, not the more organic context described in the previous chapter.

So, despite their close relations with customers, Saleco's institutional elaboration of product development activities has produced a kind of inward orientation. They know the customers and have embedded that knowledge into their routines in order to concentrate on the more vairiable (to them) technical issues. To manage the very complex multidimensional matrix, they have evolved fairly precise standards for both business and production. For example, margins expected from "new" products must meet a certain level to absorb the overhead produced by the extensive and expensive field staff. The operations level people

interviewed at Saleco perceive this concentration on business planning to be a primary requirement for new products. As one sees it: "Top management is interested in the financials first - revenues, profit, return on investment.." Another explained, "when you have an idea, you get hit with a return on investment, a return on equity, and corporate says 'what do you mean it will only make a hundred million dollars?'"

Manufacturing has also become standardized, with high standards for product quality and reliability as the norm. "We build products you can drop off a ten story building," one planner said. And several manufacturing people noted with apparent pride that they wouldn't drop the price on a new product because that would force them to lower quality checks - something out of the question, even if competitors were doing it..

One market researcher exemplified this inward elaboration when he said that he explains market research to others in the organization with a chart that lists customers at the top, then distributors, and then the product (the implication of the chart is that since they are now using distributors they must use market research to know the customer). He said, "corporate has the same chart, but theirs has the product listed at the top."

It is such a carefully orchestrated, standards following, inwardly focused routine that was violated with the successful system I and followed in the cancelled system II. This contrast can be seen best by comparing the system I process with its follow on failure. As described in the previous chapter, the system I team was "cut loose," "disconnected from the normal process of building business cases." The impetus to be cut loose came from the team members themselves, but was approved by the highest levels. "It was a good piece of work," said one who helped prepare the "pitch." "They went up to senior management - it usually takes forty-five minutes but this lasted four or five hours. The presentation was all tabbed and indexed, the charts were hand printed..."

The system I violation of routines occured in three ways: the product itself, and how it was designed, manufactured, and sold; the people; and how the people were integrated. First, the software for the machine was developed mostly by outsiders, and because of its rather low price it had errors in it. Saleco had never allowed outsiders such freedom before, and had never been a party to anything with errors in it before (at least not deliberately). The machine was composed of off-the-shelf parts and components bought from outsiders, some of

which could not be dropped off ten story buildings. And it was designed as an open system that nonSaleco people could piggy-back from. They even published a book to attract scientific and engineering applications. They followed a short, fast development cycle which had less than usual product testing. To indicate how new the technology was to the people working on it, another planner explained: "Saleco spends zillions of dollars to train employees, but the knowledge we used to develop the system I was acquired totally independently of Saleco's education effort." Moreover, the system I team had their own "channel" - they were not going to distribute the product with or through any Saleco people. "This was the first time ever that Saleco let some one else sell their products," noted one participant.

Second, the people who worked on this team also differed in their own way. According to one person who did not work directly on the team, most of the original twelve team members "were not high potential, were not high flyers.." A team participant explained:

> *Most everyone involved had nothing to lose. They were not on their way to the top, they had all run into barriers. (the field leader) didn't have patience with the system, I was bored to tears with my present job, (the engineering manager) felt boxed in, (the team leader's) previous product had been one of Saleco's all time failures..*

They were corporate deviants, like a cancer, to pick up on the Compco market developer's metaphor, or perhaps a benign tumor would be better.

Third, the team was organized in a new way. One participant explained they were fully integrated within, and operated out of a separate enclave: "You had to have a special badge to get in the building." Another indicated that they followed a creative, iterative process, unlike Salco's usually well organized process: "It was all evolving very rapidly and we constantly adjusted." A third participant said: "We never knew when we would ship until we actually did." And a fourth noted: "With the system I we had no formal business plan but everybody knew what it was. We never wrote anything down except what went to the management committee." Recall from the previous chapter that one person characterized the experience as a vacation - it was as if they were away from the usual goings on, and wore their bathing suits instead of regular clothes.

To show how truly overwhelming the normal process can be, one person explained that he and another still had to meet with others in the company. In one two week period he said they

gave fifty-six presentations between them. Usually, such interference from others would go straight on directly to the people who work on the product, but because they were cut loose, he could cut it off at his point. "We got calls from everybody. Marketing couldn't believe we weren't going to use their channels, purchasing was worried, some wanted to see the drawings, another division wanted to use the product in their system ..."

But less than a year later, the small systems division started the system II with their regular clothes back on. The number of people working on the first system and its follow-ons had grown to several hundred, and many people with no experience with such systems joined the by now very large group. As noted in the previous chapter, one person said they had no "group think" anymore - they had lost what ever it was that made them a special enclave. In hindsight people also said they had become "too smart" and carried away with their success. In addition, however, people's descriptions of how they went about developing the product sound very much like Saleco's usual well orchestrated, carefully planned, "rolling-cart adding" product enhancement procedure. Unfortunately, what makes that procedure work was missing in this case - they had no precise description of the buyers. In fact, system II was targeted at home users, people Saleco had absolutely no experience with, and in that sense was newer than system I.

An engineer diagrammed their organization as follows:
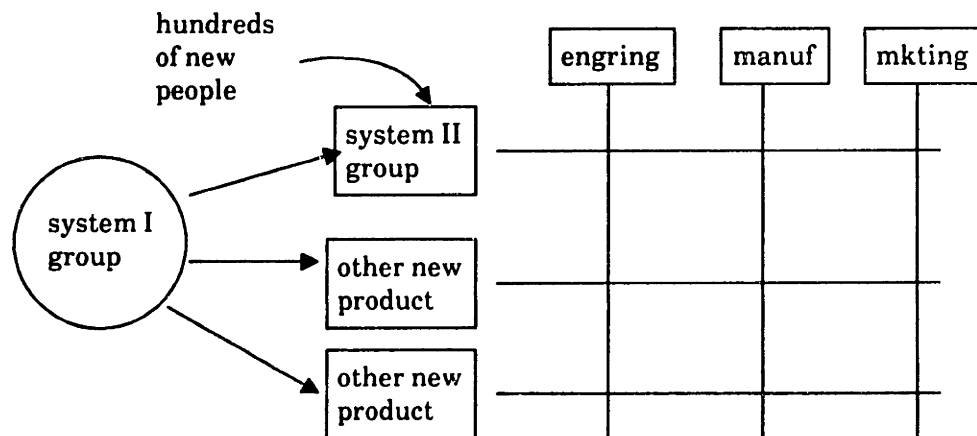
He put the system I people in a circle, but depicted the others with Saleco's usual matrix organization. As he explained it, they began the system II with a "firm charter" (a set design), and the product moved sequentially through the units. According to a planner: "We picked the technology from the learning curve to be ready when we went out." Manufacturing did set up what they consider to be a very innovative kind of organization in this matrix-mad firm - a hierarchy. But they assumed the initial design and plan was correct. "We built the product exactly as designed - that's nice from a development standpoint to a have a firm charter at the front end. But it may not have been accurate.."

The planner shifted to a general description when he described their process: "In the initial commit, you have a schedule. The closer you get to introduction, the more complex the process becomes." The orchestration of related parts is very important - power cables, key board, CPU, publications, printer, disk drives, memory expansion, operating system, packaging for it all, etc., must come together. He described their "PERT parties:"

We'd put all these parts up on PERT charts, and we'd rent a big room at a hotel and go through them - whoever is accountable for a stage or step would say where they are.. and we'd negotiate glitches.. We'd stay until 1:00 in the morning.

It appears that Saleco slipped right back into a variation of its usual routine for product development. This routine overlooks the examination of specific applications since it is built around a known market. As with hardpoly, this new product didn't fit into that routine. But the old institutional ways of working creep in, even when they don't fit, because of the complex coordination needs that exist. Some kind of procedure is necessary. Not surprisingly, most of the participants claimed that system II was a great performing machine for its price - exactly what Saleco's routines are designed to produce. Several contiunue to use system II, or parts of it, even though Saleco has since developed adavanced generations of the technology. But no market was waiting for system II when it was introduced.

Saleco, in fact, did institutionalize independent business units modeled after the successful system I. However, these have not guaranteed new product success, since not all have been successful, the system II being a notable example. They institutionalized the "structure" as the term is used in management - decentralization, participation, etc. - but not

the experiential context. It seems that one cannot fully institutionalize innovation, but can only hope to create the context for it.

Opco

Opco, an operating phone company, has also concentrated on its installed base of customers like Saleco, but their relationship with customers has been mediated by two other pressures. First, Opco provides service to a mass market rather than a few thousand end users, and so "knows" customers through abstract analyses and statistics. Second, Opco historically has been under government regulation in certain of its communications businesses, committed to providing continuous and "faultless" service without regard for cost (except as governed by utility commissions). Both of these emphases appear to have prompted in Opco a greater concentration on operations and analyses of them relative to the other firms in this study. Audit trails are required for most activities, and each program undergoes a quarterly "operations review," which focuses on financial analyses. Executives are also reviewed every quarter. One manager explained:

> *The company is very risk adverse. We avoid losing money, and so keep changing the story. If we know you won't make money until thirty-nine months out [with your new product] we may still ask in six months `hey, why isn't this making any money?'*

The short term focused, operations emphasis perhaps matched the regulated environment, but deregulation has opened up new product possibilities. In the past few years senior management has been pushing for more innovation. As indicated earlier, the two Opco divisions included in this study are among the most innovative ones at Opco as well as in the entire study. But Opco is the most "bureaucratic" of the organizations, so the relationship between these product development efforts and organizational routines illustrates more than any others a mix of leading edge technologies with a Byzantine organizational bureaucracy.

Plans for the introductory test market of the new voice service reflect this odd mixture. First, they simply bought the technological capability for voice store and forward processing from a vendor who was first to commercialize hardware. The vendor's hardware and systems were not designed for a continuous service operation, however, which is what Opco planned. So the product's design was removed from applications from the start - indeed the machinery

broke down regularly and was very difficult to enhance. The director of operations said it was a good thing they did not sell much in the beginning because it gave them time to become thoroughly familiar with the machinery.

Second, the preintroductory planning carried out by the corporate staff called for the usual statistical and analytical reports to be filled out with the usual data for regular communications service enhancements. The corporate planning staff concentrated on such routine operations issues as advertising and mailing, sales efficiency ratings, operating expenses, and financial flows. Recall from the last chapter that these data failed to deal with the possibility that no one would want the new service. The reports from the test market (in the files) also described in some detail why certain potential users were uninterested, or what others really wanted in a new communications service. These were very qualitative data, not abstract, but they contained some user requirements and other relational information. No effort seemed devoted to sorting out these various applications possibilities, however. Plans were separated automatically from applications. Coordination ensued at Opco from the plan itself, and the thought worlds "interfaced" around the analytics.

While the field group was madly turning up applications, the corporate staff concentrated on the development of what were called "market modules." These detailed modules concerned competitor analyses, demand analyses, forecasting and pricing, market research, sales efficiency - e.g., revenue per selling time, selling time per total time, and usage estimates. These analyses may have been very useful if the product development effort concerned a tractable enhancement to the regular operating system. As far as could be ascertained from the files however, all this effort never resulted in anything. After all, they didn't have any data to run through their modules. Another little example of misfitting procedures occured to those who managed the product itself. They had to run the billing for the few hundred users of the new service through the regular operating company's system designed for millions of customers. "It was like mowing the lawn with a D-9 caterpillar tractor!" said the test director.

This is not to say that the people involved blindly applied inappropriate or silly planning steps. A number of notes and memos in the files indicated that various people at Corporate questioned their planning tactics. For example, the person in charge of developing the

modules drafted an early memo that indicated certain problems. The memo stated that, due to the very short time frames established to get the voice service test up and running, some of the groundwork for research and analysis was not completed. The draft said that the sources of information for the modules were not clear, and requested "effective project management" to help pull all the information together. Two other more senior people revised this draft and both redlined these sections (their drafts were in the files). Why is difficult to say after the fact. Perhaps admissions of improper planning may have been politically unaceptable.

More importantly, it seems that the people pushing for the new product knew that this traditional operations review approach would be an empty ritual. But they could not escape the exercise because there was no other "system" available, no other way to orchestrate the multimillion dollar purchase, set up the test, hire the new people... It is important to appreciate the product instigator's uphill battle. He explained that the only way the new service was approved is because: "I kept shouting. Opco doesn't have a unit that encourages the introduction of new services, so any one who has an idea has to really push."

The director's recommendations to continue the service at the end of the helter skelter market test also followed the usual operations review modality. Topics of his report to management were:

> likely length of the product life cycle;
> cost/price trends;
> synergy with other offerings;
> time window for market entry;
> competitive product offerings;
> overall likely market size;
> importance of the emergence of interfaces and other technical standards;

These issues are important, of course. The point is that the review overlooked applications matters almost entirely, which fits Opco's operations orientation.

It took over nine months to reach a final decision on the new product after the year long test. According to the director:

The project wasn't approved until September. They kept saying 'prove it, prove it.'
People in corporate planning talk big and they have big charts. But when you
have a concrete idea they chop it down. .. They have a tendency to be very cagy.

To distance himself from these people, he packed up and moved out of Corporate headquarters, exemplifying the lack of fit between the routine and the new. He explained his contests with corporate staff as follows: "I would say let's make it happen [an open, creative view], and they would say show me the data [a predetermined view]."

Rather than bureaucracy run amok, however, one can infer that the problem arises because processes for the existing activities simply do not map onto the new product's development. The same discontinuity is reflected in comments from Saleco and Compco people, where the bureaucracies are of a different nature. A Saleco person said:

Corporate and group staffs can raise so many issues that all you do is deal with
the issues and not work on the product. They consume your talent... You have to
staff up to deal with them..

A Compco person said simply that when everybody starts second guessing you the project is in trouble. Problems are not caused only by the nature of the system - its formalization or centrality for example - but because it does not apply to or does not make sense of new and different activities.

Opco's data division people spoke directly about this discontinuity. The e-mail developers chose to avoid the traditional planning process entirely, and sneaked their product into the market. One explained the situation back before deregulation:

Within Opco's corporate environment, if we went through the normal business
planning process of the type Opco management was accustomed to getting, it
would have taken a year to produce, and the service would never have been
launched. It's been my experience over the past 5 or 6 years that there are so many
levels of approval and such a high degree of risk aversion that no one wants to be
associated with anything risky. And because of the multi-level approval process,
the system is unforgiving.

However, the e-mail developers concentrated on the technical thought world at first, as described in the previous chapter. That coincided with their own more technological approach to product development, so violation of corporate routines does not assure that all the thought world perspectives will automatically be amalgamated.

Most of the data division's product development efforts reflect Opco's emphasis on planning and concommitant avoidance of applications issues, as described in the previous chapter. However, the data division also faces altogether new markets, and so virtually has no routine of its own to even fall back on. Their procedures reflect the larger corporation's segmentation and specialization. For example, people at the data division are segmented into distinct roles - one person handles "position," one "place," one "price," and another "promotion" (the four "P"s of marketing are divided). And the people responsible for planning a product are not those responsible for selling it. At Opco, these operations focused analyses seem to have permeated the organization to become the structure within which everyone operates.

Techco

Techco, the chemical products maker, is a technology driven company. Techco began with a chemical based invention, which was patented and converted into a stream of successful document related products. The firm grew quickly as it devoted its first several decades to the development and enhancement of this technology. The founder, a Ph.D. chemist, approved all new product ideas, even after Techco had grown to a large size. He was a top down champion and stressed the technologically focused, design related attributes of uniqueness, quality, convenience, and low cost as standards for all products.

These product attributes still apply to all Techco products, and still serve as their "definition of the market." For example, when asked where the idea for the product came from, an engineer with the CRT device replied: "Our job is to create a good quality hardcopy at a low cost.. Techco is in that business - the best performance for the lowest cost." A manufacturing person also explained:

> *(Under the founder) the company was very much product oriented. We develop it and then worry about selling it. We felt we were developing unique products and they would sell themselves.*

And another:

> *(The founder) always said to make unique products that are special to the public. Techco should only do things that we can do better than anyone else. It's a philosophy to do only unique products.*

The founder left some time ago, but a technical orientation continues to dominate the firm. One engineer explained the product development process: "Technical dreams up products and marketing figures out how to sell them." A marketing person said that they were a very "tactile" company, in keeping with the technical thought world domination:

> *Management is very tactile. They respond to things they can touch. When you have an idea, the best thing you can do is make it and show it to others. It has been a company that is very product oriented. The cultural base of Techco still says 'gee, that's neat!'*

Many of the people interviewed, in fact, gave me pieces of material to touch or feel, or showed examples of the hardcopies - much more so than at any of the other firms. This tactile approach also permeates their market research processes. One engineer explained: "We always find that if you have a concept of the product you don't learn what people want until you put the product in their hands." At Techco, market uncertainty is controlled through invention - if it's neat and unique, everybody will want it.

The product development process and organization typically employed at Techco does involve all the units, as do those of the other firms reviewed. Marketing, manufacturing, engineering, and quality all participate. As an engineer put it: "they all have an axe to grind." However, like at the other firms, the process facilitates the coordination of specialized activities, not their convergence. The process usually begins with technical and "rolls up" into the other units as their specialized tasks become critical - that is, when it's time to determine the size of the market, market research gets involved, when it is time to ascertain prices, business planning gets involved. In fact, some technical people may seek to avoid inputs from the business and field people. One explained that the thing to do is hold off the preliminary planning step as long as possible, especially if you have some flexibility in your budget. Most of the planners claimed that Techco is becoming more "market oriented" - these products all began several years ago - but the technical thought world still seems to dominate.

This tactile and technical focus can be seen in the medical hardcopy development process. This effort was the least routine of all the Techco products (except the film cover), but it still followed the routines in large part. The medical hardcopy deviated from the routines in that

it began with a plan and a new strategy rather than as a technology. But, like the melted hardpoly, Techco then treated it as a typical product development, which typically is manufacturable. This one was not. The developers began a period of "selling it around the company," and when it was approved they followed the usual planning process. A Ph. D. chemist was assigned as project director, and the team, which included people from all the functions, began to carry out their specific tasks.

The hardcopy system was the first to be processed with their new "quality" assurance, or "fit for use" analysis, which emphasizes production. A technical person explained that when Techco did on occasion start the development process with planners, they found that products which then got designed could not be made, or that they did not do what they intended. But he still sees "user needs" as something clearcut, as his comment suggests:

> *If we know who the end user is, marketing ought to be able to sit down with them*
> *and write down their specs for the product.*

The comment suggests that applications will not emerge, they will be spec'ed. While it is clearly important to assure manufacturing quality, doing so does not assure that all the thought worlds may come together, or that the emergent enactment which seems critical to new product/market creation will occur.

The other less successful products at Techco also generally adhered to this institutionalized, technology/product orientation toward product development. The battery, CRT device, and video devices emerged in the design lab, and each had to first pass muster there. "We had to sell it in engineering first," said the video engineer. And the latter two faced problems with "quality," one of the strongly engrained standards for products. For example, an engineer with the CRT device described the quality needs of the projected customers in some detail, which suggested that he knew quite a bit about these users:

> *The big issue was quality. It's easy to identify quality when you have known*
> *needs. We spent a great deal of time hassling over the quality. That's the whole*
> *deal. When you make a slide presentation you want it to look good. When it's*
> *lousy, it makes you look lousy.*

Yet, when asked to explain who the customers are, he said he didn't know anything about them. An engineer who worked on the video device complained of senior management's concern about the quality of the device's output. He said that the quality was caused by the

inherently poor video electronic signals, but that management applied their chemical quality standards to the product.

The battery did not face the "quality" problems which apply to documents, but it did not "fit" market needs at first. The battery did not deliver the same amount of energy as the batteries it was intended to replace, so Techco chemists redesigned it. Following the redesign a planner explained: "Now it met market needs, plus it delivered all the other qualities." Yet he noted with some surprise : "It had all these unique properties, but it didn't sell."

The film cover began as a solution to a user's problems, and so was contrary to Techco's product focused approach. It was also not "unique" in that nothing was invented for it. Indeed, the plan called for the purchase of its major component from another firm, while Techco prides itself on producing its own products. T he developer did not broach his idea to management for several years: "It would have been political suicide." This product, he explained, was a mere convenience. When he did feel comfortable enough to bring it up to his boss, the boss's first reaction was: "My God, who's going to tell the founder?" The boss was anticipating a swift boot out of the founder's office. The developer also did not follow the tight quality checks, and claims to have made up a form to give to the person in charge of quality. All of his sneaking probably resulted in an unnecessary two or three year delay in the in the introduction of this new product

DISCUSSION

This analysis shows that organizational level routines or orientations do not merely cause "inertia" or somehow produce "tradition." Rather, they act directly on the eve.;yday efforts of organization members who attempt to develop new products. In particular, the organizational routines affect the market information that is used by prescribing what is relevant and appropriate. These prescriptions appear to be based on historically successful approaches to known markets, as explicated in this chapter. They assume certain kinds of information, however. They also concentrate attention on limited kinds of information. In effect, the routines produce the spotty arrays of information found especially with the cancelled products in this study. "Usually," the missing information is on hand, abstracted into the routines for usual product development activities. Such information must be

gathered anew for heretofore unknown markets, but the usual practices do not routinely allow for that.

In addition, the routines organize the interrelations among the thought worlds to assure that the many necessary tasks and activities are performed by the "right" people at the "right" time. Since these too are already established, the routines "integrate" the thought worlds by keeping them separate in distinct specialties. Thought world interactions are coordinated through abstract "channels," "roles," "authorities," and so forth. These routines do not generate experience-based contexts within which the joint learning and creation that appear critical to new product development can occur. In fact, the routines seem to prohibit such contexts.

The basic conclusion to be drawn from these findings is that the organization embodies a discontinuity between its present and its future. On the one hand the routines work very well for the existing product lines. The routines constitute a distillation of past product development activities, so if the future is like the past the work fine. But if the market is different, the routines cannot make sense of the new market information. This discontinuity between existing products and new products cuts across how people think about their work, how they do their work, and how they organize their work. To examine this discontinuity, this section summarizes what the routines are, what they do in the organization, and how they relate to the thought worlds.

First, these institutionalized ways constitute powerful "structures" for product development in these big old firms. From the perspective of those who operate within them, and continue to enact them, these routines create meaning and order. They convey meaningful substances in addition to forms, just like the thought worlds, and that content takes on a symbolic essence. Symbols allow people to supply more meaning than the symbols objectively contain - people can handily refer to them because their range of meanings can be glossed (Cohen, 1985). That is, "the way we do things" conveys more than lines on a chart to the people who know the routines. The routines symbolize the overall task. They allow people to meet together and agree that they all understand wha is going on, to fill in details with their own expertise, and at the same time to explain and anticipate the others' activities. The routines are not imposed by some unnamed source, but rather are local, recursive

creations of order out of an enormous array of possibilities. What they have in common is not merely certain gross abstractions of their forms, but the process of creation and recreation.

These routines, then, are cultural in essence. They manifest tacit sets of beliefs and assumptions about the organization's relationship to its market, and give people the capacity to orchestrate their joint activities. For this reason merely shifting structures may not "get" people to be innovative, just like, as Cohen (1985) discusses, the British empire's imposition of their forms of government did not make the African countries "civilized" in the British sense. Saleco's imposition of the system I teams' independent structure did not automatically create additional product innovations, because the form did not necessarily convey the experiential order within which the product creation could occur. And, the hotpoly developers at Compco had to continually "work" their new social order because people kept slipping back into the established ways of thinking and doing, despite all the commitment from senior management.

Second, the institutionalized ways serve important functions for the firms. This means that such routines will always arise in a social setting, in whatever form with whatever content, - one cannot get rid of routines per se because new ones will take their place. In the abstract, people need order. Schein (1985), for example, argues that if an individual cannot decipher, sort out, and categorize the multitude of stimuli a human is capable of perceiving, he or she would feel "cognitive anxiety," or overload. Culture becomes a stable set of cognitions, feelings, and behaviors in order to protect people from this anxiety. People are very reluctant to give up such ways of thinking and doing, especially if they were adopted in the first place to alleviate cognitive anxiety. Hilbert (1986) makes a very similar argument from the sociological side. Durkheim's anomie, he suggests, is not merely normlessness. "Society" or the moral order governs reality by providing the categories around which people can mutually share - objectify - experience. Anomie is the withdrawal of the exteriority and constraint of society, its sensemaking procedures, and with it, the possibility of objective experience. Hilbert cites Garfinkel's (1967) "breaching experiments" in which Garfinkel actively and ongoingly sabotaged subjects' sensemaking procedures, producing "profound and marked anxiety" (1986:11).

At the organizational level of order, these institutionalized ways of thinking and doing regarding product development serve two very important functions. First, they eliminate

uncertainty about the market. Indeed, they define the market and how the firm relates to it. As such they embody considerable knowledge about what needs to be done when, how, and why. Conventional market research tactics appear to be a part of these routines. Second, as repeatedly described, they help coordinate and organize the extremely complex sets of activities which must somehow come together to "get the iron out the door." And they <u>work</u>, at least for familiar products going to known markets, so they are very important.

That is why the routines resist change. People cannot act jointly without some sort of framework. To have so many people involved requires something to guide their joint efforts, so if the particiapnts cannot be convinced almost en masse of a new order, they will fall back on the old. While it may be easy for writers to exhort firms to change their "cultures," it is not easy for people to actually do so. As described, people seem unable to get away from the routines, and also feel helpless to change them, at least alone. The director of the voice service, for example, went so far as to pack up and move out of corporate headquarters, but he still has to undergo quarterly operations reviews. As with the voice service, people may follow the routines because no other procedures are widely shared. Saleco produces a peanut butter-proof keybcard that nobody likes, Techco a unique battery that serves no particular function, Opco an accounting system that does not accout, and Compco a plastic that melts unexpectedly.

Third, the routines reiate directly to the thought worlds. They constitute an abstraction of the whole for which the separate thought worlds constitute the everyday, lived-in parts. The routines break the complex task of product development down into more sensible and tractable subareas of thought and action. There is no need to devote resources to the creation of understanding if the market is already known, so the routines help the people concentrate inward in each thought world to develop the nuances of technologivc·l enhancement, advertising, model building, and so forth. The routines reinforce thought world separation, simplify interactions, and carry away uncertanties. By so doing, the routines also prohibit the 'leaps of faith" necessary to the creation of new products for new markets. They eliminate the future by redefining it in terms of the present.

Participants in the successful products stepped out of the organizational routines, which helped them conceive of a new kind of product rather than a basterdized version of an old

product. They seem to have done this by amalgamating the thought worlds, something not allowed under the routines. But second, they did not operate in a vacuum. They set up an "organic" order based on the contribution of ideas from various specialties, and on realistic and grounded information that everyone could appreciate. They also reconfigured parts of the old - Saleco turned a toy into a serious business machine, Compco extended its expertise, Techco continued its innovative document business.

The fundamental problem is a discontinuity between the old and the new, between the present and the future. Solutions which separate out all new product efforts into skunk works may preclude adjustments to the routines, and thus do not deal directly with the discontinuity. To ignore the strength of the existing routines may reinforce the production these crazy new/old products. On the one hand, these innovative deviations are very tenuous. They seem readily assimilated into the much larger and voracious institutionalized order, as the Saleco case in particular demonstrates. Each new product constitutes a unique integration or creation of perspectives of all the thought worlds. That is, for each new product, a field person cannot think only in generic field terms, but needs to brainstorm on the peculiar application issues of this product. This means, however, that innovation is not structurable. On the other hand, the vast majority of effort and resources in these large firms is devoted to maintaining the routines - to making money with existing products and surviving in the present. Routines are structurable. Is that why they dominate?

The solution lies in managing this discontinuity. But there are no pat answers to the problem of new products in old organizations. The discontinuity between the new and the old comes from constrained social action and entrenched structures, as the basic process model in the first chapter indicates. The final question is, can we conceive of an interpretive order for a large organization that coordinates and orchestrates for the present, but which also enables new creations for the future? What might constrain or condition such intepretive orders and perhaps preclude innovation? What might loosen them up and enhance innovation?. The last chapter summarizes the findings of the entire study, and speculates on some future research that will push these implications.

CHAPTER VII

NEW PRODUCTS IN OLD ORGANIZATIONS:

MANAGING THE DISCONTINUITIES

INTRODUCTION

This research unravels the question of why new product development is so erratic, erspecially in large firms (Hayes and Abernathy, 1980; Quinn, 1985). The problem arises from three discontinuities between social action on the one hand and social structure on the other. First, to understand a new market, product developers need to link up a complex array of information in a new and creative fashion - to construct the new market. Conventional marketing tactics call for all these kinds of information, but provide a framework or structure that links them up only for old markets. The solution, then, is to develop a new marketing framework that encompasses all these data. The second discontinuity blocks this solution, however. People in the different functional units think of "the market" in distinct ways. Market information as well as the framework to make sense of it are fractured into separate pieces. The solution to this dicontinuity is to pull the members of these different thought worlds together, but the third discontinuity intervenes here. The institutionalized ways of going about product development reinforce the distinctions of the thought worlds, keep them separate, and prohibit the creative or nonroutine frameworks for market comprehension.

This concluding chapter summarizes the specific findings in each of these three areas. I then speculate on the discontinuities that likewise obtain in the theoretical and practitioner realms relevant to innovation, and suggest some ways to manage them all.

MARKET INFORMATION

The existing literature on new products claims that more information about "the market" leads to more commercial success. Yet these studies do not explain what constitutes relevant market information for new products, nor how product developers are to pull that information together into a comprehensible picture of their new market This research finds that new product developers seek grounded, realistic information and are put off by the equivocalities

they say are generated by conventional market research tactics. They also attempt to follow a creative, building process and are put off by the top down, predetermined logic of standard marketing. Yet many different kinds of information about the market appear to be necessary. The successful efforts had more of more kinds of information than the less successful ones, so all these data seem critical.

Thus, new markets put product developers in a quandary. This complex array of market information needs to be gathered and linked up, but the structure of conventional market research does not do the job. To gather all these data and pull them together also requires a new order or framework to guide that action. Participants in the successful efforts seem to have generated such a framework, while those in the less successful efforts did not.

Additional grounded research is necessary to adequately describe these "frameworks" more clearly. The potential biases from attributions and retrospections limit the inferences that can be drawn from this study. However, several specific propositions and researchable contrasts about the market information can be put forth to focus follow-on research in this domain:

Proposition 1: Information of all three types is essential.

> Product development efforts for new markets that have all three categories of information prior to introduction will have a higher success rate than those that do not, regardless of industry.

> New product developers who generate hands-on information in addition to conventional business cases or typical market research will have a higher success rate than those who rely solely on conventional market research tactics.

Proposition 2: A creative, building-up process to organize and comprehend all the information is essential to effective comprehension of new markets.

> Market research and development procedures which presume a predetermined, fill-in-the-blanks logic (marketing by objectives) generate less understanding about the new market on the part of product developers than do creative, iterative processes. The reverse is true for existing markets.

> Successful "skunkworks" or creative learning approachs to new products work because they pull together all these different kinds of data.

The creative context for learning is more important than quantity of information alone.

One could stop here and say that lots of market information organized with a creative, building process solves the problem of erratic new product development. But there is more to the problem than that. This study reveals that two levels of organizational sense-making mediate people's comprehension of the market: "thought worlds," or the work-a-day realms of functional specialty; and "routines," or institutionalized ways of going about product development that orchestrate the joint activities of the thought worlds. Together, these sense-making contexts affect what information is gathered and how it is interpreted and linked up. These, too, must be managed.

INTERFACES AND INTEGRATION

Existing research claims that "integrating" the functional units who play a role in product development is essential, and that the conflict between these units should be overcome. But none of this research explains how these units differ with regard to "the market," nor whether their conflicts have anything to do with market comprehension. This study does. The basic finding is that members of the different functions have a strikingly distinct perspective of "the market" as well as the product development process, seek different information about it, and interpret that information differently. These so-called "thought worlds" get in the way of new market comprehension because they distribute the information across the organization. Moreover, they distribute the ability to make sense of certain kinds of information across the organization. To overcome the barriers these thought worlds create, it is first necessary to appreciate what they are and how they work.

Four distinct thought worlds are detailed. First, technical includes the design and development engineers and scientists. The most crucial and intricate part of product development to the technical thought world is the design of the product itself. They focus on the many technological trade-offs and choices necessary as they put the product together. To them, the future and thus the greatest source of uncertainty consists of the ever emerging technological possibilities. The information they most need, then, are precise design specifications and an exact description of what the product is supposed to do for the potential users. Technical people are much less interested in the other kinds of market information

except as they concern design directly. Technical people consider the product to be a concrete reality, but view "the market" in abstract terms.

Manufacturing is treated as a subset of technical here, but they also have distinct views. In particular, they focus on the plant or the operations, on building the product, and on how durable or well made the product is. Thus, they tend to live in the ever present now. Manufacturing people also worry that others will design products that cannot be produced because they do not understand the inflexibilities of the plant. They want exact volume and price estimates so they can get on with the manufacturing.

The field thought world includes sales and customer support people who work on a regular basis with both customers and sales. In contrast to the technical and manufacturing people, field focuses on the creation of each sale, and on establishing relationships with potential buyers. From their ideographic and customer-by-customer view of "the market," the customers' applications needs appear to change constantly, not the technology. The future comprises ever changing and uncertain applications, and so field wants technical and manufacturing to produce a diversity of designs on command. The product itself is a concept to field, while the reality of "the market" consists of relations with customers.

Last, the planner thought world includes market researchers, business planners, forecasters, and other inhouse "marketing" people who work on business plans and projections rather than on customer support. Planners focus on estimating the number of users and the growth rates of purchases over time so that they can estimate revenues and costs, and develop a business plan. "The business" is the most uncertain aspect for them. Unlike field, they take a general and abstract view of "the market," and unlike technical, they worry about design primarily in terms of costs and general trends, not technological possibilities. Planners are conceptual, technical people are tactile, and field people are relational.

To say that these units conflict is to miss most of the problem. They do not merely conflict over goals and interests, they operate under different orders of experience, have different understandings of what it is they are about, and expect different things from one another. Each thought world concerns a separate world of experience and viewpoint that defines "the market" and the processes of creating a product for it differently. Each reflects only a part of

the entire market and so each is incomplete. "Differentiation" consists of these unique yet partial interpretive frames. "Conflicts" arise when these separate worlds define joint issues and actions in disparate ways. Conflicts comprise misunderstandings and dashed expectations, not only haggles over resources. While power and politics certainly play some role, and that role would vary by organization, these thought worlds generally operate in a lateral relationship with one another. The bigger problem among them is not power but sense.

If differentiation consists of separate interpretive frames, then integration would consist of joint comprehension. That in turn requires an interpretive context that facilitates translation and learning. Given the strength of the thought worlds, complete integration in the sense that everyone fully understands the perspectives of everyone else may be difficult if not impossible. Integration in the new product arena is perhaps best understood as a context or interpretive order within which the thought world perspectives can interact with and respond to the others. I use the term "amalgamation" to reflect such a coalition of perspectives, not their complete synthesis. The object is not to reduce conflict but to amlagamate the information and insights.

Each of the fifteen product development efforts is described to uncover the dynamics of the thought world interactions, or lack of interactions, as the products are created. This analysis finds four distinct patterns of new product enactment. Three patterns characterize the less successful efforts, and illustrate different ways that the thought worlds do not amalgamate: the "leap before you look," the "plan and then plunge and then plan again," and the "feed it or shoot it?" patterns. The last, the "cut it loose" pattern, characterizes the successful efforts. Here, all the thought worlds interact from the early in development phase onward.

These findings indicate, first, that each thought world has a particular and important contribution to make. But, second, when the thought worlds stay separate, each tends to assume away the concerns of the others, and to recreate the entire product development process in its own image. In the successful efforts the participants iterate, play ideas against one another, and build plans and products based on most of the different kinds of market information. Thus, while new product development is inherently uncertain, uncertainties are dealt with more effectively if they examine them rather than assume them away.

The successful efforts also shed some light on what amalgamation of thought worlds is all about. The data imply that each person does not fully understand the other perspectives, and continues to live in his or her own thought world. But the participants with the successful efforts recognize and apparently appreciate the importance of these other perspectives. The successful efforts also rely on an experience-based context that seems to facilitate the development of a "commonsense understanding" of the market, as a participant with the system I calls it. This in turn provides the creative framework for all the market information - everyone saw the focus groups or visited users, haggled over the design, considered distribution problems, worried about the plant. Amalgamation operates in this sort of a grounded setting or context, and seems organic in nature. Again, as with the creative frameworks, the nature of this integrative context cannot be detailed more clearly without observational research.

But propositions with testable contrasts follow from these inferences:

Proposition 3: Each thought world has a unique perspective on the market that derives from its primary task in the product development process.

> Members of the different units in a random sample of firms will exhibit the same views on the most crucial information, what is the future, what is concrete, as described above.

> Members of a particular thought world are best able to interpret or make sense of new market information that falls into their own area of specialty.

> People who rotate into a new function adopt the perspective of that thought world; they do not merely add to their own overall perpsectives of product development. (This might vary in interesting ways depending on the routines - perhaps the Japanese organizational routines are such that rotation does enhance perspective amalgamation within the individual, while within the American organizational routines, rotation begats successive specialization).

Proposition 4: Amalgamation of thought worlds is critical to the success of new products.

> New product development efforts that do not incorporate the perspectives of all the thought worlds will have a lower success rate than those that do.

> Project teams, matrices, skunkworks, champions and other "innovative" structures that also do not amalgamate the thought worlds will have a lower success rate than those that do.

"Harmonious relations" (i.e., Souder, 1981) among the thought worlds are less important to new produ...t success than amalgamation of thought worlds.

Proposition 5: The integrative context that facilitates amalgamation of thought worlds is "organic" in nature as described by Burns and Stalker (1961). It is a different kind of negotiated order than that which is created and experienced by people who do either conventional products or less successful new products.

> Project teams or matrixed groups who work on routine products in large organizations will not generate an organic context to the same extent that teams who work on successful new products.

> Project teams or matrixed groups who work on less successful new products w'll not generate an organic context to the same extent as those who work on successful products.

ORGANIZATIONAL ROUTINES

Finally, the organizational routines which guide and orchestrate everyday work comprise yet another structure that constrains product development. The successful efforts violate institutionalized ways of going about product development, while the less successful ones become mired in them. Analyses of four of the organizations' routines indicate that each set is unique, yet each has similar effects on new ; roduct efforts. The routines build up around critical aspects of the firms' overall activities and incorporate only certain kinds of market information. In addition, the routines coordinate the specialties of the thought worlds so that each one contributes its usual expertise at the right time.

These routines work for existing products intended for known markets in these firms, and such products comprise the bulk of product development. The routines do not work for new markets. They limit amalgamation, reinforce separate specialization, and emphasize only certain aspects of the market. None of the new product efforts really fits the established routines, but the less successful ones either tried to or were forced to follow them, at least in part. The successful product developers were able to amalgamate their thought world perpsectives and pull together the market information in new ways ways because they got out from under these routines.

The analysis also suggests that these routines perform two important functions. First, they create order both by defining "what we do around here" for organization members and by eliminating uncertainty. Second, they enable the hundreds if not thousands of people who might participate on the development of a product line to work together - they orchestrate the the complex array of activities and resources that go into product development. They allow the organization to survive in the immediate present. Thus, routines per se will not go away, and they cannot be ripped out because other routines will develop quickly. What is "new" to the organization depends on what its routines already make sense of. A company can perhaps generate new to the world technology readily, but bungle a distribution process used by hundereds of other firms because its people are collectively unfamiliar with it.

Propositions and several testable contrasts clarify these implications and suggest additional research.

Proposition 6: Existing organizational routines do not make sense of new products intended for new markets.

> New product efforts that do not follow existing routines will amalgamate the thought worlds more completely than those that follow existing routines.

> Successful new products for new markets in very innovative organizations will also violate existing routines.

Proposition 7: Organizational routines always emerge.

> A newly organized group or division will stop generating new kinds of products for new markets successfully after three or four new products, because they begin to follow established routines. Their successful efforts after this time will violate those routines.

THEORETICAL AND PRACTICAL IMPLICATIONS

Ultimately, this research suggests that the large firm embodies a discontinuity between its present and its future. The present lies in its routines, which capture and organize past practices to tell people what to worry about and how to coordinate their joint efforts. The future lies in the unorganized and perhaps unorganizable activities of employees who push new product ideas. The key to ongoing viability lies in the management of this discontinuity:

to assure that the old routines change to facilitate new activities, and that what is learned in new activities becomes embedded in the routines. Yet this also study suggests that such a flow between the two is rare. It will take both different kinds of theoretical perspectives and different kinds of management to work out these issues.

With regard to theory and theorizing, two forces limit the possibilities of effective resolution of the discontinuities. First, like the thought worlds within organizations, academics inhabit disparate disciplines - even within "management" schools - and do not appreciate the insights and information of one another very well. Solutions require more than glib calls for interdisciplinary research. They require amalgamation and creative contexts. Perhaps research projects that operate separately from deparmental routines can provide the tenuous and temporary contexts for innovation. And perhaps research "in the cracks" between disciplines - like this one, sponsored by a marketing research group, egged on by organization theory - can raise questions that interdisciplinary team members can then address from the comfort of their own thought worlds.

A second limiting force is the discontinuity between static, structural analyses and processual, probing interpretations. Both are partial and piecemeal, and at least from time to time, need to amalagamate in new, nonroutine ways. This study, for example, is strongly process-based. But some of the propositions speculated on above would require good old surveys with reliable measures and generalizable samples to examine properly. And some would require indepth ethnographies to examine properly. One way to manage this discontinuity would be to focus on the practical affairs of organizations and of people at work, not on ethereal theories and constructs that may have very little to do with real organizations (Mintzberg, 1979). In particular, we need to ask straightforward questions about specific organizational activities. For example, how do senior managers either deliberately or inadvertently reinforce certain concerns over others, and how do operations level people enact and maintain the routines, even when senior management wants them to change? How do certain routines become "short term" focused? Why do managers impose two year payback periods for radically new technologies - what are they thinking of?

The more general theoretical question that stalks this very discusion is can the large organization ever be innovative? Economists, sociologists, and strategists have been arguing

this question for generations, and the weight of opinion is no (e.g., DiMaggio and Powell, 1983; Quinn, 1985). Yet at least from time to time we see innovation from large firms. This question cannot be adequately addressed without grounded, close-up empirical examinations of processes within organizations. For some reason we seem satisfied with the manipulation of abstract, proxy variables that require rather broad leaps of faith when we can study actual processes themselves. For example, how does an overly diversified product line affect people's work (Rumelt, 1974)? No one has answered this question with process data yet people seem willing to accept the rule of avoiding diversification (Peters and Waterman, 1982). How can a company that needs to shift into new markets avoid diversification? More intriguing, is there some point of "task complexity" or "size" beyond which no routines can operate? What is that and why? To say that "size" or "technology" or "structure" cause inertia is not to say much at all. Structural tactics such as divisionalization, decentralization, joint ventures, and new venture divisions are all various ways to chunk up routines. They should be studied as such and with very specfic details: how do they affect the kinds of information people gather and use, the interpretations they make, the sense the make of their work, the amalgamations of different thought worlds within? These are the important questions, but they are merely implied by existing work which ignores processes to worry about states.

Finally, the critical management questions concern what to do about new products. Discontinuities in perspective occur here also. On the one hand, this study has indicated that the existing routines are very strong, that they creep into product innovation rather easily, as the less successful histories illustrate. Senior management routinely imposes them, and operations people routinely rely on them for their work. To ignore them and their effects is to court the routine generation of crazy new/old products. Moreover, these routines summarize the past. So they too must be changed occasionally, at least dragged into the present from time to time. The conventional management wisdom is to separate new activities from old ones, but if that is done without an effort to also change the routines, what action will then adjust the routines - how will the organization learn? On the other hand the successful innovative efforts are very tenuous. Indeed, perhaps innovation is so new it cannot be routinized or structured, and so wisps away easily, especially in the face of these voracious routines. People can amalgamate their thought worlds for only so long before routinization creeps back in. Thus the creative new activities need to be protected. The answer lies in

active management of the relationship between the old structure and the new actions. And herein lies the discontinuity. We know much more about static analyses and now-time controls than about the active process of managment. Ironically, more energy goes into the protection of the routines than to their management and change.

Several normative suggestions follow from this research. The first is the obvious one that if you are doing something new, don't use the old rules and processes. Rather, consider what the newness consists of, what it means for the information and amalgamation and organization necessary to execute the project. More generally, routines can be examined for elaborations that routinely shut down innovation. This is not to call for a "culture change," because doing so may not be easy (Schein, 1985). However, the manager can ask answerable questions such as: do rules prohibit the creative context? keep people from generating grounded, realistic understandings of "the market?" limit the interactions among thought worlds? In addition to these more general suggestions, simple, everyday policies and practices can affect new activities in negative ways. People have so much busy work that they cannot sit back and think; certain personnel are not allowed to interact with customers; management won't allocate resources to gather new kinds of information in new ways; project teams are organized but people are not given time away from their usual work; accounting processes are such that certain units will not participate in new projects because they cannot afford the costs to show up in their budget. If the ideas about the routines discussed above are correct, then these bureaucratic barnacles will keep growing. Management must keep scraping them off.

Innovation is an active, ongoing process, not a state of being. Change and adaptation is best conceived of as a process of simplification and renewal: aspects of existing routines need to be pruned and simplified to allow new activities and insights; and thought worlds need to be disorganized and re-amalgamated. To develop new products, it takes the interplay between senior people and operations people, plans and intuitions, structures and actions.

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