1-1-1986

The process of implementation : an eclectic field study of a strategic implementation effort.

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THE PROCESS OF IMPLEMENTATION: AN ECLECTIC FIELD STUDY OF A STRATEGIC IMPLEMENTATION EFFORT

A Dissertation Presented

by

JOHN JOSEPH VOYER

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

February, 1986

School of Management

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Dedicated to my wife,

Joan

A C K N O W L E D G E M E N T S

The completion of a doctoral dissertation marks not only the end of document preparation; it marks the end of a long process of study, training and preparation, of a special period in one's life. So I would like to indulge myself in acknowledging people who were important to me during this entire period, as well as those who helped during the dissertation.

Most authors who are married wait until the end of their acknowledgements to thank their spouses. I would like to break away from that convention by thanking my wife, Joan, up front. I dedicated this dissertation to her for many reasons. She supported me unwaveringly in my decision to pursue a doctorate. She made many adjustments in her own life to accomodate the rather bizarre lifestyle of a Ph.D candidate. She even worked full-time while pregnant with our second child so that I could conduct this field research. She was not always placidly supportive; I doubt that any sane woman would calmly put up with everything doctoral students have to do. If she felt that she was being asked to do something unjust, she voiced her opinion. But she always provided me with the spark I needed to see the projects through to the end. And she helped me more than she'll ever know by being proud of my accomplishments.

I want to thank my daughter, Carly, for being such a good child through my dissertation period. She was only 3 1/2 when I started my fieldwork, and had to go to full-time daycare because of it. She never

complained, and was, and is, a joy to be with. (In this regard I would like to thank the staff of the New World Day School at UMass for running such a good program for Carly during this period.) My son, Andrew, was born right in the middle of the project. He had the good grace to be born three weeks early, before the crucial Demo III described in Chapter IV, which allowed me to do my research without constantly looking at my watch or waiting for the phone to ring at NICC.

George Odiorne is the man I most want to thank among members of the UMass faculty. George is an authority on mentoring, and has a gift for practical application of this knowledge. My advisor for three years, George provided me with support and confidence, and always encouraged me to test myself. I learned much from being with George. My family and I will always be grateful for his loan of his gasoline credit card. Right in the middle of the fieldwork, Joan had to quit her job, and I'm convinced that George's loan enabled my family to keep body and soul together during the six months I had to drive to the NICC field site. (I put over 9,000 miles on my car during this project.) I, and they, shall always be grateful.

Tony Butterfield and Linda Smircich provided me with support and encouragement of another, but equally important, kind. At a time when I felt that I should pursue a second-tier career, they urged me to set my sights higher, and gave me the confidence to believe that I could do it. Linda also provided me with a set of intellectual tools that are the underpinnings of the theory that runs through this dissertation.

Intellectually, I owe her much.

I also owe a great deal to Joe Litterer, chairperson of my committee. I would never have found out about this great project had it not been for him. He also provided entree into NICC. In the early stages of the fieldwork, the NICC staff did not take me seriously, but took Joe very seriously. He helped me get over this troublesome period. Joe also provided me with something else, which I did not really appreciate at first--rigor. I resented his criticisms of the early drafts of this dissertation, but now I realize that his judgements only served to make this a much better document. I learned a lot in doing the field research for this project, but I had done data gathering before. What really made this project different was that I was forced to think through the presentation and analysis of the data in a way that was lacking through most of my doctoral program. I am indebted to Joe for this, and many other things.

I would like to thank Rob Faulkner, the outside member of my committee. Because of the eclectic nature of my ideas and methods, I was not sure that I could find an outside member that could be useful. I had heard of Rob second hand. I rejoice in the day that I set foot, sight unseen, in his office. Since that moment our relationship has been both fruitful and pleasant. Rob provided me with much-needed advice about the gathering and analysis of qualitive data, about pieces of literature that were appropriate, and about the presentation of my ideas. We have also embarked on a course of research that I feel is

very exciting and potentially important and interesting. I look forward to a long and productive association with Rob.

No acknowledgements about a doctoral program would be complete without some mention of the most important "others" in such a program--my fellow students. I must admit that early in my years at UMass, I wondered about the collegiality and conviviality of the group. But my observations were probably caused by (1) being in a new environment, and (2) the entire class from the previous year having left or flunked out. My last three years in residence were great fun. I should like to single out Rick Molz; he and I turned out to be soulmates in the program. I know that Rick provided me with a lot of encouragement and comfort; it always helped to talk about problems with Rick. We shared so many concerns, and went through so many things together; it was good to know that Rick was there to talk things through. I only hope that I helped him as much as he helped me. Stephanie Newell is another person I should like to thank; it was always enjoyable and productive to talk with Stephanie. I've missed her since I left UMass; I hope she does well.

I would also like to thank the following people for being such good friends: Rahul Bishnoi, Marta Calas, Kent Carter, Kenny Chan, Irene Clark, Connie Daniel, Steve Demsky, Mary Dereshewsky, Robbin Derry, Rajiv Grover, Ron Karren, Evangelos Kechris, Bob Marx, Dave Moore, Nancy Podolak, Pam Sherer, Tim Sugrue, Debbie Ramirez, Benny Tsou. I'm sure I've left some important people out, so let me say that I really enjoyed

the company of most of the people in the UMass SOM doctoral program. I would also like to thank Harry Tamule and Stu Westin for their help with the computer.

I would like to thank Dean David Blake and Prof. George Farris of the Rutgers Graduate School of Management, my bosses, for being so supportive, and for facilitating my schedule, so that I could complete this dissertation, and my colleague Joel Harmon, for lending me his leftover paper, so that I could really complete this dissertation.

There are two people that I would very much like to thank publicly, but cannot. There are two human resources staffers in the R & D department at NICC who jumped aboard Joe Litterer's research bandwagon very early on, and actually made it possible to do this project. Ours was the first social science research project at NICC. We never would have gained entree without these two people. They also served as extremely competent peers and debriefers as the project progressed. The research project could literally not have happened, and would certainly have been of lesser quality, without them. Unfortunately, because of confidentiality agreements, I cannot identify them publicly. I only hope they know how grateful I am to them, and how much admiration and affection I felt for them by the time the project ended.

Lastly, I would like to thank the people who are central to this research project--the men and women of the 1221 project. Many social researchers have pointed out the natural awkwardness that surrounds the relationship between social researchers and social research

respondents. Most of the responsibility for making that relationship work rests with the researcher; he or she is, after all, treading on the turf and time of the respondents. In a development project like this one, with such intense pressure, the members of the 1221 organization could have made it very difficult for me. And, candidly, one or two of them were <u>not</u> very cooperative. But most of them were more than cooperative--they were cordial, generous with their time, and curious about the project. These were professionals who were extremely dedicated to their work, and who were, for the most part, interested in their organization and its effectiveness. They really made it easy for me. I know that I was twice blessed--with a good project to research, and with project members who facilitated that work. For all of that, I am very grateful.

I should like to close with a note about confidentiality. This was strictly observed throughout the project, and it shall be observed here as well. All the essential facts in this dissertation are true except for the identities of the company and the people mentioned. Names, and other details in the biographies of the people mentioned, have been changed to disguise them. The company exists, but not under the name Northeast International Computer Company. The reader should rest assured that the ethnography as recounted is completely accurate.

A B S T R A C T

THE PROCESS OF IMPLEMENTATION:
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A STRATEGIC IMPLEMENTATION EFFORT

February, 1986

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Using Mintzberg's notions of intended, realized, and emergent strategy, the notion of strategic implementation is examined and reconceptualized around interpretive ideas. The idea of frame of reference is central. A software development organization is researched in an effort to answer key questions raised by this reconceptualization. These questions revolve around whether a professional organization like this one can get from strategic intent to strategic realization deliberately, or if there is a substantial emergent element to the outcome. Key issues are the agreement on intended strategy at the outset, the adequacy of communications, the nature of the frame of reference, the enactment of a realized strategy by the organization, and the relevence of political models of strategy formulation for strategy implementation. Methods include participant observation, sociometry, semantic differential with discriminant analysis, cognitive mapping, and ethnography. The results showed that there was no organizational

agreement about strategic intent. The organization was also not cohesive in terms of administrative communication, technical communication, and social interaction. The cognitive map revealed a web of interrelated variables which indicated that the members believed that the likeliest outcomes of the project would be dissatisfaction, turnover, non-advancement of their careers, and commercial and technical failure. Among the major causal variables in the map were: the intensity of organizational politics, the lack of incentives built into the effort, the aforementioned lack of effective communications, and the lack of agreement on strategic intent. The study concludes with the building of an integrated model of this implementation effort. This complex model has four tracks: an "institution building" track which concerns the enactments of the members of the development organization; a technical track, concerned with task elements; a marketing track, concerned with the formulative and political activities of that function; and an organizational political track, concered with the formulative and political activities of the organizational context within which the development project was embedded. Variables from all four tracks must be taken into account for implementation to be fully understood.

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CHAPTER I

STRATEGIC IMPLEMENTATION

Strategic implementation is one of the six process elements in the Schendel and Hofer (1979) paradigm of strategic management. It is not well defined in their paradigm, save that they say it is essentially a behavioral process. One finds it hard to disagree with this assessment by Schendel and Hofer, but unfortunately the readings in their book that deal with implementation are about (1) formal planning systems and how best to get them working (Lorange, 1979), and (2) the fit between strategy and structure (Galbraith & Nathanson, 1979), i.e., work from the Chandler (1962) tradition. The Schendel and Hofer treatment of strategic implementation is not unusual--the concept is seldom defined. The purpose of this review is twofold--to attempt to develop a definition of implementation, and to identify important questions about strategic implementation that could be addressed given the context of this study.

Dictionary Definition of Implementation

Let us begin with a dictionary definition of implementation. According to Webster's Third New International Dictionary (1983), implementation is "the act of implementing or the state of being implemented." The same dictionary's definition of the verb implement is

> to carry out: ACCOMPLISH, FULFILL; esp. to give practical effect to and ensure of actual fulfillment by concrete measures.

This definition implies that some scheme has already been devised, and is waiting for someone, an implementor, to "really fulfill" it. Indeed, the etymology of the word strongly implies this kind of interpretation. The word implement comes to modern English directly from Middle English, which in turn came from the Late Latin implementum, "action of filling up," which came from the Latin implere, "to fill up." Since one can fill up something only if it already exists, this etymology strongly implies that implementation occurs after the formulation of a plan or strategy (in the context of this paper).

Computer software engineers use the word implementation quite a lot, and they use it in this way. They first design their program, then they implement it, in a sense "filling up" or "fleshing out" the skeleton of their design. One engineer interviewed by the author used the word implementation several times. When asked what he meant by it, he replied, "Writing the code."

Underlying Process Models of Strategy Formulation and Implementation

This type of definition of implementation is typical of what Chaffee (1984) calls the linear model, and what Narayanan and Fahey (1982) call the rational model, of strategy formulation. As the latter say, "Many [rational model] authors separate strategy formulation and implementation into two distinct phases" (1982: 32). Bourgeois and Brodwin say that

> the traditional textbook approach to strategy implementation was to treat "implementation" as an activity following "formulation." Usually, the topic was treated as a question

> of organization design, where systems and structures were manipulated in concert with strategic goals (1984: 241).

This type of conceptualization reflects the underlying metaphor of "filling up" a "vessel" (a strategic plan) which has already been created. This metaphor seems to be so firmly imbedded in managerial and scholarly thinking that no authors bother to define implementation. A key question is--"Is this the proper metaphor?"

Bourgeois and Brodwin (1984) make the metaphor more explicit (although they neglect to give an alternative definition to the term implementation), and they identify five approaches to implementation which can be found in the business policy literature. The first approach is the Commander Model; in this approach the CEO's strategic question is "How do I formulate the optimum strategy?", and the CEO's role is that of Rational Actor. Bourgeois and Brodwin say

> Generally, [this model] fails to consider the implementability of plans, either as a binary variable ("implementable" or "not implementable") or as an aspect of strategy with a cost in time and money associated with it (1984: 243).

Four requirements flow from the Commander Model:

1. Easy implementation, since it is not addressed in the model
2. Good information, since success relies on the CEO's getting complete, accurate information
3. Objective planners, who will not bias the process which turns data into plans
4. Splitting the firm into thinkers and doers

All four of these requirements are questionable. Implementation is usually not straightforward, information is often biased, planners often

skew plans in favor of their subunits, and there is much evidence (Bower, 1970; Carter, 1971; Mintzberg, 1977; and Burgelman, 1983) that strategy often results from individuals taking the initiative in identifying and championing opportunities. Yet this, despite these shortcomings, is the model which is most prevalent in the traditional literature. Bourgeois and Brodwin offer some reasons about why this is the case--the model offers a valuable perspective to the CEO, reduces the number of inputs the CEO must process, and puts the planner in a position to influence the firm's destiny. Lastly, they say,

> . . . the separation between the planner/manager as a thinker and everyone else as a doer fits the view of the boss as an all-powerful hero, shaping the destiny of thousands with his decisions. This somewhat macho view naturally appeals to many aspiring managers (1984: 245).

The second model is the Change Model. The strategic question is "I have a strategy in mind; now how do I implement it?" The CEO's role is that of Architect. Bourgeois and Brodwin describe the model:

> This approach starts where the Commander Model ends: with implementation. It assumes that the economic tools [of] strategy formulation have been mastered and adds to the tool kit three sets of behavioral science techniques to increase the probability of successful implementation: (1) the use of structure and staffing to convey vividly the firm's new priorities and focus attention on the desired areas; (2) the alteration of systems used for planning, performance measurement, and incentive compensation; and (3) the use of cultural adaptation techniques to introduce system-wide change (1984: 246).

The Change Model preserves the split between formulators and implementers.

Bourgeois and Brodwin next identified the Collaborative Model, where the strategic question is "How do I involve top management to get

commitment to strategies from the start?" The chief executive's role is that of Coordinator. The authors say that "in this model, the CEO employs group dynamics and 'brainstorming' techniques to get managers with differing points of view to provide their inputs to the strategic process" (1984: 248). But the input is still solicited only from management, and focuses on formulation. As the authors state, "This model preserves the artificial wall separating thinkers and doers and fails to draw upon the full human potential within and throughout the organization" (1984: 249).

The Cultural Model asks the question "How do I involve the whole organization in implementation?" The CEO's role is that of Coach. This approach essentially takes the participative elements of the Collaborative Model to lower levels in the organization. According to Bourgeois and Brodwin:

> In this model, the CEO guides his organization by communicating and instilling his vision of the overarching mission for the firm, and then allowing each individual to participate in designing his or her work procedures in concert with that mission. So, once the game plan is set, the CEO plays the role of "coach" in giving general direction, but encourages individual decision-making to determine the operating details of executing the plan (1984: 250).

The authors quote critic Robert Reich (1981: 30), who claims that the Cultural Model is just another variant of the macho-flavored Commander and Change Models: "The sharp distinction between thinkers and doers will remain intact but will be camouflaged by cosmetic devices--quality circles, work groups, collaborative teams, encounter groups . . . which serve to soften or blur the underlying management control. . . "

Lastly, Bourgeois and Brodwin propose the Crescive Model. The central strategic question is "How do I encourage managers to come forward as champions of sound strategies?" The CEO's role is that of Premise-setter and Judge. This model is named from the Latin crescere, "to grow," because it is a model of

> strategy "growing" from within the bowels of the firm. . . . The role of the CEO has moved from designer to that of premise-setter and judge. Here, the strategic problem revolves around the CEO's ability to define organization purposes (i.e., set decision premises) broadly enough to encourage innovation, and to select judiciously from among those projects or strategy alternatives that reach his attention (1984: 254).

Strategic management (which includes implementation) in this model requires balancing between "emergent strategy" (Mintzberg, 1978) or "autonomous strategic behavior" (Burgelman, 1983), on the one hand, and strategic control at the top (Bales, 1977).

Mintzberg, in a model-building article derived from much empirical research, generally supports the crescive model and underscores the dynamism of strategic management. He defines strategy as "a pattern in a stream of decisions (1978: 28)." He argues that patterns develop in the interplay between intended strategies and realized strategies. Intended strategies which are realized are called deliberate strategies. Intended strategies which are not realized are called unrealized strategies, and strategies which are realized, but not intended, are called emergent strategies. Mintzberg's important point is that the dichotomy between strategy formulation and implementation can be a false one. It ignores the learning process that often takes place after an intended strategy is conceived. Mintzberg argues that

the word "formulation" is misleading, given his definition of strategies--many consistent organizational behavior patterns that were not completely developed consciously and deliberately. Mintzberg's argument follows the crescive model in the sense that strategy is seen as growing from organizational activity, through the learning process mentioned above, as opposed to being deliberately formulated, as in the commander model.

Another empirical study which supports the crescive model is Bower (1970), a study of the resource allocation process in a large, complex company. He found that three sub-processes operated in the firm's resource allocation process. One group of managers defined the need for projects. A second group provided the impetus for the commitment of resources. And a third group shaped the structural context (measurement, information and reward systems, and organization structure). It was the interplay between these three factors which shaped the firm's resource allocation pattern, and not a deliberate, linear "commander-type" approach. Carter (1971) did a similar study which showed that setting the premises too narrowly tended to suppress proposals deemed to have to low a probability of approval. Note the similarity between Bower (1970), Carter (1971), Mintzberg (1977; 1978), and the crescive model proposed by Bourgeois and Brodwin (1984). Bower and Doz (1979) explicitly adapted the earlier Bower work to strategic management. They said that complex organizations are characterized by the interaction among three processes:

1. Cognitive processes: for understanding of the environment

2. Social and organizational processes: channelling perceptions and developing commitments
3. Political processes: shifting the power to influence purpose and resources

According to Bower and Doz:

> Strategy is viewed as an outcome of these processes and the task of the chief executive is viewed as the administration of these processes (1979: 159).

The second set of processes mentioned above, social and organizational processes, are close to the premise-setting aspect of Bourgeois and Brodwin's (1984) crescive model. Bower and Doz explicitly reject the commander model saying:

> Far from the heroic view of the chief executive . . . , what emerges is a view of the CEO as a shaper of the premises of other executives' thoughts and the source of balance in the personal interactions of others. His or her contributions to strategy may be more than anything else, an effective call for change . . . , a higher level of aspiration or a new sense of what voices should contribute to the debate (1979: 157).

These empirical studies lend much support to the crescive model. There are some other works, more explicitly political, which suggest the validity of the crescive model. To these we now turn.

Explicitly Political Models of Strategic Formulation and Implementation

Pettigrew (1977) posits that strategy formulation is contextually based, with strategic choices focusing on environmental and intra-organizational dilemmas. Strategy evolves out of the partial resolution of those dilemmas. Therefore, he argues, strategy

formulation and implementation are inextricably intertwined, with formulation issues flowing out of the organizational interactions that take place during implementation. The formulation issues, in turn, have an effect on the interactions. For him, the process of strategic formulation is as follows:

1. Identification of the set of dilemmas faced by an organization over time
2. Analysis of the dilemmas that become a focus for organizational interest and of those that are suppressed
3. Specification of the individuals or subgroupings that seek to define alternative dilemmas as worthy of organizational attention
4. Study of the demand by those individuals and subgroupings that certain dilemmas be discussed and of the attempts to mobilize power in support of those demands
5. Specification of the outcomes of these processes of demand-generation and power-mobilization
6. Consideration of the interactive relationship between formulation and implementation

The resolution of these dilemmas takes place in the context of a political decision making process. Pettigrew, in an approach remarkably similar to Bower's (1970), says that the process has two broad elements: (1) demand generation (similar to Bower's definition), and (2) power mobilization (similar to Bower's impetus process). Bower does not couch this type of process in political terms, but Pettigrew does, saying that

> political behavior is defined as behavior . . . within an

commitment to strategies from the start?" The chief executive's role is that of Coordinator. The authors say that "in this model, the CEO employs group dynamics and 'brainstorming' techniques to get managers with differing points of view to provide their inputs to the strategic process" (1984: 248). But the input is still solicited only from management, and focuses on formulation. As the authors state, "This model preserves the artificial wall separating thinkers and doers and fails to draw upon the full human potential within and throughout the organization" (1984: 249).

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The authors quote critic Robert Reich (1981: 30), who claims that the Cultural Model is just another variant of the macho-flavored Commander and Change Models: "The sharp distinction between thinkers and doers will remain intact but will be camouflaged by cosmetic devices--quality circles, work groups, collaborative teams, encounter groups . . . which serve to soften or blur the underlying management control. . . "

> organization that makes a claim against the resource-sharing system of the organization (1977: 81).

Organizational members (individuals or groups) can be seen as interest groups, making differential demands on the system because of specialized functions and responsibilities, and individual career dynamics. For Pettigrew, the connection between demands and mobilization is the management of legitimacy. He argues that it is managed through symbolism, language, beliefs and myths. In this regard, Pettigrew's formulation contrasts with Bower's notion of structural context, although it could be argued that the latter is a subset of Pettigrew's "meaning system."

Pettigrew's analysis and model obviously bears little resemblence to the commander model. It is an explicitly political approach to conceptualizing strategic management. Pettigrew's process model does not directly resemble any of Bourgeois and Brodwin's five models; in spirit, it resembles the crescive model, in that it implies that a strategy will grow out of the partial resolution of political struggles among the interest groups in the firm. If an analogy can be drawn between "premise setting" and "the management of meaning," then the models are roughly similar.

Quinn (1980) proposes a model, called logical incrementalism, which was developed after many years of fieldwork at many large U.S. companies. His work fits in nicely with the research reviewed so far. Quinn says that there are three patterns that characterize the successful management of strategic change in large organizations:

1. Creating awareness and commitment--incrementally,

which involves:

a. need sensing to get objective information

b. amplifying understanding and awareness

c. establishing and building credibility, often using symbolic moves to change direction

d. legitimizing viewpoints

e. tactical shifts and partial solutions

f. broadening support

g. overcoming opposition

h. structuring flexibility

2. Solidifying progress incrementally, which consists of:

a. implanting support

b. a focus on developing strategies at critical points

c. managing coalitions

d. formalizing commitment

e. insuring that the consensus does not become inflexible

3. Integrating processes and interests, which involves:

a. making sure that the pattern of action, though incremental, is not piecemeal

b. using formal analytical techniques to evaluate the resources required, the benefits sought, and the risks undertaken

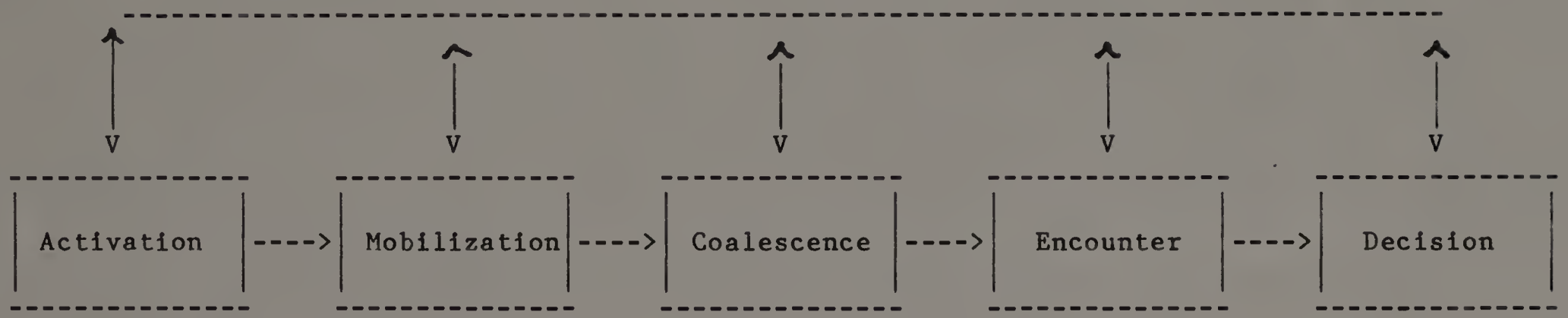
This model also resembles Bower (1970) and Pettigrew (1977). Creating incremental awareness and commitment is similar to Bower's definition

and Pettigrew's demand generation, and incrementally solidifying progress resembles Bower's impetus and Pettigrew's power mobilization. Integrating processes and interests roughly resembles Bower's management of structural context and Pettegrew's management of legitimacy. Quinn's model is somewhat more political than Bower's, in that it explicitly calls for the general manager to manage coalitions, and somewhat less political than Pettigrew's, in that it implies that the general manager, and not the various interest groups, is the focus of action. It seems appropriate to classify it as a political model. In any case, Quinn's work strongly supports the notion of the inseparability of formulation and implementation. Indeed, his model illuminates the details of this link better than most of the others.

Narayanan and Fahey (1982) developed what is perhaps the most supported conceptual model of strategy formulation as political process. They assert that "organizations are fundamentally political entities: coalitions of interests and demands emanating from within and outside organizations" (1982: 26). After citing many authors who provide examples of sources of different interests and demands, Narayanan and Fahey summarize:

> . . . Organizations can be viewed as loose structures of interests and demands, competing for organizational attention and resources, and resulting in conflicts that are never completely resolved. . . . [This] is a political conception of organizations (1982: 26-27).

Narayanan and Fahey (1982) develop a model of strategic decision making (see Figure 1). The first phase is called gestation, and it is concerned with things like "problem formulation," "attention directing,"



SOURCE: Narayanan and Fahey, 1982.

Figure 1. The Stages of Strategic Decision Making

"problem finding," and "problem identification." It has three stages:

1. Activation: individuals become cognizant of issues or concerns salient to them
2. Mobilization: elevation of issue awareness from the individual to the organizational level
3. Coalescence: a coalition forms as a result of the need to take action on strategic issues

The second phase is called resolution, and it is concerned with things like "problem solving," "choice," or "selection." It has two stages:

1. Encounter: the coalition interacts with other organizational entities
2. Decision: a commitment to action, or a postponement of action, or a dropping of the issue, or a transformation of the issue, etc.

Although Narayanan and Fahey do not try to extend their model to implementation, they do attack the rational model for, among other things, making formulation and implementation separate, distinct phases. Perhaps this model can be adapted or extended to an implementation process. That the authors think so is implied in this quotation:

> The coalitional model of strategy formulation suggests that logical incrementalism . . . is a more appropriate description of the process of strategy making than that implied in the analytical scheme of a strictly rational conception. . . . Formulating the content of strategy inevitably entails managing its context and processes (1982: 32; emphasis added).

The Underlying Process and Political Models: Implications for Understanding Implementation

The most important thing learned from the literature reviewed in the previous two sections is that there is nothing straightforward about implementation. One cannot simply say that "implementation is the execution of the plan." (The exception, according to Mintzberg (1978), may be in highly bureaucratized firms.) In general, there are too many social, organizational, and political forces that come into play whenever any plan is proposed.

Indeed, this literature shows that these forces are so pervasive, and potent, that they affect the "formulation" of the strategic intent as much as they affect the "implementation" of it. Bower (1970) showed that while definition of a capital need was often done by individuals using quasi-analytical methods, the impetus process, which got those projects a hearing by people in a position to do resource allocation (i.e., formulate a plan), was more social, organizational, and political than analytical. According to Pettigrew's ideas, getting the organization to rally around a "plan" was more a function of power-mobilization than of analysis.

Hence, it is difficult to support the commonly-invoked dichotomy between formulation and implementation. Mintzberg's alternative term "strategy formation" (1977; 1978) seems much more appropriate. Removing this distinction introduces the notion of learning as important to the understanding of strategy formation. As Mintzberg puts it: "Strategy formation then becomes a learning process, whereby so-called

implementation feeds back to formulation and intentions get modified en route, resulting in an emergent strategy (1978: 946)." Mintzberg and Waters make this point about emergent strategy even more forcefully:

> In our view, the fundamental difference between deliberate and emergent strategy is that whereas the former focuses on direction and control--getting desired things done--the latter opens us this notion of "strategic learning. . . . The concept of emergent strategy, based on the definition of strategy as realized, opens the process of strategy making up to the notion of learning. . . . Emergent strategy itself implies learning what works--taking one action at a time in search for that viable pattern or consistency. . . . It is also frequently the means by which deliberate strategies change (1985: 270-271).

The concept of learning will prove to be very important for understanding implementation, as will be shown later.

Some shortcomings of this literature

While the ideas in the process and political models discussed above are fairly complete, there are some gaps in this literature. Primarily, the models are described at a fairly high level of abstraction, but are not well specified in particular contexts. In other words, no one has gone into the "black box" these models describe, no one has investigated the goings-on in detail.

For example, while the notion of emergent strategy is very plausible, and has been amply supported by Mintzberg and his colleagues, we really don't know what causes an intended strategy to deviate from deliberate strategy to become emergent. We also don't know how this process differs in various forms of organization, if at all. We don't know, specifically, how organizational politics enters into this

formation process--we only know the skeletal framework, some of the important gross variables, of how politics affect strategy formation.

This study will fill in some of these holes. It will attempt to specify the detailed model of how an organization goes from intended strategy, to emergent strategy, and finally to realized strategy. It will also attempt to examine in necessary detail the role of organizational politics. As to the question of how these processes differ among organizations, this study will contribute a detailed investigation of the model in a professional research and development organization; however, there will not be any comparative treatment of organizations.

Other literature on implementation

It seems appropriate at this point to mention some other literature on implementation which has been developed recently. This literature takes a very different approach from the one taken so far in this review. It could be characterized as the "rational" or "planning" approach. Many authors take a view of implementation which is synonymous with control and control systems (Camillus, 1980a, b, c; Camillus & Grant, 1980; Roush & Ball, 1980). Others look mostly at how to set up and optimize the performance of planning systems (Lenz and Lyles, 1981a, b; Lorange, 1979). The fit between strategy content and the research and development efforts of firms is the focus of some research (Tushman, in progress; Iyer & Ramaprasad, 1980).

Gupta and Govindarajan (1983) studied how strategic managers'

prediliction toward risk would affect the success of strategic implementation. Using a survey design, they found a relationship between risk-taking and success. Although they did not explicitly define implementation, since they measured various financial outcome variables, it is safe to say that they implicitly defined implementation as the financial performance of the firm. According to the view of strategic implementation developed so far in this paper, the Gupta and Govindarajan view of implementation is very limited. It is not dynamic, it does not examine the process of implementation, and comes dangerously close to a trait theory of strategic leadership. It is far removed from organizational reality, and it takes a monodimensional view.

Vancil (1979) explored how profit center managers perceived their relative autonomy, and found that the most important determinant was the managerial climate created by the philosophy and style of corporate managers. The second most important determinant was functional authority, expressed by the profit center manager's custody of physical resources. Although this work is limited by the focus on perceived autonomy, it does serve to highlight the role of structural context (Bower, 1970).

A New Metaphor for Implementation: Organizational Learning

The literature reviewed so far suggests that the "filling the container" metaphor prevalent in the strategy literature's skimpy discussion of implementation is inappropriate. The review suggests that

strategy formation is an interaction between definitional, political and administrative processes within the firm, processes which do not resemble a distinct sequence between formulation ("building a container") and implementation ("filling the container"). It was suggested earlier in the review that strategic learning becomes more important as strategy becomes more emergent. As Mintzberg and Waters said, "Emergent strategy itself implies learning what works--taking one action at a time in search for that viable pattern or consistency" (1985: 271). In other words, if strategy is a pattern in a stream of actions and decisions, then strategic learning revolves around the discovery of viable patterns. In this context, learning is the acquisition of a new realization of what one has been doing; it is the search for a new way of doing things (if the old way isn't working); and it is the realization that in a dynamic world one should always be prepared to change.

Therefore, a more appropriate metaphor might be "learning to constantly redefine and change (1) the shape of the container and (2) its contents," using cognitive, social, organizational and political processes. This is a more appropriate metaphor because we are focusing on the makeup of realized strategy--how much is deliberate, how much is emergent? The literature reviewed in depth earlier implied that much of it is emergent. This in turn implies, again according to the same literature, that the role of learning is crucially important. This leads to the question, "What is being realized?" The answer is (1) the organization itself ("the shape of the container"), and (2) its strategy

("the contents of the container").

Frames of reference: The medium for organizational learning

A metaphor based on "learning" leads in two directions: (1) how individual strategic managers learn from emergent strategy, and (2) how organizations learn to construct themselves and their realized strategy. Individual learning, and its effects on decision making, has been studied a great deal. However, this study will not look at questions in this domain.

Organizational learning has not been studied nearly as much. One scholar who examined this question was Jelinek, who did an historical and qualitative study of Texas Instruments (Jelinek, 1979). Her main interest was in discovering how a large and successful firm could institutionalize innovation. She grappled with the notion of organizational learning, and decided that trying to analogize from individual learning to organizational learning was problematic: individuals have a single brain, organizations do not, so it is nonsensical to discuss the two forms of learning in the same way. She resolved this problem by using theoretical assumptions based on Silverman's (1970) notion of an "action frame of reference" shared by all (or at least most) members of an organization. Her conclusion was that organizational learning stemmed from evolution in this frame of reference.

Weick (1979) argues that "an organization is a body of thought thought by thinking thinkers." As Pfeffer puts it:

> Weick specifically rejects the conceptualization of organizations as being dominated by routines, standard operating procedures, and uncertainty-reducing mechanisms, with a correspondeng deemphasis on thought and cognition. For him, organizations are at once bodies of thought, or causal schemata, and also embody specific types of thinking practices, or algorithms (1982: 215).

Weick's notion of "bodies of thought" is equivalent to the frame of reference notion which Jelinek borrowed from Silverman.

Michel Bougon, a disciple of Weick's, believes that socially constructed realities can be found in the cognitive structures of the organizational members (Bougon, 1983), and that one can aggregate the cognitive maps of organizational members to arrive at a representation of the organization's frame of reference. Bougon, Weick and Binkhorst (1977) conducted one study to test this line of thinking. The setting for their study was the Ultrecht Jazz Orchestra in the Netherlands. They uncovered a good cognitive map and were able to make some interesting interpretations of how the variables were arrayed on the aggregate causal map. Essentially, Bougon, Weick and Binkhorst found that

1. their etiographic technique yielded an ordering of variables that were interpretable in terms of organizations
2. the ordering of the variables was strongly associated with the level of the participants' perceived influence over the situation
3. the ordering ranked the variables plausibly in a sequence of three clusters of givens, means, and ends

This study is important for three reasons. First, it shows that, out of the interplay between the intended strategy and the realized strategy of

the orchestra, their develops a distinctive cognitive map, a surrogate for a frame of reference, which makes sense, and can be interpreted. Second, it demonstrates how the notion ofthe development of a frame of reference must be one element of any definition of implementation. And third, it demonstrates that direct measurement of a frame of reference is possible, by using cognitive mapping. All of these points will be addressed in great detail later in this paper, as they bear directly on the present study.

Although he did not use the term "frame of reference," Barnard (1938) placed a lot of importance on the body of values generated by an organization. He stated that executives of organizations must fulfill three functions: (1) facilitating communications (which includes structure), (2) inducing members to contribute to the organization's goals, and (3) defining organizational purpose. Presaging many of the authors reviewed here, Barnard had this to say about the distribution of the latter function:

> The formulation of organization purposes and objectives and the more general decisions involved in this process and in those of actions to carry them into effect are distributed in organizations, and are not, not can they be, concentrated or specialized to individuals, except in minor degree (1938: 187; emphasis added).

In saying this, Barnard rejected the split between "formulators" and "implementors." Barnard placed most of his analytical weight on the third executive function, definition of purpose, and said that organization-wide interaction processes led to a definition of purpose, embodied in a system of values. (Parenthetically, it is interesting to note that in their hugely popular book, In Search of Excellence (1982)

(a work which focused on implementation), Peters and Waterman drew on Barnard (1938), highlighting his view that managers must be shapers and guiders of values, and on Weick (1979), pointing out that he felt that important management assumptions lie embedded in the frames of reference that arise out of the minutiae of day-to-day activities.)

Summary of ideas relating to frames of reference

The definition of strategy which is being used in this section is Mintzberg's (1978: 935), "a pattern in a stream of decisions." As Mintzberg and his colleagues have shown, these patterns can be either deliberate or emergent. To the extent that they are emergent (which Mintzberg says is "common" (1978: 947)), the concept of learning becomes centrally important to strategy formation (Mintzberg, 1978).

Organizations learn by using, and evolving, organizational frames of reference (Jelinek, 1977; Silverman, 1970). The concept of frames of reference is widely accepted (Bougon, Weick, & Binkhorst, 1977; Bougon, 1983; Weick, 1979), and can help us to understand organizations (Barnard, 1938; Peters & Waterman, 1982; Weick, 1979). And, in a point which will be expanded later, frames of reference are measureable (Bougon, 1983; Pfeffer, 1982; Weick, 1979).

The argument of this review can be summarized as follows: if organizational learning is a key component of strategy implementation (formation), and if frames of reference are a key medium for organizational learning, then our understanding of implementation will be increased if we focus on the frame of reference of an organization

which is "implementing" a strategy.

A working definition of implementation

The word implementation is in quotation marks above because, in practice, the split between formulation and implementation is a false one. (A better word, borrowing from Mintzberg, might be "realizing" a strategy.) However, the two activities can be distinguished conceptually, with "development of strategic intent" (which need not be a formal, or group, process) being analogous to formulation, and "organizational strategic activities" being roughly analogous to implementation.

Probably the best route to the development of a good definition of implementation is (1) to adopt a working definition at the outset of the study, (2) examine the findings, and (3) construct a more complete definition. This is the route which will be followed here. The working definition which will be used is "organizational activities and events which seem to advance the realization of strategic intent." This mirrors Mintzberg's terminology: to the extent that strategic intent is fully realized, we have deliberate strategy; to the extent that non-intentional elements creep into the realization, we have emergent strategy. Either way, this working definition meets Mintzberg's test that an operational definition should be designed to give the researcher "a tangible phenomenon" (Mintzberg, 1978: 935) to work with. Using this working definition, the tangible phenomenon is a stream of activities. It is interesting to note that in Mintzberg and Waters, those authors

state

> . . . because of practical necessity, we have been drawn into studying strategies as patterns in streams of actions, not decisions, since the latter represent intentions, too (1985: 257; emphasis added).

The Setting for This Study

The firm studied here, Northeast International Computer Company (NICC), made a strategic decision to enter a market to which it had not previously paid attention. This required a new product which would address the needs of a set of customers new to NICC.

NICC could have acquired a smaller firm already in this market, or it could have resold, under its name, the equipment of other manufacturers (so-called OEMs), but, instead, it chose to innovate, to internally develop its own distinctive computer for this new market.

The history of this project, called "the 1221 project" in this paper, will be examined in great detail below. The focal organization of the study is the software development group, within the larger NICC research and development department, which was charged with writing the operating and applications code for the new machine. By necessity, the marketing department, and upper management of NICC, will receive some attention, as will a few other salient groups in the larger NICC context.

Some Key Issues

The focal organization here is a cross between what Mintzberg (1979) called a "professional bureaucracy" and an "adhocracy." In any case, the professional status of the organizational members, and the

dynamic and complex environment of the computer industry, introduce some distinctive issues.

The outcomes, the "strategic intent," are only partially specified. This is partly because of the dynamism and complexity of the environment, and partly because of the somewhat "artistic" nature of the profession of software development. That is, the software development professional can accomplish the same technical task in many different ways; which way is "better" is not necessarily technically determinable, but contains a large judgemental component. Therefore, the outcome of the work, and the method of performing it, are largely determined by the members of this professional organization.

This situation is akin to what Mintzberg and Waters call "the umbrella strategy":

> Leaders who have only partial control over other actors in an organization may design what can be called umbrella strategies. They can set general guidelines for behaviour--define the boundaries--and then let other actors manoeuvre within them. In effect, these leaders establish kinds of umbrellas under which organizational actions are expected to fall. . . . (1985: 263; emphasis in original)

Implementation involves the members' of the organization creating a method (algorithm, frame) by which they attempt to carry out the strategic intent (stay under the umbrella). But in the umbrella strategy situation, it is impossible to specify this method. So we need to examine how it could be created. In other words, how can a process be developed which will help organization members make choices which will support the strategic intent? Is there a way to encourage the enactment of a frame of reference which will increase the

"deliberateness" (staying under the umbrella) of the strategy, thereby reducing its "emergentness" (straying from the umbrella's boundaries)? Mintzberg and Waters put this issue this way:

> In its pursuit of an umbrella strategy--which means, in essence, defining general direction subject to varied interpretation--the central leadership must monitor the behaviour of other actors to assess whether or not the boundaries [of the umbrella] are being respected. . . . (1985: 263-264; emphasis added)

The emphasis was added to the preceding quotation to show how this conceptualization supports the notion of the enactment of a frame of reference, which is an interpretive concept, as a key element in implementation. We need to know the frame, or frames, of reference held by the actors who make the behavioral choices. The more similar those frames, the more coordinated the actors, the likelier it is that strategic realization will be deliberate rather than emergent. The more consistent frames at the operating level are with those at the strategic level, the more deliberate, and the less emergent, will be the realized (implemented) strategy. Finding answers to these questions, which are largely of a process nature, can be guided by the general sociotechnical framework (Homans, 1950), which suggests that information and interactions, which ultimately lead to the formation of a frame, can flow along three dimensions: (1) technical, (2) administrative, and (3) social.

C H A P T E R II

RESEARCH QUESTIONS

Relatively little is known about strategic implementation, particularly as it has been discussed here. The motivation of this study is to begin to illuminate the issues as they have been framed here. In essence, the questions addressed in this research project are: "What events occurred during this implementation process?" and "How were these events interpreted by the people involved so that they formed a frame of reference about their activities?" The former question is a complicated and difficult methodological issue. The second question is equally difficult, and requires some attention to the means by which data collection on people, activities and interpretations of events was carried out in the 1221 organization. The latter set of issues will be addressed in the methods section. Here, the research, or content, questions will be presented. These questions arise out of the general issues raised given the distinctive view of implementation assumed in the preceding review, and they arise out of the peculiar nature of the group studied here.

1. "What were the initial outcome specifications for the project? Was there an integration in the project about these objectives, or was there conflict and ambiguity between technical and business objectives? Or between the managers and the engineers?" (This is important because of this group's being a professional

organization.)

2. "How effective were communications and interaction patterns in terms of technical, administrative, and social activities?" (As pointed out earlier, the sociotechnical systems framework was used here to guide data gathering and analysis, which seemed appropriate given that what was being studied here was a process.)
3. "What was the frame of reference which emerged in this organization? What was the pattern of givens, means, and ends in the cognitive map of the project's organization?" (This gets directly at one of the contentions of the definition of implementation developed in this study--that what is implemented is not merely a product or service, but also a structure, some processes, and a scheme for representing how the organization views itself, i.e., a frame of reference also emerges as a product of implementation.)
4. "How did the members of the organization extend the initial, partial, outcome specifications into subunit outcomes? How did the subunits extend those into overall organizational outcomes? Putting it another way, what was the interplay between the project's intended strategy and its emergent strategy?" (This encompasses questions about the members' reaction to technological and strategic constraints, the structure and processes which developed in the organization, and the content strategy which resulted from the project.)
5. "How useful are the political models of strategy formulation,

specifically the Narayanan and Fahey (1982) model, in explaining the process of implementation?" (Remember, one of the assumptions in this study is that formulation and implementation are not separable in practice. Therefore, this model should be applicable; if it is not, either it is wrong, or the assumptions are wrong.)

C H A P T E R III

METHODS

Types of Data

As we have seen, understanding the complex phenomenon of strategic realization, or implementation, requires obtaining data on how an organization learns. This in turn requires data on the nature of the organization enacted by the "implementors," and data on the frame of reference of the organization.

Re-examining the questions from the previous chapter, and recalling the peculiarities of a professional research organization, implies that specific kinds of data are needed:

1. Data on the strategic intent of the organization
2. Data on the interpretation of and agreement about the strategic intent
3. Data on coordination, communication and interaction, regarding technical, administrative, and social factors, within the organization
4. Data on the basic content of the frames of reference of various actors in the organization, making sure that the data distinguish among the frames of these different actors
5. Data on the overall frame of reference, if there is one, of the complete organization
6. Data on the political events and activities in the focal organization and its larger organizational context

7. Data on the realized strategy, and how it might differ from the intended strategy

Issues in Data Gathering

How does one get these data? Some could be gotten through standard quantitative approaches. For example, agreement on objectives could be measured with a semantic differential questionnaire. The degree of coordination and communication could be measured, at least in part, by using sociometric interviews. Some data, especially about strategic intent, could be gathered archivally.

But, since process research requires detailed description of the process, most of the data need to be gathered qualitatively. This means that the researcher must get very close to, probably inside, the implementing organization. Typically, organizational research is carried out in one of two paradigms (Evered & Louis, 1981): "inquiry from the inside" or "inquiry from the outside." Evered and Louis argue that a far better approach is to combine both ways of knowing and both kinds of knowledge, a view accepted here. But the preceding discussion shows that an electic approach is desirable from a practical as well as a philosophical standpoint. Therefore, this study combines "inside" and "outside" techniques.

The most effective means for collecting information on implementation and frames of reference is a combination of

technologies--observation, interviewing, questionnaires, and cognitive mapping. This chapter explains each method in detail.

Note on data quality checks

The quality of the data gathered by each method used in this study is examined in the section where the method is discussed. The criteria used were developed by Guba and Lincoln (1981). They argue that data from any scientific inquiry must meet three tests: (1) truth value, also known as internal validity or credibility, (2) applicability, usually called external validity or transferability, and (3) consistency, the well-known criterion of reliability or dependability. The quality of each kind of data will be evaluated against each of these criteria.

Participant Observation

This research employed participant observation, using the definition from Schwartz and Jacobs:

> [Participant observation] means being in the presence of others on an ongoing basis and having some nominal status for them as someone who is part of their daily lives (1979: 46).

The author became something of a fixture during the nine months of fieldwork, visiting the site an average of three time a week, and even receiving his own office at the site. The author occasionally even assisted the engineers, in very modest ways. Observation was done of staff meetings of the 1221 managers, and of members of the 1221 project

at work. Many informal conversations, resulting from participant observation, were manually recorded in extensive field notes.

In order for researchers to get enough detailed data on an implementation process, some form of observation must be included in the many methods used. Simple observation would probably not be rich enough to address the issues raised in the implementation process as it has been developed in this dissertation, namely, details on organizational goals, structures, processes, and frame of reference. Survey data alone would not suffice to get the richness of detail which is necessary. So the researcher engaged in relaxed interaction with and observation of the members of the 1221 project. The information so gathered helped to answer the questions of what took place in the project, what the interplay was between the intended and realized strategies, what were the communication and interaction patterns, and the reactions to technological and strategic constraints.

Quality checks on participant observation data

Internal validity, the credibility of the information gathered, is a great strength of participant observation. In this study, it was enhanced by the richness of detail recorded, by persistent observation (9 months, 3 days a week, 6 hours a day), and by member checks, i.e., asking the members of the organization if data and conclusions were accurate. Validity was also improved through peer debriefing by three other researchers, two of whom were company insiders, and by triangulation, i.e., validation using other methods (discussed below).

External validity is not necessarily a strength of this method, unless the ethnographic description is detailed enough for readers to decide if the setting corresponds to other, similar ones. Discussion with people knowledgeable about softward R & D suggests that this study meets this test.

The chief referee of the reliability of participant observation is triangulation, i.e., the extent to which the observations are borne out by other methods; in this study, reliability is high, as the reader will see later.

Open-Ended Interviews

At the beginning of the research project a series of open-ended, tape-recorded interviews were conducted with some members of the 1221 project--the department manager, the five group managers, the two most senior project leaders, two marketing managers, and the human resources specialist assigned to the 1221 project. The purpose of these interviews was twofold--to get information, but mostly to build rapport quickly with the members of the project. The information gathered related mostly to the manager's or staff member's duties and responsibilities, to the history of the project to that point, to the rationale for the 1221 product, and to some of the issues of being a project embedded in a larger organization. Two other tape-recorded, open-ended interviews were conducted--one with a senior manager, one with a junior engineer. On both occasions the reason was to get their unstructured points of view about what was happening in the project.

These interviews were also crucial to generating the needed level of detail in the data. Since the research project did not start at the same time as the development project, some method was needed to get historical information. Open-ended interviews were deemed best for accomplishing this. And as countless anthropologists have shown, open-ended interviews are an excellent tool for gathering cognitive data. These interviews also gave considerable insight into the technical and marketing requirements of the product, and the intra-organizational political ramifications of the 1221 project. The interviews conducted with the leader of the overall project were the major source of information about the very earliest stages of the project and about the politics of the situation.

Quality checks for unstructured interview data

For these data, internal and external validity were both high. Members told their stories in their own words, which was built-in member checking. The sample of people interviewed was important--top managers, top technical people, marketing managers, and some less central sales and manufacturing staff people. This sample provided a good overview of strategic intent, and of the context within which the 1221 project was embedded, and its comprehensiveness improved external validity. The varied interviews triangulated with one another, providing an additional check. Also, this method could be validated by other methods, particularly observation. This triangulation was the major method for ensuring reliability.

Semi-Structured Interviews

Other interviews were conducted from a semi-structured protocol of questions. The areas investigated using these were: (1) position, (2) reporting relationships, (3) work flow, (4) information flow, (5) sociometric choice, (6) role sets, and (7) role expectations. The questions were suggested by Homans's (1950) model of group dynamics and sociotechnical systems (extended here to a larger organization of forty to fifty people).

Waves of interviews

The interviews were conducted in two waves, and tried to gather data on three points in time, which was crucial given the historical perspective taken here.

The first wave. The first wave of interviews took place from mid-January to late February of 1984. One objective of the first wave of interviews was to gather current data. But the second section of the protocol asked about the period of June, 1983. This was an attempt to get a retrospective measurement of the development project at that point, from those people who were there at that time.

The second wave. The second wave was conducted in June, 1984, to add one other time point to the measurement.

Summary of time points. In all, then, three points in time were measured:

1. June, 1983, which was retrospectively measured in January-February,

1984

2. January-February, 1984, which was measured in "real time"

3. June, 1984, which was measured in "real time"

Sampling

Rather than interview the entire 1221 department, the researcher identified a "vertical slice" judgement sample of about 25 members of the 1221 project. This sample included all of the managers, all of the project leaders, and a subset of the remaining workers. The latter were selected in order to make the sample representative of the overall project. This meant the inclusion of at least one member of each sub-group in the 1221 project.

Quality checks for the semi-structured interview data

Both internal and external validity were enhanced primarily by two factors. Triangulation was again a major quality check. For example, the data on interaction patterns and communication could be checked by observation; this aided internal validity. The variety of data sources enhanced the description of the situation, which improved the transferability or external validity of the findings.

The sampling was done purposefully and theoretically. The purposeful part was the deliberate inclusion of the managers and the technical supervisors. The theoretical part was the random selection of representatives from all parts of the whole organization. The sampling

thus ensured adequate coverage of the project team, improving internal validity. It also enhanced the transferability or external validity of the findings by being comprehensive in its view of the whole organization.

Internal validity was also helped by the longitudinal measurement. Since what was being studied was a process, the phenomenon was dynamic. A static, one-time measurement would have been a serious violation of internal validity. Since most project evolutions are also dynamic, this aided external validity too. The reliability of the data were primarily enhanced by standardizing the interview protocol. Also, some of the interviews were conducted by peer researchers who were company insiders; this enhanced the reliability of the data.

Questionnaires

The questionnaires investigated the meanings assigned to various statements that reflected the dichotomous nature of the 1221 effort, namely, striking a balance between business and technical goals. As mentioned earlier, the question of goal congruence is particularly important in a professional organization like the 1221. Six concepts were gleaned from initial interviews at the company, three from each of the two competing attitude sets:

1. Business considerations
    a. Low end product
    b. First customer shipment by July

c. Product compatibility

2. Technical considerations

a. Technical excellence

b. Lots of functionality

c. "State of the art" work

The questionnaire used the semantic differential technique, and had twenty of Osgood's original 76 scales (Osgood, Suci, & Tannenbaum, 1957). These twenty scales were heavily skewed in favor of the scales that Osgood and associates interpreted as evaluative. This was because of the need to measure the 1221 organization's members' cognitive assessment of the possible dichotomies inherent in the development effort.

Quality checks in the semantic differential data

Internal validity was enhanced by the sampling, for much the same reasons that were valid for the semi-structured interviews. The particular concepts which were gleaned from the open-ended interviews were a great source of internal validity, since they were generated by the members themselves; this was built-in member checking. And, again, triangulation was important here. The selection of the six concepts was reviewed by research collegues familiar with the project, which improved internal validity.

External validity was enhanced by the use of terms which were sufficiently broadly worded to be generalizable to other settings, and by the proper sampling of engineers and managers.

The major means for ensuring reliability was the selection of standard Osgood semantic differential scales. These scales have been in use since the early 1950s, and have been shown to be reliable.

Cognitive Mapping

Cognitive mapping was used in this study because it is an effective way of measuring the frame of reference of an organization (Bougon, Weick, & Binkhorst, 1977). In this discussion of implementation, we have stated explicitly that implementation can only be discussed in the context of experience, i.e., of what happens in the organization as its members seek to move from strategic intent to strategic realization. Presumably they have experiences, which they process in some way.

The question then becomes, "What do human beings do with their 'processed' organizational experiences?" Of course, seeking the full answer to this question would occupy the full professional lives of many organizational researchers. But a partial answer can be obtained by looking at work done by some scholars with similar interests. We have already discussed the work of Bougon, Weick, and Binkhorst (1977), Silverman (1970), and Weick (1979). Weick's work, in particular, focuses on how people deal with their experiences. In his ESR Model (Enactment, Selection, and Retention), he shows how people sort and select ("punctuate") their experiences, how they put these into cause and effect chains, and how they combine them into frameworks ("bodies of thought"). Let us look at some other works that deal with these

issues.

Tversky and Kahnemann posited that individuals construct "frames" with their experiences. Their use of the word is similar to how it has been used here: ". . . the decision-maker's conception of the acts, outcomes, and contingencies associated with a particular choice" (1981: 453). These frames take on the form of "schemata": webs of acts, outcomes, and the connections ("contingencies") between them.

Bougon sees experience as being processed and retained in a very similar way

> . . . the process transforming raw experience into knowledge relies on cortical schemas. . . . For perceiving patterns into one's raw experience (i.e., for acquiring knowledge), one needs schemas. For organizing and retaining that knowledge, one needs further schemas. Schemas, perception, and knowledge are intimately interrelated, and one cannot be isolated from the others (1983: 175).

The work the notion of schemas, of organizational variables connected in some sort of meaningful way, is potentially a very powerful way to understand what organizations enact when they go through an implementation process, to understand how they process their organizational experience. The question then becomes, "What does it take to know an organization's schema?" Bougon responds that it is impossible to <u>truly</u> know, but that an approximation is possible:

> . . . Every schema is associated with a concept, [and] concepts are the notions behind words, and . . . a schema can reconstruct the pattern of concepts that it recorded. Therefore, to the extent that concepts in the concept-structure [i.e. schema] of [an organization] are tagged by words, we can explore that concept-structure [schema] (1983: 177).

Bougon calls the mapping of schema <u>cognitive mapping</u>. Here,

cognitive mapping was combined with all the other methods, resulting, it is hoped, in a triangulation around the frame of reference of the organization. We have already discussed at length the appropriateness, in the context of strategic implementation, of the notion of causal schemata. If these are appropriate, then measuring the causal schema of an implementing organization should be very desirable, perhaps even necessary. Cognitive mapping is simply one of the best techniques which has been developed so far to capture causal schemata, an assertion supported at length by Axelrod (1976) and Pfeffer (1982). The latter gave the following assessment of this method:

> Using [cognitive mapping] it is possible to assess the extent to which members of an organization . . . share causal schemata, as well as to discover those relationships for which causal perceptions vara. These causal schemata . . . reflect the members' understanding of the organization and represent the organization and its organizing process. . . . [Cognitive mapping helps in] understanding the causal structures which underlie organizations (1982: 216-217).

Cognitive mapping is the most "qualitative" of the various approaches to surfacing organizational schemata, and allows the inquirer to get the closest to the organization members and the phenomena of interest. It uses the members' own words as variables. Other techniques rely a great deal on multivariate statistical techniques and data gathering techniques which are more sterile.

The technique of cognitive mapping

The technique of cognitive mapping used in this study was a three-stage process. First, the researcher interviewed the

respondents. The interview consisted of the researcher's asking the respondent to develop questions about his or her view of the organization. The respondent did not answer these questions. Instead, the researcher gleaned concepts from the questions, and then checked these for accuracy with the respondent.

Second, the researcher examined all the concepts developed, and constructed a set of the ones mentioned jointly by all the respondents.

Third, a square matrix of the items was constructed. The respondents filled in the cells of the matrix to indicate their beliefs about the existence and type (positive or negative) of interrelationships between the concepts. The respondents were also asked to indicate their perceived level of influence over the inter-relationships. The data were aggregated for the entire sample and analyzed by the researcher, who then developed the cognitive maps.

Quality checks on the cognitive mapping data.

The generation of the map in close cooperation with the members of the 1221 project, at every step of the way, greatly enhanced internal validity. Since this was the first time cognitive mapping was used in this kind of setting, it is not clear just how much external validity there is to the data. But the sampling, the nature of the people responding, leads to the belief that external validity is fairly high. Triangulation, as mentioned above, was a major source of confidence in internal and external validity, and was the primary source of reliability.

C H A P T E R IV

CHRONOLOGY AND ETHNOGRAPHY OF THE 1221 PROJECT

Pre-1221 History

To really understand what happened in this project, one must go back to 1981, when the company introduced its first "low end" word processor, the NICCwriter. This is important for two reasons. First, one of the key managers on the 1221 project was the manager in charge of the NICCwriter. Second, the NICCwriter was the closest thing to the 1221 that the company had previously tried to develop.

The NICCwriter met with only limited success. Several reasons were cited. One was that it lacked competitive functionality, i.e., it couldn't do the things that the editors on the word processors of NICC's competitors could do. Another was that the company was unable to adequately compensate its sales force, which had always been oriented towards large, expensive word processors. A third reason given by many NICC insiders was that the NICCwriter had excessive manufacturing overhead. Finally, observers felt that the marketing department had erred in targeting only the large National Accounts held by NICC, thereby marketing the NICCwriter to only thirty percent of its potential market.

While all this was happening, Alfred Tsou, who eventually led the 1221 project, was managing the Microsystems group. (See Figure 2 for the pre-1221 NICC organization chart.) Tsou is an interesting character. A native of Hong Kong, he joined NICC in 1973, and became a

manager in 1977. He is about thirty-three, medium height, and wears glasses. He wears the "standard" garb for middle and upper managers at NICC, a suit; in his case it is usually gray. Tsou is very energetic. He speaks in an emphatic way, hardly seeming to pause for breath. As his managers will attest, he is not shy about candidly articulating both his beliefs and his expectations. Tsou is very self-conscious about being Chinese, even though a large percentage of the engineers at NICC are Chinese, and even though he speaks virtually accent-free, rapid-fire English. He is self-conscious in the sense that he feels his ethnicity is an advantage to him. "I am from another culture," he says. "I use the same survival skills in the NICC culture that I used in Hong Kong." Tsou evidently did not know his biological father very well, and it is clear that he views Dr. Smith as a surrogate father.

In 1981, Tsou's Microsystems group tried to build a low cost terminal for NICC's largest machines, the Mainframe Systems (MS). These terminals were so different from the expensive ones NICC traditionally made, that they were not accepted by the company. Despite this, Tsou went ahead and built prototypes without telling anyone. Risky as this might seem, "bootleg" projects like this were, and are, quite common at NICC. "You really shouldn't use frontal assault when you're trying to work against internal competition," Tsou said. "I like to think of what I'm doing as playing GO. To win you have to use encirclement and subtlety." During this episode Tsou began to demonstrate his understanding of the political element in getting strategy formulated and executed--one does not use "frontal assault"; one waits until a

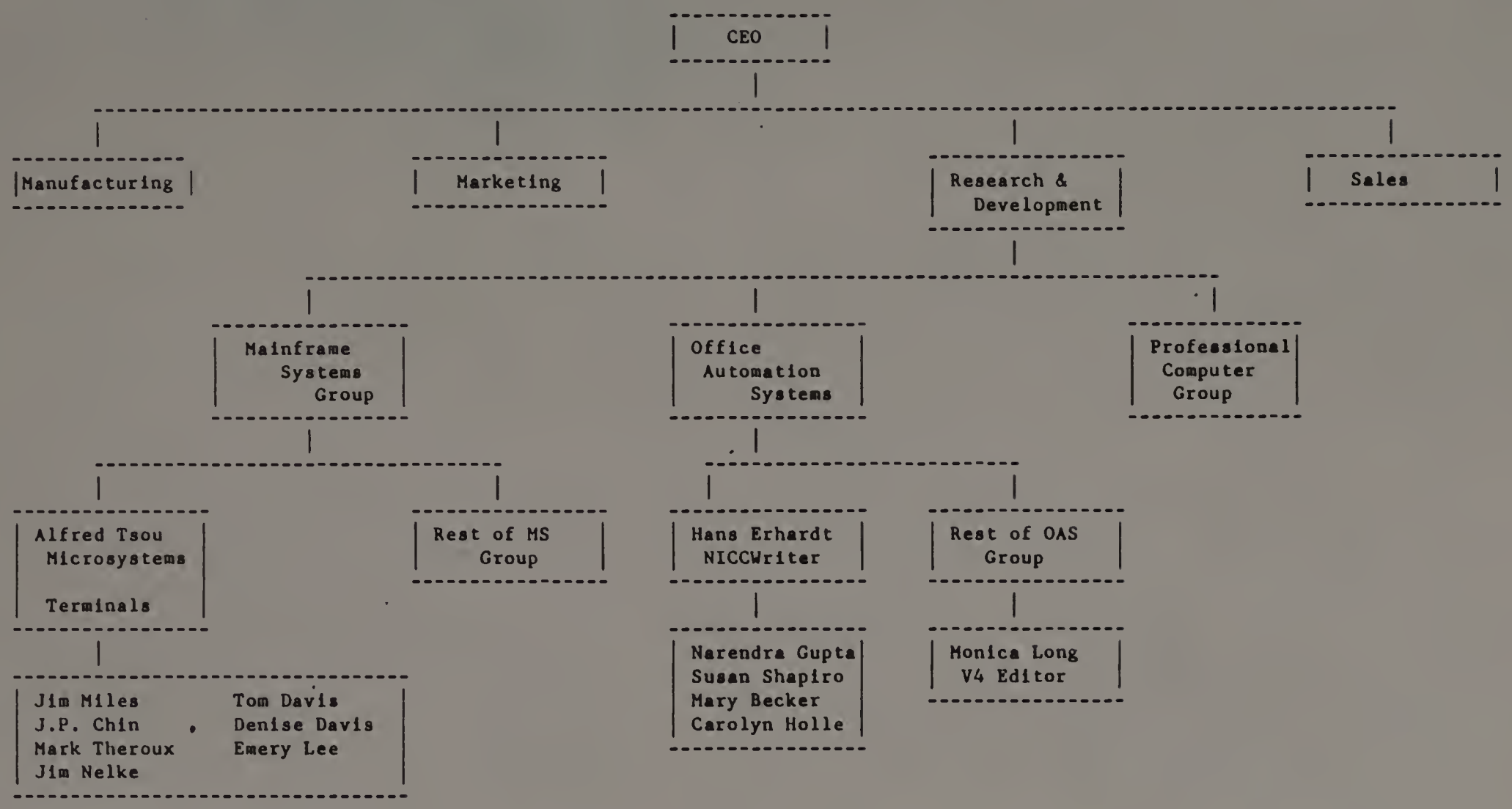


Figure 2. Northeast International Computer Company, partial organizational chart, before 1221 project

sponsor can be found who will give some impetus to the project; one waits to form the proper coalitions.

Tsou's leading subordinate in Microsystems was Jim Miles. Miles was originally from Illinois, outside Chicago. He is about five feet, ten inches tall, rather thin, and wears glasses. He speaks in a nasal tone, apparently from chronic allergies. Unlike Tsou, he rarely wears a suit, but he usually comes to work in a sport coat, and he always wears a tie. Miles is a very measured speaker. If a question can be answered in one word, he is sure to answer it that way. It is clear that he has thought about most questions that people put to him. He is meticulous and believes in planning and preparation, even if that means sacrificing something in the short term. Miles went to the Univeristy of Illinois during the Vietnam War era. "My draft number was 43," he said, "so I ended up in ROTC." Allergies prevented him from becoming a pilot or navigator, so the Air Force placed him "with the computers on the base" in California, where he was stationed. He was reassigned to the Pentagon, to work on computer security. "That was a research type of place," Miles said, "as opposed to just a standard military thing. The Pentagon being the Pentagon, it was a 9 to 5 job." Miles recounted that his superior at the Pentagon was also Chinese, "just like Alfred. I think that they grew up in the same town--they have identical personalities. . . . He was a captain when I knew him. He just got promoted to full Colonel about two weeks after Alfred got promoted to the project," he said, remarking on the irony. Miles went to work for

Honeywell after the military. He eventually worked on terminals. After a shakeup at Honeywell, Miles joined NICC in 1981, where he worked for Tsou on terminals and microprocessor-based equipment.

In August, 1982, Tsou and Miles co-authored a paper on low cost/high functionality systems. Said Miles:

> It recommended that we take the--at that point, it was aimed directly at the terminal products like MS--that we use technology to our advantage in two different directions: to lower the cost of our products, yet maintain the current functionality; the other direction was to maintain the cost and boost the functionality. Since we're very product oriented, the cost is the main competitor. So, functionality and cost are the two key themes.

The writing of this paper was the definition (Bower, 1970) or activation (Narayanan and Fahey, 1982) (at least from the lower levels, which Bower called the "initiating" level) of what would ultimately become the 1221. The paper's recommendations were not accepted, but it <u>did</u> achieve some notoriety. "The paper," Miles said, "was being waved as the flag within NICC--people were saying that there are people who can be innovative, and that type stuff. It made me feel proud." Even though the paper became visible, this was not the mobilization phase (Narayanan and Fahey, 1982), because the paper did not raise awareness of <u>issues</u> to the organizational level. It simply raised awareness about how someone could write such a paper at NICC.

During this period Alfred Tsou chaired a task force on strategies for terminals for the MS group and the Office Automation Systems (OAS) group. Tsou had acquired a reputation for being aggressive and pushing things through quickly, which was a key factor in his selection for this chairmanship. The paper had something to do with

it, too, according to Jim Miles: "At [this] point in time--I don't know all the ramifications--the NICCwriter was getting killed on the marketplace. Because of that paper, Alfred had been named chief of the task force for NICC's work station strategy for MS and OAS. But the politics at NICC at that time were so heated that the right thing to do was just totally lost. So the task force really got nowhere." Almost as an aside, Tsou and his hardware counterpart, Jim Bunning, began to investigate possibilities in electronic typewriters.

Hans Erhardt was the software manager of the NICCwriter project. Physically, he was the most distinctive of the managers on the 1221 project. Tsou said that "Hans adds color." He is about six feet, four inches tall, and is neither thin nor overweight. At the beginning of the project he had only a mustache on his bespectacled face, but he grew a beard in the early winter, which he kept. Erhardt dresses like the other managers, in sportcoat and tie. His attire is decidedly "preppier" than most of the others'. Erhardt joined NICC in 1970. Like many of the veterans at NICC, and elsewhere, Erhardt had an unusual background for a software engineer. Like Jim Miles, Erhardt was from Illinois. He got a bachelor's degree in physics and a master's in mechanical engineering from the California Institute of Technology. His first job was for the California Electronics Accelerator. "It was a big physics laboratory at Berkeley," Erhardt said. "I was the operations engineer, which basically meant running the machine." After he'd been on the job for two years, the Atomic Energy Commission cut the funding

of the Accelerator, and Erhardt had to find another job:

> I was sort of gearing myself as being half physicist and half engineer. . . . I noticed from the advertisements for jobs that there were very few jobs for physicists or engineers at the time [1970], but hundreds of jobs for programmers. And I decided I was going to make a change and go into this field of computers, which I actually hadn't ever studied in school at all. . . . I started going across the street to the Harvard Computation Center, getting manuals on various things and reading them and playing around with this little basic language computer they had in the lab. And getting . . . sort of testing the patience of my friends who were programmers by plying them with beer and asking them dozens of questions--"What is a _____?"

Erhardt received some good fortune when the wife of a coworker at the Accelerator, who worked for a small software company, got him an interview, which led to a job. "It turned out," Erhardt said, "that this software company had been bought by Northeast International Computer Company, although it was still an independently operating place at the time. That's basically when I joined NICC. I joined this little 200-man software company, and now, like, without changing companies, I'm with a billion dollar corporation, which is kind of weird." After some initial breaking-in, Erhardt went to work on micro-coding what turned out to be NICC's first word processor. He kept on working on enhancements and improvements of word processors, including the first CRT-based word processor and the first NICC use of microprocessors. Erhardt took a brief sabbatical at another computer company in the area, and he also spent about three years working on communications software, but he ultimately ended up managing software on the NICCwriter project.

In the summer of 1982, while the NICCwriter was in its "maintenance" phase, after introduction, Erhardt had some time on his

hands. He developed a proposal that was similar to the Tsou-Miles one, except that it was not for a low end product:

> I had this idea of a real high-end fancy thing we were calling NICCwriter 3 that was going to be built on the PC [NICC's Professional Computer], and some fairly specific ideas about a powerful screen hardware facility and so on and so forth. My proposals weren't being eagerly listened to by anybody, but I kept working on it anyway.

The Genesis of 1221

In the Fall of 1982 there began to be some concern among top management at NICC that the company needed a shot in the arm. This feeling was strongest for Herbert Rodman, a Vice-President and "the father of wordprocessing and OAS", according to Miles. Miles continued:

> Rodman was very upset with how OAS was going nowhere, how NICC in general was going nowhere. He was Dr. Smith's right hand man. So, they had a big meeting and Rodman went out and just cut everybody apart--the MS, the OAS, the PC, vice-presidents, and so on--saying how none of them knew what they were doing or where they were going. I don't know if Alfred brought it up, or if Fred Riley [the Vice President of Research and Development] brought it up, but one of them brought up the fact that, well, Alfred <u>does</u> have this paper ; . . . and that's when it hit the top and things started happening.

It was then that mobilization occured. The issues raised earlier by Tsou and Miles in their paper suddenly penetrated the awareness of top management. Dr. Smith, Fred Riley, and Herbert Rodman were very powerful, and they became the sponsors of Tsou's and Miles's idea, i.e., they provided the idea with some impetus. The formation of this group marked the coalescence phase (Narayanan and Fahey, 1982).

Some thought was given to developing a typewriter replacement.

The coalition met with Ray Culp [V.P. in charge of the Professional Computer], and Larry Rosen [V.P. in charge of MS]. They all decided that the typewriter concept didn't fit anywhere, so they changed it to a low end word processor. They decided to re-enter the low end market, despite the problems with the NICCwriter. But there was some degree of indecisiveness, because of the success of the large systems. These discussions marked the encounter phase, where the coalition backing the 1221 came into contact with representatives of two groups which had a different point of view on the issue of launching a low-end effort. The top management coalition prevailed.

On December 21, 1982, the 1221 (named after the date) was approved. The product was targeted for 70 percent of small business companies. Top management decided to split the 1221 organization off from existing divisions. (See Figure 3 for the post-1221 organization chart.)

The selection of Alfred Tsou to run the 1221 project was not automatic. It took until January of 1983 before Dr. Smith decided to let Tsou run it. Once he had the project, Tsou and Miles began to estimate the parameters of the project: what the product should do, where the product should go, what could be adopted from other groups, who could be recruited from other groups. The project officially began on February 1, 1983, when Tsou had twelve people assigned to him. Five of these, including Hans Erhardt, were from the NICCwriter project, which by now was officially buried. Seven, including Jim Miles, were from Tsou's terminals section in Microsystems. This movement was met

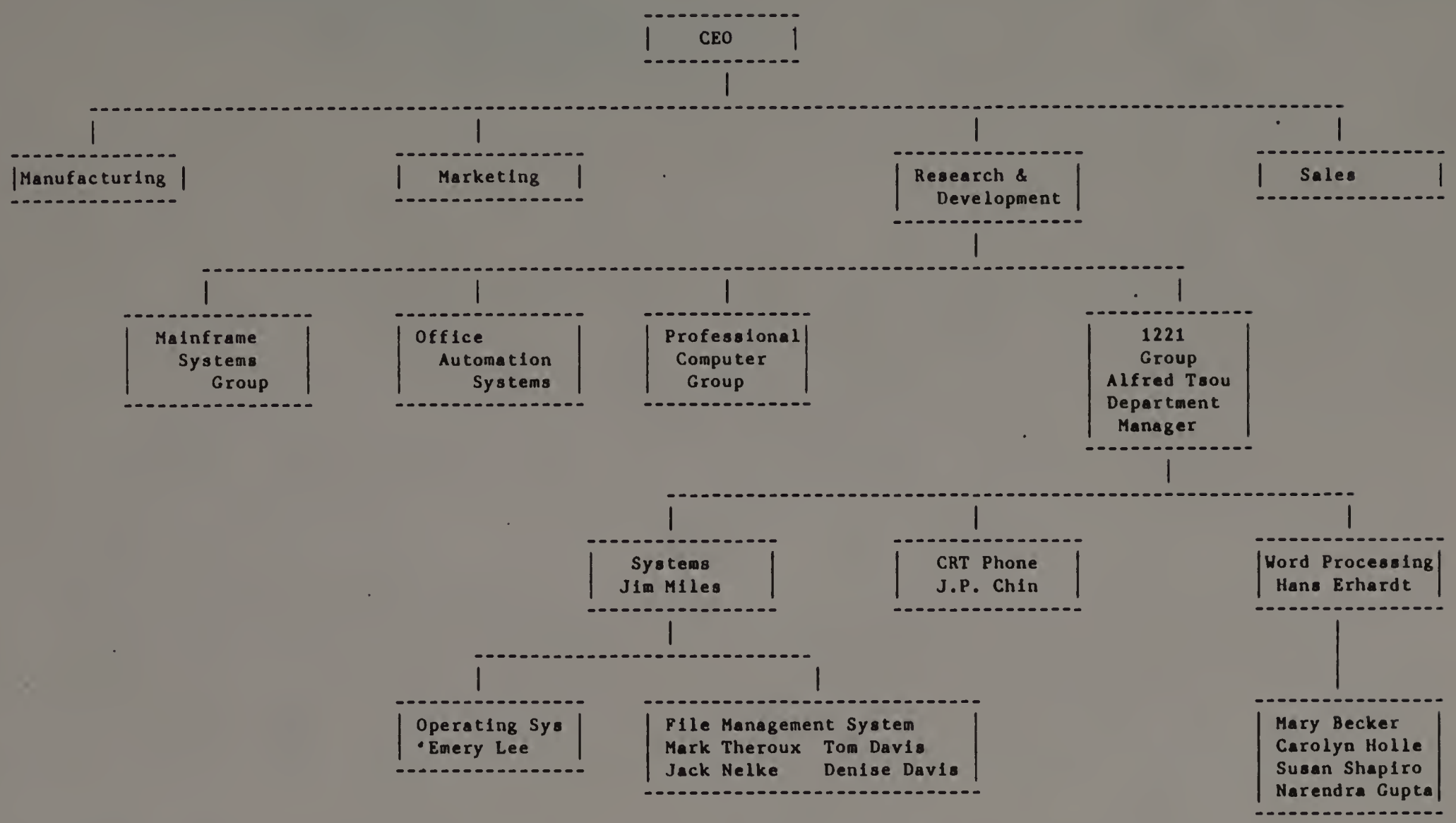


Figure 3. Northeast International Computer Company, partial organizational chart, after formation of 1221 project

with acrimony by the terminals engineers who remained behind, according to Jim Miles. "They were very antagonistic when we left the terminals area," he said. "Finally, they were getting to do new things, as opposed to the same old stuff. Then, when Alfred and I left, every time we walked by their cubicles, they'd shout out, 'Turncoat! Traitor!'. They were really upset. They thought we left them out to dry and walked away from them, because the driving forces of getting things done had left; and now they had to fall back into the old mode of operation."

The Structure of the Task and the Organization

A microcomputer is a complex machine. At the "bottom", which is the term the engineers give to the most basic level of the machine, is the hardware. This is composed of silicon chips, which contain thousands of tiny switches. Some of the chips are for storage of information. These are called "memory." Temporary memory is called "random access memory," or RAM. The information on these chips is erased when the user turn off the computer. Some chips have routines permanently inscribed onto them; these are called "read only memory," or ROM. Occasionally, computer engineers will install chips which can be altered like RAM chips, but only by service technicians, not the users. These are called "programmable read only memory," or PROM.

All computers have what is known as a "Central Processing Unit," or CPU. This is the part of the computer which carries out computations and manipulates data. In microcomputers, the CPU is a specialized chip called a "microprocessor."

Microcomputers typically have three other important hardware components--keyboards, disk drives, and video screens. Technically, all three of these are considered "peripherals," i.e., not part of the CPU. Keyboards are used to input data and commands. Disk drives hold magnetic disks, which can be used for permanent storage of information and programs, and from which data and programs can be loaded into the central memory. Video screens are the most common form of output device in microprocessors, or in the terminals which are used as workstations on larger computers; they are used to display information that is being input, and information that is the result of various computer operations. In addition, microcomputers have a myriad of wires and other hardware that perform various "housekeeping" and connecting functions.

The hardware in a microcomputer must somehow be gotten to perform effectively. Actually, all the activity in any computer could be "hard wired," i.e., etched right into the chips which make up the computer. This would, of course, make for a very rigid computer. The usual course is to place many of the instructions to the hardware on disks, in the form of programs, usually called "software." Software has various levels, also.

The level of software which is closest to the hardware, which directly controls the hardware, is the microcode. The microcode is in turn controlled by the operating system. This is the code which directs the computer to shift data, for example, from a floppy disk to the core memory, or from one part of core memory to another, or from core memory

to disk, or from disk to an output port (to a printer), and so on. Sets of data are usually called "files," and these are handled by a subsection of the operating system called the file management system.

The software which is furthest from the hardware is called applications software. These are programs designed to take advantage of the capabilities of the hardware, as controlled by the operating and file management systems. In the 1221, there were three applications. The most important by far, given that the machine was conceived as an office automation product, was word processing, an application which allowed users to write, edit, and print special files, called "documents," much more effectively than one could with a typewriter. In the 1221, word processing was itself broken down into the editor, which is the interface through which a person uses the application, and the formatter, the part of word processing which readies the input text for typewriter-like printing.

The 1221 had two other applications. One was office applications, which allowed users to emulate a typewriter, define and print mass-produced forms, and use industry-standard software packages, like spreadsheets and accounting. The other was the CRT Phone, which allowed a user to process data, and transmit voice and data, all simultaneously.

As mentioned above, applications are written to exploit the capabilities of the operating and file management systems, which in turn are written to exploit the capabilities of the hardware, particularly the microprocessor chip and the disk drives. A mechanism is needed to

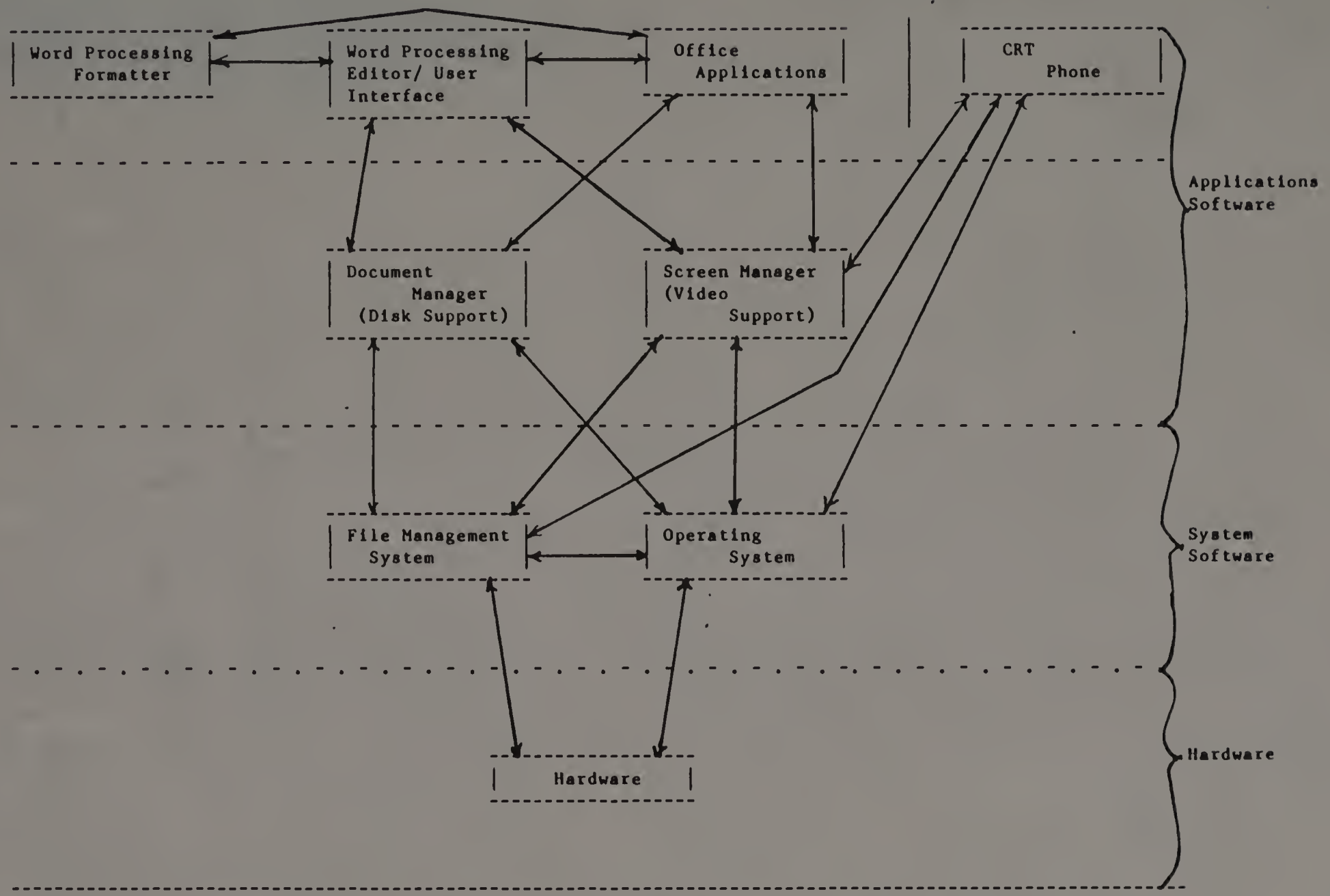


Figure 4. The technical configuration of the 1221 computer. Please note that this diagram is a composite of two diagrams drawn by two engineers in the 1221 software development organzation. The dot and dash line (- . - .) represents the boundary between the software and the hardware. The spaced dashed lines (- - - -) represent alternative ways to specify the boundary between system software and applications software. The 1221 management chose to place the boundary between the operating/file management systems and the screen and video managers.

tie the applications and systems software together. In the 1221, this was handled by two programs--the document manager, which provided disk support for the interface between applications and systems, and the screen manager, which provided video support for the interface.

Administratively, the programmers writing these linking functions could have been placed with either the systems or the applications group. In the 1221 organization, they were placed with the applications, at least initially. Figure 4 shows how all these technical functions were linked in the 1221. The organization structure of the 1221 project was broken down as follows: a "systems" side, consisting of Jim Miles, as the architect, a file management system group, and an operating system group; and an "applications" side, consisting of a word processing group and a CRT Phone group. (The Office Applications group was not added until August, 1983. See Figure 5 for the detailed organization chart of the 1221 project, as of late October, 1983.)

Some key people

One person Hans Erhardt brought with him from the NICCwriter group (although she was a new addition to that group) was Mary Becker. In her mid fifties, she usually dresses in casual dresses (never slacks), often accompanied by cardigan sweaters. She speaks in a very soft tone, and gives the impression of a very nice person with esoteric interests who would like to be left alone to pursue those interests. She joined NICC in 1976, and began working in the telecommunications

group that was being managed by Hans Erhardt. She stayed with telecommunications after Erhardt left to manage the NICCwriter group. At the end of 1982 she arranged a transfer into the NICCwriter project, but shortly after the transfer became effective, Erhardt had become part of the 1221 project. So Becker became part of it too. She was nominally the project leader of the editor subgroup, concentrating on the interface between the user and the word processing editor.

Mark Theroux was another person who joined the 1221 project in February of 1983. Theroux had bachelor's and master's degrees in mathematics. He had joined NICC in 1976 about three weeks after completing his master's degree. He is about five feet, ten inches tall, medium-to-thin build; he does not wear glasses, and keeps his hair close cropped. One might say that Theroux dresses like the stereotypical computer engineer--tee shirt, blue jeans and sneakers. But in most other ways he seems far from stereotypical. He is quite good at communicating orally, and seems to take great pride in putting his words and sentences together with precision and style. Perhaps it was qualities like these that led Theroux to be characterized by another member of the project staff as "a creative genius" at programming. Up until 1982 Theroux worked for the MS division, mostly writing assembly language and micro code programs. In late 1981 and early 1982 his old department began to break up because of reorganization, and Theroux ended up working for Alfred Tsou in Microsystems. This led directly to the 1221 project. His early input to the 1221 was in writing conversion utilities. Software development usually occurs in an environment where

the hardware and the operating system of the computer are given. Applications programmers "write to the system." But the 1221 was being developed distinctively--the hardware was developed first, but the systems software and applications software were being developed in "parallel." And even though the hardware was "set," there were no circuit boards available until the project was about ten months along. So some way had to be found to allow the software engineers to design, write, and test code in the meantime. Mark Theroux was the person chosen to write the utilities that would allow the development systems on hand to emulate the eventual 1221. Although he wanted only technical responsibilities, Theroux was unofficially the project leader for the File Management System (FMS) subproject.

Emery Lee also came to the 1221 project from Alfred Tsou's former group. Lee is a native of Hong Kong, and had been in the United States for about ten years. He held a master's degree in electrical engineering. He is about five feet seven inches tall, with a slight build and glasses. While working for a rival electronics company, Lee received a standing job offer from Tsou. Becoming disenchanted with his job, Lee joined NICC in 1980. He worked on one of Tsou's low-end MS enhancements, which was released in 1983, just as the 1221 project was being formed, and he was put in charge of the operating system.

The other manager in the 1221 project was J.P. Chin. Chin is also from Hong Kong, and he holds a bachelor's degree in applied math from a Taiwanese university. He also holds a master's degree in computer science from Ball State University. Chin is about five feet,

five inches tall, wears glasses, and is very slight. He joined NICC in 1978, going to work for Tsou. Given Chin's interests in the applications of microprocessors to telecommunication, he was placed in charge of the "CRT Phone", which was somewhat separate from the main 1221 project, but used the same hardware and operating system.

Early Politics

One of the first things a software development group needs for its work is a development system, i.e., a computer on which to write and test code. The 1221 organization had a difficult time getting a development system.

The fastest way for it to get a system was to use an existing MS machine. But Larry Rosen, the manager of the MS group, and until recently Tsou's boss, was angry over Tsou's leaving, and taking good MS people with him, for the 1221 project. Another good system for the 1221 was the new NICC PC [Professional Computer], since the chip on the PC was very similar to the chip on the 1221. But Ray Culp, the manager of the PC group, didn't like the 1221 project's being split off from the rest of the company, and particularly from his group, since it might have been logical to put both microprocessor-based products together under his purview. It was widely rumored that both men forced design changes in the early stages of the 1221's development, changes which did nothing but make things more difficult for the 1221 engineers. The upshot was that the latter made extensive design changes. Jack Nelke, a young engineer working on the File Management System, talked about the

effects:

> This created a lot of frustration among the engineers. They shouldn't be exposed to the politics. Managers should handle the politics. I'll give you some examples. We thought we could use the PC for development work, because of the similarity in chips. Ray Culp vetoed the idea. I've heard that Fred Smith chose not to override Culp.
>
> When the hardware finally got straightened out, Bob Erlich was chosen as our liason. But he was not a supporter of the 1221, so our hardware support has been poor. Larry Rosen, my former boss at MS, was so angry about our leaving his group that he forced us to physically move off our old floor before we wanted to. This was very unsettling for us.
>
> In those days, when I identified myself as working for the 1221, it really turned people off.

These data suggest that encounter, the organization's (now an actual development team, with some engineers in it) coming into contact with other interest groups in the company, does not end with the decision phase of strategy formulation, but continues well into the actual execution of the strategy.

The project team finally did get a MS and an OAS for development work. Miles also arranged for the project to be a beta test site for a new development tool being brought out by Tektronix. Since all these machines had different characteristics, many conversion utilities needed to be written and used. Sometimes a given engineer would have to go through all three machines in order to write and test code. The Tektronix was in itself a complicating factor. "We started our development on the Tektronix," Nelke said. "We feel that this was a fundamental error on Jim's part. It's a really bad development system." These sentiments were echoed throughout the project's staff.

After a while, Tsou helped the situation a great deal by

persuading Culp to allocate some PCs to the 1221 project. Most of the engineers got one, although it took several months in some cases. Most of the engineers who got a PC spoke highly of them. But one problem that persisted throughout the project was the scarcity of mundane materials, especially floppy disks. No one knew quite why these basic but necessary items were so scarce, but the rumor which circulated was that Tsou was determined to not only develop this machine in record time, but also at minimum cost. Tsou may have done this for reasons of political "impression management."

Equally unclear was why Tsou refused to spend money on more powerful development tools. Rudolph Kaiser was the system architect. He joined the project in mid-autumn, 1983, after Miles had initially performed the architect's role. Kaiser was charged with developing variations on the theme of the 1221. He felt, perhaps more so than others on the project, that the development tools were poor. He urged Tsou and Miles to spend about $200,000 on a really good system. "After all," he said, "this product is supposed to make millions for the company." Tsou's response was that, for political reasons, only NICC equipment and the Tektronix could be used. Tsou, with his penchant for "subtlety and encirclement", may have felt that using non-NICC equipment may have been too provocative, a "frontal assault" on his peers in the MS, OAS, and PC groups. He may have felt that neutralization of this potentially hostile interest group may have been worth the inconvenience, to his engineers, of poor development systems.

The Early Stages

In March, 1983 work began on designing the 1221. Barbara Campbell, from the marketing staff, was contracted to do some market research, based on the initial functionality and price specifications. Her study of the 1221 convinced her that this was the best word processing editor ever. Her report was sent to Fred Riley, which increased the visibility of the 1221 project. But not everyone agreed that Erhardt's design was the proper approach. Jim Miles had reservations about it. He said later, "Hans took the wrong turn with WP from the beginning. His approach was not on the mark. Hans's WP is a scientific achievement, but it is not a desk top system. I don't think it was made clear to the programmers in WP just what the parameters were. People were told, 'Come up with these functions.' And they did. But no one made it clear to them that they only had 128K to do it in. I knew in May, from the design, that they couldn't cut back. I knew they needed a different design, one that would allow cutting later. But I kept getting assured that the size goals would be met." Miles felt that Tsou was determined to prove to others in the company that Erhardt could be trained to become an effective manager, from a commercial standpoint, despite his esoteric technical background and unsuccessful recent track record.

In May, Tsou and his superiors decided that compatibility among all NICC word processors was a critical variable in NICC's marketing strategy. Monica Long in the OAS group was developing a new editor

called the V4, which was considered to be the NICC standard. Hans Erhardt and Long began negotiating over the features of their respective editors; Erhardt had the technically superior product, but Long had the standard for the company. These negotiations proceeded for several months.

The Business Plan

The month of June brought an important element--the Business Plan. The author was marketing staffer John Steffano. Steffano is an interesting character. He holds three degrees, and "none have anything to do with computer science," he said. Steffano joined NICC in 1979, doing systems analysis and consulting for an end-user organization that used NICC products. He joined Product Marketing in 1980. During the 1221 project he worked for the Standalone Office Products sub-subgroup of the Office Systems Marketing subgroup. Here is how he described his role:

> I'm responsible for all that the 1221 is from a product standpoint--its functionality, its interface, and things like that. I tie the whole thing together. . . . Largely, my task over the past many months has been one of definition, consolidation, and just what is the 1221 and what's it going to do.

Steffano related that writing the plan had been extremely time consuming and burdensome. Steffano had been working on it since January or February. He described the process:

> The approach that I took was there is not a NICC format for a business plan. There is not a NICC document that says, "This is what a business plan should be, how long it is, etc., etc." Earlier on, the largest business plan that I think that I had ever seen was out NICC PC business plan, which was in the 50s in terms of page length. I wanted to do one about 10 or 20 pages. In fact, the first draft was

something like that. My director . . . said that's definitely not what he wanted. He wanted substantial pages and wanted substantial things. So, what I did is I reviewed business plans that had been written here and looked at some of our competitors' outlines [of business plans] that I got a hold of; and we came up with an agreed outline, which was four pages long in and of itself, of items that should be included in the Business Plan. Everybody agreed on that; and, once that was done, it was basically a matter of filling in the blanks. Tnere are major sections in there that have to do with manufacturing, customer engineering, marketing, competitive and financial risks, product--hardware, software--development plans, and things like that. What I primarily did is I went to each of the people who are involved in the program and said, "This is what we want. This is the type of information from your organization we would like. You are going to be involved in it, so please make a contribution." What I did is I collected just lots and lots of information and made a 120-page document.

Steffano pointed out that the Business Plan was more than a straightforward business plan:

> . . . An interesting thing about business plans is that they are perhaps, being charitable, fifty percent business plans; and the primary purpose of that document, other than a business plan, was to sell the product. The Doctor and everybody else [in top management] was committed to it, but the rest of the organization was not necessarily. So, one of its primary functions in life was to act as a sales instrument. . . . You [can] see that in terms of the redundancy of certain sections and in phrases repeated and emphasis placed on certain issues; but it also appears in ways you don't see, like the way the numbers add up.

Here is another suggestion that the 1221 organization continued to maneuver politically <u>after</u> the strategic decision to commit. Here, the symbolic weight of a business plan was placed behind the project. It is interesting to note that the financial justification for the product was formulated <u>after</u> the decision to commit; this goes counter to the usual model, where projects are subjected to discounted cash flow analysis and the superior ones selected for funding. In this case, the financial

analysis is used purely for political justification and image building.

The rationale for the 1221 was straightforward. The 1221 Business Plan, dated June 1, 1983, began with the concession that no one product can satisfy every need, and that the 1221 was a recognition of that. Combined with NICC's leadership in word processing, the Plan stated that the 1221 was an effort "to redefine the low-end word processing market."

An extended quotation from the Business Plan would be the best way to capture the flavor of the rationale for the 1221:

> The 1221 is a new, low-cost standalone word processor with hardware and software optimized for advanced text editing operations. Just as the [NICC] Professional Computer has been designed for professional office support functions, the 1221 is intended to satisfy clerical office support. . . .
>
> The 1221 offers word processing to those who need it without the additional cost associated with high-end data processing and decision management tools on professional computer systems. It performs a better job than traditional high-cost standalone systems at <u>one-third the price</u> and offers an upwardly-expandable alternative to expensive top-of-the-line electronic typewriters. . . .
>
> Essentially, the 1221 will create a new standard of word processing functionality at a breakthrough price.

Given its price/performance characteristics, the 1221 was envisioned by Steffano to be positioned between three distinct product markets. It would be <u>below</u> the traditional standalone word processing market. It would be <u>above</u> the electronic typewriter marketplace. And it would be an <u>alternative</u>, or <u>parallel</u>, to the market held by personal computers with word processing functions.

Corrolary issues

John Steffano recognized that this type of product presented distinctive challenges to the company. It would have to be carefully positioned vis-a-vis the NICC PC and some OAS products. It would require the development of new distribution channels. The advertising would have to be different. In fact, most of the product marketing would have to be different, since this was a high-volume, "consumer" product. For example, the Plan discussed the need for new types of service arrangements for the 1221 compared to the more expensive NICC systems. The base technology of the 1221, the Intel 80186 microprocessor, was a new chip, and supply was dependent upon Intel. Also, manufacturing had to be done differently; the design had to be simple and durable, able to withstand the rigors of high-volume production. Steffano addressed all of these issues in thorough and exhausting detail.

Summary of the business plan

The Business Plan for the 1221 demonstrates that the idea for the product was painstakingly developed. A market niche opportunity was identified, and a product, making use of what were seen as NICC's distinctive competencies and competitive advantages, was proposed to fill that niche. The Plan had estimates for costs, prices, projected sales, actions by competitors, and important marketing and manufacturing issues.

More Marketing Actions

At just about the time of the Business Plan's release, Rich Findlay joined the company. He was a product manager, and he became John Steffano's boss. Findlay had a bachelor's degree in English literature, and had developed himself as a marketing specialist through on-the-job experience at various companies. Immediately before coming to NICC, Findlay worked for the Apex Business Machines company, doing product planning for their low-end word processors. He also had some experience marketing typewriters. "I was recruited here," he said, "because they were getting into low-end products." Findlay was also hired because of his experience with distribution systems: "[At Apex] we were very big into the dealer organization--dealer marketing. That was Apex's, and still is, their strong point."

Findlay said that "the problem when I started here [was that] nobody wanted to sell [the 1221]." He corroborated Steffano's view of the the Business Plan:

> When I came on board we were in the process of issuing the first Business Plan, which was a combination business plan and almost a sell-the-product type of document. The first thing I got tasked with was trying to work the distribution issues--who would be willing to sell this, who would want to sell it, what would we have to do to get it sold through different channels.

Shortly after the release of the Plan, the 1221 project, through Findlay, established an interface to the Indirect Sales Organization (ISO):

> [So the next thing I did was] trying to establish an interface within the ISO group. That's the NICC group that handles dealers. . . . It's not just dealers; it's systems houses and OEM distributors all rolled into one. This

> product itself is a dealer product because of the price and where it's going. . . . With this kind of product . . . you have to have everything lined up before it. You don't do consumer products as a "let's build it and then sell it." It should be a flow. The product starts as an idea. It goes through R & D. At the same point, people are getting distribution channels and sales channels ready for the product to be primed. It's introduced, and it's pushed right into those channels. You don't have a big window. You want to sell a lot of products. You've got to be there very quickly and maintain a steady volume in sales over the relatively brief life of the product.

This marketing philosophy complicated the political problem for the 1221 coalition, because it meant that the latter would have more encounters with other coaliltions and entities within the company.

Software Development Continues

Alfred Tsou had decided earlier in the project that certain "milestones" would be established in its schedule. The first milestone was scheduled for sometime in June of 1983. Tsou called it "Demo I," since it was intended not only as a scheduling objective for the software group, but also as an opportunity to demonstrate progress to others in the company. Demo I did not occur; the product was simply not developed enough.

In late June and early July, it became clear that Hans Erhardt and Monica Long would not resolve the editor issue. So Tsou stepped in and resolved it--he decided on Long's version, requiring that the 1221 programmers write word processing code that would run adequately on OAS and MS systems. This decision was not popular with Erhardt. Later in July, upper management mandated that the 1221 word processing software must have compatible data structures with the OAS V4 editor being

developed by Monica Long's group. This was a more exacting standard than the one specified in Tsou's earlier decision. Erhardt felt that this would use too much memory space, but he was overruled.

In August, Tsou personally began to work with the Marketing and Sales organizations at NICC. This month also marked the arrival of Sam Fratelli, who was put in charge of a small subgroup that was to develop software to handle the processing of forms. Fratelli was different from the other managers. They had all been with the company for a time as engineers before coming to the 1221; some got promoted when they joined the project, like Lee and Chin, others had been managers at NICC previously, like Miles and Erhardt. Fratelli was the only one hired directly into a management position from the outside. Fratelli was from New Jersey, and had a master's degree in computer science from the Stevens Institute of Technology to go with his bachelor's degree in computer science from the New Jersey Institute of Technology.

Fratelli was put in charge of developing a small group which would write a specialized software application--the forms package. This software would enable a secretary to define the fields for an often-used form, enter the data into the appropriate fields, and print the form out. Fratelli claimed that Tsou told him that this package was needed to overcome the need, on the part of secretaries, for keeping typewriters on their desks:

> It seems that when we sell office automation equipment, the secretaries still refuse to give up their typewriters. . . . Even here at NICC, nnxt to the wordprocessing terminal, the secretary has an IBM Selectric typewriter. The primary reason, I'm told, is that the secretaries need a typewriter to fill in forms--preprinted

> forms, doing labels, things like that. So, we're trying to automate that on the 1221. . . . The thing we're trying to do is to justify the replacement of the typewriter. Don't give in to the excuse that they need the typewriter to fill out forms. And it needs only to be as good as how it would be done manually, you see. Because it only has to be as good as the way you perform it.

On the organization chart, Fratelli's group fit in on the applications side, along with Erhardt's and Chin's groups. (See Figure 5 for the 1221 organization's chart for this approximate period.)

In late September, the 1221 project finally held Demo I. The managers demonstrated the hardware and the operating system (OS) to people from Product Marketing. The results were modest, but everyone, especially Tsou, was pleased. The project was only a week or two behind the revised schedule.

A Change in Leadership for the 1221 Project

Early October, 1983, brought a big surprise. Alfred Tsou, who until a few months earlier had only managed small or medium-sized staffs, was promoted to director of the OAS division. He went from managing the 30-person 1221 project to managing it plus one of the company's three product family divisions. This appointment was not really a "natural" one. Tsou's experience had been in the MS group, and specifically in low-end terminals. The 1221 group was another low-end group. The OAS division had always been NICC's premier division. But it had fallen on hard times. Tsou viewed the turnaround of OAS as a difficult challenge. "What do you do with a division" he asked, "when other divisions have developed products that should have been within its

Director:
Alfred Tsou
one secretary

SYSTEM ARCHITECTURE DEPARTMENT:
Acting manager: Jim Miles
one computer operator

Machine architecture: ---
Keyboard architecture: ---

OPERATING SYSTEM SECTION:
Section Mgr.: Emery Lee
Tom Dickinson
Bill Jones
Ray Chan
Bill Holmes
Migration of OS to portable system: ---
MSDOS/UNIX/CPM Based Adoptions: ---

FILE MANAGEMENT SYSTEM:
Project Leader: Mark Theroux
Tom Davis
Denise Davis
Jack Nelke
File Interchange with MSDOS and NICC Network: ---
System Interconnect with MS: Paul Staras

OFFICE FUNCTIONS DEPARTMENT:

WORD PROCESSING SECTION:
Section Mgr.: Hans Erhardt
WP Editor:
Mary Becker, project leader
Carolyn Holle
WP Formatter:
Sergei Brickman, project leader
Susan Shapiro
Jeanne Martin
Screen Manager:
Narendra Gupta, project leader
Bill Wright
Printing and Input:
Peter Chen, project leader
Bob Porter
Henry Rogers
Document Manager:
Dave Lodge, project leader
Bill Parris

INDUSTRY APPLICATIONS SECTION:
Section Mgr.: Sam Fratelli
Forms:
Roger Johnson
Rich Brown
Adoption, NICC OA Models:---

TELECOMMUNICATIONS SECTION:
Section Mgr.: J.P. Chin
Susan Bradley
Salah Khelfoui
Monica Kim
Rich Wilson
Networking Support:
Cary Whipple
Misha Petrovich

Figure 5. Standalone Office Products (1221 project), organization chart, October 1983.

charter? The MS and Standalone groups have both developed, or are developing, products that OAS should have developed, but didn't. What do I do with OAS now?"

This announcement came about three weeks before the scheduled time for Demo II, which would be when the word processing editor would be demonstrated. Tsou temporarily decided to try to run both OAS and 1221 simultaneously, with Jim Miles as his day-to-day manager in the 1221 organization.

Demo II did not occur until November 4, about two weeks later than scheduled. In the weeks between Tsou's promotion and Demo II, the word processing (WP) group worked feverishly to try to finish enough of their code to make a good demonstration. Tsou, Miles, and Erhardt decided that functionality, and not code size, would be the target for Demo II. One of the specifications for the 1221 was that it would have a core memory size of 128 kilobytes (128K). However, for development purposes a prototype with 512K was being used, in order to avoid problems with achievement of functionality. Mary Becker described what was going on:

> Right now, we're really concentrating on getting the thing implemented--getting the functionality up to, you know, what we said it was; and then we're going to have to really see what we can do about squeezing it into the memory. . . . [Both the user interface and] the formatter . . . are really too large to fit into the memory that we've allocated to ourselves. So we have some problems with that.

Complicating the code-writing process for the programmers was that Tsou had decided early on to use a high-level language, "C", for

all the code. Computers operate by tiny switches being opened and closed by electrical impulses. One of the engineers said that the instructions on which switches to open or close could be placed on either software--programs stored on magnetic devices like tape or disks--or hardware--the silicon chips used to make computers. "There's always a tradeoff as to how much you should 'hard wire' and how much should be software," he said. "Whatever you can put on software, you could also put on hardware. The problem is that you would be tied to whatever that machine had on its chips." It is easy to visualize the limitations of having all the computer's instructions etched into the machine's silicon. But there are levels of software, also, and they vary in their flexibility. At the lowest level is the microcode, which is almost embedded in the wiring. This is code which actually causes the hardware to do certain things. At the next level is assembly language, which is basic code that gets translated into microcode, causing the computer to perform certain operations. Both microcode and assembler are specific to given microprocessors. Next, and last, come "high-level languages," which resemble English. These languages are translated internally into assembly language, which in turn gets translated into microcode, which causes the computer's electronic switches to perform. Upper-level languages are the easiest to use, but they offer an even greater advantage--they are "portable." Microcode and assembler are tied directly to the hardware, the microprocessor, of a computer system. But upper-level languages are universal. A program written in BASIC, a very popular upper-level language, can be used on

any computer which supports the BASIC language, regardless of its hardware. This could be important in the fast-changing world of computers. As Tson put it, "You must write transportable code, in high level languages. This is because hardware can be obsolete in two years. But this takes up more space than assembly language." Therein lay the problem for the programmers. The C language was chosen because it was one of the most "structured" of the high-level languages, i.e., it encouraged coders to make minimum use of memory. But it still used more space than assembler.

C also presented a problem distinct from other high-level languages. It had to do with how the disk operating system went about storing and retrieving information, specifically, with how it stored location names for data. Information is stored in thin magnetic disks, usually called "floppy disks" because they are more flexible than the metal disks used for large mainframe computers. Although this storage is "transparent" to the user, the engineers who design the mechanisms for actually moving the information from the core memory, through the disk drives, and onto the surface of the disk, have many decisions to make. One decision is where to place the information, and a related decision is how to let the system "know" where particular information is being stored. This is done by using "location names," which are literally the names given to physical space on a disk's surface. There are two ways this can be done in the C language--"large mode" and "small mode." In large mode, location names are handled entirely by the applications program (like word processing), with no need to use the

operating system. In small mode, location names are processed by both the applications program and the operating system. The 1221 WP group was writing in small mode, and the OS group was writing in large mode. Each group had an interest in writing its code in its chosen way. By writing in large mode, the operating system's overall code size would be smaller, since part of the location name processing would be done by the applications programs. The word processing group wanted to use small mode, since its code would be smaller if the operating system bore the full burden of processing location names. Neither group was aware of the difference before Demo II.

Demo II

When the demo date finally arrived, it did not go well. Miles and Erhardt from the 1221 project, Findlay, Steffano, Barbara Campbell and two others from Product Marketing congregated in the 1221 lab. "The groups didn't come in because it's too crowded," Miles said. "They've seen it." Erhardt began to "run the board." "It's a formality," Miles added. Even though the demo was late, the project staff still hadn't gotten all the functions implemented. Steffano began to field questions from his marketing colleagues: "I'd like to know about the movement of the cursor," one person asked. "How do you find it if it's lost on the screen?" Someone else asked who should be utilized to test--should it be NICC operators? "Wouldn't it be better to use people not familiar?" someone else offered. In the meantime, Erhardt was pecking away at the keyboard. Steffano said that the purpose of this demo was to make the

marketing people feel comfortable, to show the changes since the last demo, and to identify problems (although not necessarily to resolve them).

Miles mentioned that the 1221 had all the functions expected to date, but that it hadn't been debugged. "There were still glitches as of this morning," he said. The only functions it had at this demo were create document and edit text; both had to be rewritten in the near future. Miles said, "Engineers like to talk about all the bits and bytes changed, and the marketing people just want to know what it can do." The functions seemed to be there, but they kept cancelling. Every time Erhardt hit a wrong key, the entire system would "go down." Mary Becker came in to see what was wrong; she and Erhardt moved away from the marketing group to a new board. They were joined over the next ten minutes by three other members of the WP group. Erhardt never got it to work. His four group members looked frustrated, disappointed, and demoralized. The meeting ended with a discussion among the marketing people about who should be used to test the machine.

Later, Mary Becker talked about what had happened at the demo:

> It was really sort of a disaster. We had the functions that we were supposed to demonstrate pretty well working last week, you know. We really weren't very rushed towards the end at all. We kind of had things; but we did . . . but there were a few bugs. We thought, "Well, the more bugs that we can clear up before the demo, the better off we'll be." It was really working, basically, pretty well. We could do the basic things without messing up. Just the morning of the demo, we had one last build--we call it a "build", where we compile all the programs, we put it all together. . . . We had one last one [that] morning to compile the discs for the demo. We did that, and it all appeared to go smoothly. We gave the disks to Hans to go to the demo, and so on. Then, apparently, during the demo,

things were just really going screwy; and there were all kinds of bugs that--it appeared that there were all kinds of bugs that we didn't even think we had. People didn't seem to be that upset. I don't know. I couldn't figure out why it wasn't a disaster, you know. I thought the roof would fall in or something. But, you know, from my point of view, it was a real disaster. But, the marketing people were kind of smiling and all looking at the thing. And when it blew up, they didn't seem to mind. They said, "Well, you have a bug." But, we had thousands of bugs in that.

Anyway, it turned out later that something had gone wrong during this build process. We had gotten some of the wrong modules and with the wrong . . . well, you know, it was a much worse demonstration than it should have been. You see, one of our things with our hardware is we can have . . .we can run programs in small mode C or large mode C. Actually, we run our programs in small mode on the PC for debugging because it's much easier to debug in small mode. Then, when we go to the 1221, we have to run a large mode because the OS doesn't support small mode. So, we have these two groups of modules, and one should not combine them on the same disk, and try to run some small and some large, which is what happened in the last build. . . . Yesterday, we had another demo. This was just for some tech writers that happened to be around. We had the demo again for them, and it was much better. . . .

A few days after Demo II, Tsou held his weekly meeting with the 1221 managers. His staff meetings frequently turned into monologues by him. This November 9th meeting was no exception. The memory constraints were on his mind as he addressed his subordinates. "The 1221's objectives may not be reachable," he began. "The memory size may be too limited at 128K. But our competitors all have good machines at 128K. I want to challenge you. Are we not as good as our competitors' engineers?" There was dead silence from the managers. Tsou continued. "Are the people working on the 1221 truly committed to cost efficiency in programming? Tell your software engineers not to do things for their

own convenience, but to take the painful steps necessary to compress the program. The big systems, high end people are convinced that what the 1221 is trying to do is impossible. This makes me even more determined to meet the 1221's objectives.

"I'm going to challenge you," he continued, "at the risk of insulting you. Where is our technical excellence? Our competitors have had products out for two years. Why can't we? Let's achieve the same level--or better. We've got to cut costs, which means count bytes. I will not accept that we are not as good. Where is your professional pride? You've got to give me no less than any other competitor has or you're out."

"But we're working under extreme limits," Hans Erhardt said.

"I expect you to create innovative solutions," Tsou retorted. "We have not done our best. If we can't beat them we might as well drop the project."

Re-Thinking the Product

On November 15, 1983, John Steffano called a meeting between him, Miles, Erhardt, and Fratelli. The memo Steffano circulated said

> The purpose of the meeting is to identify the product focus, from a development perspective, of the 1221 product family in general and the 1221 128K base unit in particular. Time permitting, we will investigate the growth path to the larger versions of the 1221 family.

This was a coded way of saying that he was concerned about the problems in the overuse of memory. The managers did not tell Alfred Tsou about this meeting.

The group began by forming a matrix of product configurations (128K system with one disk drive, two disk drives, and hard disk; 512K system with one disk drive, two disk drives, and hard disk) by market type (personal computers with word processing, high end word processing, offices seeking to replace electronic typewriters, and offices seeking to add electronic typewriters). Then they filled in the cells of the matrix with percentages representing how they felt each configuration would be allocated among the markets. Figure 6 is the matrix which they developed.

	128K			512K		
	Single $3750	Dual $4250	Hard $5750	Single $4545	Dual $5045	Hard $7300
PC with WP	10	25	40	30	40	40
High end WP	--	--	--	30	40	50
ET repl	70	45	30	20	15	10
ET addon	20	30	30	20	5	--

Figure 6. The price/market matrix developed by the 1221 managers

The four men sat around a conference table looking at the matrix when Tom Findlay entered. Steffano briefed him quickly. Findlay agreed with the four-segment breakdown. Then he addressed the engineers. "This should be a NICCwriter that we can sell. This matrix seems to be on the right track. The Direct Sales Organization will sell the 512K with hard disk, and will combine the 128K system with other office products."

"You want NICCwriter functionality with V4 document structure?" Erhardt asked, with a note of incredulity in his voice.

"Yes," Findlay replied.

"There will be problems with indexing," Erhardt said.

"Leave out what we don't need," Findlay said. "Just put in 'hooks.'"

"We won't have compatibility," Erhardt argued.

"I think what Hans is saying," Steffano interjected, "is that there's too much overhead."

"Exactly," said Erhardt.

"Unfortunately, that's the way it has to be," replied Findlay. "There's no problem with leaving some of the code on the disk. I want the 128K to be full-functioned word processing . . .

"With the V4 document structure?" asked Erhardt, sarcastically.

"Yes," replied Findlay. "But understand, word processing. We have no choice with the V4 document structure.

"Remember," Findlay continued, "this is low end marketing. These people have never been able to buy NICC products before. Now, the 512K machine is a totally different machine, aimed at a different market."

"Our numbers show that, too," Fratelli interjected.

"The numbers look OK," Findlay said, looking at the matrix on the marker board. "In the first year, eighty percent of the 1221s will go out with dual disks. One hundred percent will be 128K." The group

then spent about a half hour going over various functions that were either necessary or could be dropped for the 128K version.

The Climax of the First Memory Problem

Two days later Tsou, Miles, Ray Culp (manager of the PC group) and Fred Riley met. They decided that the NICC PC and the 1221 should have different hardware and software. This increased the distinction between the two products, lowering the chance for one's eating into the other's market. They also decided that NICC would produce an electronic typewriter, and that Tsou would have the responsibility for that development effort.

On November 21, the group managers met, without Tsou. They openly questioned the direction of the project. They expressed concern about whether or not they could accomplish what they wanted with the memory constraint. They were joined by Steffano. The discussion turned to what the 1221 was supposed to do. The group examined the list of functions, and they discussed the performance problems (the 1221 ran the code very slowly). Steffano said that he needed background print or "it's not a product." (Background print is when the printer is typing out a document while the user is editing at the terminal. This is a specific example of "multitasking," i.e., doing more than one task at a time.) Erhardt responded by saying that there were problems with the memory. Steffano said that he wanted all the functions, but Erhardt's

solution was again to add memory. The group decided to work on the problem, come up with a solution, and then take it to Alfred Tsou.

Two days later Jim Miles and Emery Lee were having a conversation in the 1221 lab. They were discussing some problem with another group when Miles suddenly told Lee that there was an eighty percent chance that the operating system will go onto a PROM. Lee expressed surprise. "There are three options for solving this memory problem," Miles said. "One would be for Alfred to get upper management to drop the requirement for V4 compatibility, but that seems unlikely. The second would be to put in a special set of RAM [Random Access Memory], but that would be very expensive. The third option is to put the operating system onto a PROM. [PROM stands for "Programmable Read Only Memory"; this means that the code is stored on a silicon chip, not a floppy disk, and that it can only be "read" by the system, i.e., the user can not "write" information on the chip. Writing can only be done by service technicians.]

"This will cost about $10, and will raise the price by about $50," he continued. "It will also put us over certain functionality limits. This PROM would be the cheapest way to get core memory into the box, and it would allow Hans to put in a better editor." The idea did have some disadvantages. The major one was the potential for a servicing disaster. "If we make a mistake in the OS," Miles explained, "and the error is on a floppy disk, all we have to do to straighten it out is send all our customers an updated floppy. But," he continued,

"if the error is on a PROM chip, we have to send a service person to each purchaser, and to each dealer, to install a new chip. That's obviously a lot riskier and more expensive."

One week later, November 30, the managers felt confident enough about their solution to bring it up to Tsou in the weekly staff meeting. After some sharp questioning and expressions of skepticism, Tsou accepted the PROM solution, although wihout much enthusiasm. He admonished the managers for "not doing their jobs," while he had done his job of paving the way politically for the 1221. He ended by telling them that success was crucial, and that there were "some senior VPs who would love to see you fail."

Later that day, the company formally announced that it would build an electronic typewriter. Observers predicted that the 1221 department would be working on it by January 1st.

A Promotion for Miles

On December 1st, Tsou and Miles discussed the formal elevation of Miles to the position of manager of the 1221 project, still reporting to Tsou. Tsou had not been able to devote himself to the 1221 organization as much as was needed, so he decided that someone had to be formally elevated to department manager. Miles, who had been acting department manager ever since Tsou's promotion to head the OAS division, expressed a desire for this legitimizing move, but said that he was concerned that Tsou use the proper rationale in explaining the promotion. "I don't want people to perceive me as your 'favorite son,'"

he said.

The next day, Tsou made the formal announcement at the weekly technical staff meeting. His rationale was that Miles was the most hard-nosed and aggressive of the managers and thus was the best qualified to hold the position. Later that day, Miles related that this would relieve his frustration of not being able to control important aspects of the 1221's development. But he also said that this move increased his feelings of basic displeasure with the job. "I miss the nuts and bolts work in the lab," he admitted. The move also raised his anxiety about the project, he said. "The formal title makes me more personally responsible now." At the same meeting, Tsou announced another change. Sam Fratelli took over responsibility for all printing functions--background print, typewriter emulation, and the forms mode that he already had. Hans Erhardt retained responsibility for the electronic aspects of word processing--the editor, the formatter, the screen manager, and the document manager. This move was widely interpreted as a reprimand for Hans Erhardt. (See Figure 7 for the revised organization chart.)

Suicide Missions

Later that afternoon, Miles interviewed a college student who wanted to get a co-op job with the 1221 project. "What I like about co-op jobs," said the student, "is that we learn what the real world is like."

Miles responded with alacrity. "You'll learn what we're like.

Director:
Alfred Tsou
one secretary

SYSTEM ARCHITECTURE DEPARTMENT:
Manager: Jim Miles
one computer operator
one secretary

Machine architecture:
Section Mgr.: Rudolph Kaiser

Keyboard architecture:
Angel Enriquez

OPERATING SYSTEM SECTION:
Section Mgr.: Emery Lee
Tom Dickinson
Bill Jones
Ray Chan
Bill Holmes
Eric Louie
Migration of OS to portable system: ---
MSDOS/UNIX/CPM Based Adoptions: Alan Mullins

FILE MANAGEMENT SYSTEM:
Project Leader: Mark Theroux
Tom Davis
Denise Davis
Jack Nelke
Paul Staras
File Interchange with MSDOS and NICC Network: ---

OFFICE FUNCTIONS DEPARTMENT:

WORD PROCESSING SECTION:
Section Mgr.: Hans Erhardt
Dave Lodge
Bill Parris
WP Editor:
Mary Becker, project leader
Carolyn Holle
WP Formatter:
Sergei Brickman, project leader
Susan Shapiro
Jeanne Martin
Special Projects:
Narendra Gupta, project leader
Bill Wright
Bob Porter
Alex Lanin

INDUSTRY APPLICATIONS SECTION:
Section Mgr.: Sam Fratelli
Document Printing:
Monisha Sashar, project leader
Henry Rogers
Forms:
Roger Johnson
Rich Brown
Vertical Market Appl.: ---

TELECOMMUNICATIONS SECTION:
Section Mgr.: J.P. Chin
Susan Bradley
Salah Khelfoui
Rich Wilson
Networking Support:
Cary Whipple
Misha Petrovich

Figure 7. Standalone Office Products, organization chart, December, 1983

We like to think we're a little different. We are people oriented. We are aggressive. A lot of people think we do suicide missions, but the accomplishments are great."

A few days later Miles talked about that statement. "I do feel a certain pride at being associated with a 'suicide mission,'" he admitted. "There are two kinds of engineers--those who are professional, and those who see it as a job. Those who see it as a job will not attempt difficult projects. The pros will. Seventy percent of the engineers at NICC see it as a job. This pisses me off because it means that I have to spend a lot of time persuading that seventy percent that a difficult project is worth doing.

"When the 1221 began," he continued, "there were some people in the project who acted like it was just a job. But I see less of that now, because people are seeing the 1221 happen. They believe that it will be done." So even within the core of the 1221 organization, the software engineers themselves, the job of persuasion, of gaining commitment, had not ended with the decision to proceed with the strategy.

The schedule of demos bore out Miles's "suicide" notion. Demo II had occurred in early November. Since then there had been serious problems with functionality, performance and memory usage. Yet Tsou held to his target of December 16th for Demo III until almost the last minute, when he changed it to December 30th.

Preparing for Demo III

On December 14th, he held a meeting with his managers. "Sam," he asked, "when will the printing functions be ready?"

"December 30th," replied Fratelli.

"Sam's testing them now," interjected Miles.

"I don't want this to be last minute," Tsou stated, "and have it croak in front of these people. What hiccups are there towards Demo III?" Miles and Fratelli answered that there were problems with the NICC Professional Computers being used for the software development itself, and problems with spare parts for the prototype 1221 circuit boards. Tsou and Miles agreed that Bob Erlich [Miles's hardware counterpart] was being antagonistic toward the 1221 project. "Bob says he's not," Miles related, "but that the board we're using is a piece of shit, and he wants to clean it up before it goes to manufacturing."

"He has spare resources to clean up the board," Tsou asserted. "He has people sitting around down there. Jim, I want you to push for spare parts and a clean board. We have to go that one last step, Demo III, to convince the other 25,000 people at NICC."

A few minutes later, Miles asked Tsou, "Is the 1221 going to be the industry standard 32-bit operating system?"

"I'm not afraid of that," Tsou shot back. "We can do it. I am going head on with IBM. I don't want to beat around the bush about it. I want people to recognize our software as being so superior that people will use it on IBM machines. And when the IBM PC wears out or breaks, I

want people to think about buying a NICC as a replacement. And our products will all be compatible. IBM will never have that. That's where we will beat them!"

On December 16th, Tsou held another meeting with his managers, this one to iron out technical problems. But the conversation quickly turned toward a pressing administrative issue--getting cooperation from hardware on providing prototype circuit boards. Tsou asked Miles and Steffano to "beat up" on hardware, if necessary, in order to get the boards. Tsou also asked Steffano to get him the Winchester hard disks from Jim Bunning, the hardware manager.

"How many do you need," Steffano asked, "of the fifty that you're supposed to get?"

"Say 'all,'" Fratelli advised, "and we'll take what we can get."

"I don't want you to make that kind of request," Tsou said sternly. "It destroys our credibility. Figure out what you really need. Now, are there any other problems regarding Demo III?" (Tsou was still thinking about managing the image of the 1221 development team with the rest of NICC.)

Miles offered his opinion that the 1221 organization could not meet the December 30th deadline for Demo III. "I just don't think there's enough hardware to let us do all the necessary integration in time," he said.

Tsou stared at Miles. "Is that the only reason?" he asked.

"Or might we not not make it on our own?"

"If we had the hardware," Miles asserted, "we would make it."

With that, Tsou went right to a phone which was in the conference room. He called Jim Bunning. Bunning was not in, so Tsou left a specific message about the lack of boards in the software development group. "Tell Bunning I'm yelling at him," Tsou told the secretary, "and tell him to call me as soon as he comes in."

Tsou looked at his managers. "I can't overemphasize the importance of a good demo," he said. "Six years of rehearsal can be blown in fifty minutes on stage."

Demo III

Things did take longer than Miles thought. The integration of the entire system simply could not be done in the small amount of time allotted. But by mid-January, things finally fell into place. Demo III was done during the week of January 16th, 1984. So many people had the 1221 demonstrated to them, that it took several days. One of the groups even included Dr. Smith and Fred Riley. It really had a "show biz" atmosphere. The demo was held in a local hotel's conference center. John Steffano stood on a stage, with one marketing staffer to his left and one 1221 software engineer to his right, each with a working 1221 prototype. He would talk about a function, then walk over to one of the operators, who would then demonstrate the function. Steffano alternated between the two operators in this way until all functions had been demonstrated. This demo, in contrast to Demo II, was a huge success.

Moving Towards Alpha I

NICC has a graduated system for releasing its products to end users. The first step is the Alpha Release. Next comes Beta Release. And last comes First Customer Ship (FCS).

Alpha releases consist of NICC's allowing the product to be used by some of its own clerical and secretarial workers. The idea is to test the product for bugs in a relatively risk-free environment. If major problems are found, the only people who know about it are inside the company. No customers are alienated. There may be several alpha releases before the next step is taken.

Beta releases are the first time the product is used outside the company. It is lent to trusted customers, who give the company feedback on the product's performance. After the bugs have been worked out in alpha and beta releases, the product is produced in quantity and shipped to paying customers--FCS. After Demo III, the 1221 organization was aiming for Alpha I.

Starting on January 16th, the engineers engaged in extensive debugging and rewriting of code to prepare for Alpha I. They also continued to try to integrate the code being written by the various subgroups. The objectives for Alpha I were: to improve the functionality achieved for Demo III, or at least to maintain it at that level; to reduce the amount of core memory used in the total system (operating system plus word processing) to 128 kilobytes; and to have

good performance, i.e., do all of this at a fast speed. Early on, these processes went along at a difficult, but not frenetic, pace. As the projected release date, March 14th, approached, the pace became brutal. The last two weeks before Alpha I were eighty- or ninety-hour weeks for most of the engineers and managers. And still, they missed the March 14th date.

Alpha I

The person in charge of the Alpha I integration of code was Tom Dickinson. Dickinson was a veteran computer engineer. He had joined NICC just recently, during the summer of 1983, having spent about twelve years at Honeywell. Whenever he was asked about the fast pace at NICC, Dickinson would point out that at Honeywell they used to take their time on product development. "We'd have great products," he said, "but they'd get to the market too late for anyone to want them." Yet he felt that perhaps the pace on the 1221 project was a little too fast. "There must be a golden mean somewhere," he mused.

Dickinson worked under Emery Lee in the OS group. He was a very measured and methodical person. He had noticed after Demo II that there was no formal mechanism for doing the integration "build" of the entire system's disk. So he devised a mechanical system for doing that. First, each engineer was responsible for making sure that his or her piece of code worked. Then he or she would bring it to Dickinson. He put it all together, and gave each subgroup copies of two disks which contained all the necessary code. Each engineer was then responsible

for making sure that his or her code worked with everyone else's. Finally, necessary changes were made. Sam Fratelli added, "And if things don't work, people stay until it's finished and working.

"These bursts of code integration have always coincided with milestones, like demos and releases," Fratelli admitted. "People are reluctant to integrate more often because they're reluctant to abandon a piece of code that's been working for them, even though it might not work in conjunction with anything else." He said that he'd like to see formal integration occur more often, maybe once a week or once every two weeks.

On March 20th the project members were still working on integrating the code for Alpha I. Fratelli said that this release was easy compared to the one coming up, Alpha II, on April 4th. "You see, our code is about thirty percent over capacity," he said. "Up until now, we've been using machines with 512K, including the ones for this release. But the next release must use 128K. It'll be a big job to get it to fit."

Over in the forms group, a final test of the forms package was going on. Some sort of bug was affecting the printing of a form. Information was printing in the wrong boxes on a form. One of the engineers, Roger Johnson, was determined to show that the problem was not in the program, but that someone had misused it. He sat down to define a form.

One of the other forms group engineers, Rich Brown, brought his

code to Tom Dickinson. "Here's three-quarters of the forms package," he told Dickinson as he handed him the disk. "OK," Dickinson responded. Miles was there with Narendra Gupta, the engineer in charge of the "screen manager," the piece of code which controlled the video display. There was a bug in the screen manager. They hurried off to see about correcting it.

The forms group got its package to run, but had a peculiar bug. "After we create a form," Brown said, "we have to power down before the printer will reset and print the form." Fratelli spent about ten minutes trying to find Bill Wright, the engineer who would know why this was happening. When he finally found him, Wright told him that they needed to insert a command from the file management system. Fratelli rushed back to tell Henry Rogers, the person in charge of printer code. Rogers said that he'd found another bug. Fratelli sighed, and told him to fix it and get the code to Dickinson by three o'clock.

Mary Becker and her associate Carolyn Holle, in the editor group, told Miles that they were still "chasing a bug." He told them to keep looking, but to be sure to get everything to Dickinson by three o'clock.

The final integration did not occur until late that evening. Alpha I finally happened on March 21st. The entire system was integrated, and prototypes were delivered to users at NICC for field testing.

The next day, Dickinson was reflecting on why the release had

been a week late.

> Partly it was because of the testing and debugging process. People have been coding and debugging in isolation. They can get things to work, but only under the assumptions they were using when they began coding. For example, perhaps they had to make a call to the printer, but the printer wasn't ready. So they worked on something else, or they made a simulated call. Then, when I put their code together with the printer code, the call doesn't go to the right place. Or maybe their code works in isolation, but when someone "hammers" on it, it breaks.
>
> So the integration-debugging process definitely slows things down. But it's not the process itself that was too slow. That target date never changed. We kept approaching the date without doing the integration, and when we finally finished coding, we had little time for integration. I haven't really thought it through completely, so I don't want to point the finger at anybody.

Later that day John Steffano was sitting in a patent attorney's office, thinking ahead to Alpha II. "Alpha II will be a problem," he admitted. "We have functionality problems, we have performance problems, and we have code size problems. Putting in all the functions we need is hurting the performance and taking up a lot of space. As for functionality, what we're working on for Alpha II is the bare minimum, except for a couple of things."

Debugging

A week after Alpha I, Jack Nelke of the File Management System group (FMS) and Bill Wardley of the Operating System group (OS) were sitting together in front of a debugger in the lab. There was some sort of bug in the interface between the FMS and OS. Wardley was sitting in

for Emery Lee, who had to attend a meeting. Nelke and Wardley worked for an hour and a half, with no success. After lunch, Lee rejoined them. Several problems were found, all in Lee's code. Lee and Nelke discussed how best to solve them. "Why don't you just make some 'patches,'" Lee suggested to Nelke. (Patches are temporary solutions.)

"I don't want to do that," Nelke responded. "I already have to make some patches to FMS for Cary [Whipple, in the telecommunications group]. Why don't you make a new release of the OS and we can fix all the problems at once?" Lee seemed reluctant, but he decided to go along.

Any software group will have bugs on the interfaces between its various subsystems. The real issue is how the solution of those interface bugs is handled. In the 1221 project, for whatever reason, those bugs frequently did not surface until all the code was integrated. Nelke was trying to avoid such an occurrence when he suggested to Lee that the change be made publicly.

Nelke didn't think that people debugged together because of any particular technical or administrative reason, but more as a matter of personal preference, particularly if they work well together. "When two people debug, one can hold the printout and provide the code's author with information. It speeds things up." As for the debugging incident described above, it really had nothing to do with a problem with the interface between FMS and OS. "Emery didn't test the code after he wrote it," Nelke said. "The problems were all internal to his code. I just happened to be the first one to call it.

"In all fairness," he continued, "this code was written just before Alpha I, and no one called the function until now. I guess Emery just didn't have the time to test it. But if he had, it would have eliminated this problem."

The Climax of the Second Memory Problem

Bill Parris, the engineer in charge of the document manager, had been under more pressure than some other engineers because of the requirement that the 1221 have a document structure that was compatible with that of the OAS V4 group. One day in late March he and Rich Brown were discussing the problem when John Steffano happened to walk by.

"John," said Parris, "I don't care how many Ph.D.s that guy in OAS has, this V4 document structure sucks. It's a pig [uses too much code space] and it's slow."

"Why are you beating around the bush?" Steffano asked wryly. "Why don't you just tell me what you think?"

Parris laughed.

"You know how I feel about it," Steffano continued. "But there's nothing we can do about it." Steffano was one of the few people in marketing who felt that the requirements were too exacting, given what was needed. Little did he know at that moment how drastically things would change, and soon.

On March 28th and 29th a late-season snowstorm deposited over a foot of snow on the surrounding area. Before leading for a meeting in California, Dr. Smith, having been briefed on the memory, functionality,

and performance problems with the 1221, had scheduled a meeting for Thursday, the 29th. That meeting had to be cancelled because his flight back from the West Coast had been delayed. It was rescheduled for Monday, April 2nd.

On Friday, the 30th, most of the area businesses and schools were closed; snow removal was proceeding very slowly. Some of the 1221 engineers came in to work anyway. Jim Miles was snowed in at home. Suddenly, his phone rang. It was Steffano. The Doctor felt he simply could not wait until Monday to resolve the problems with the 1221. Steffano told Miles that he would be around shortly in his four-wheel-drive vehicle to pick him up.

Present at the meeting were Dr. Smith, Fred Riley, Alfred Tsou, Jim Miles and John Steffano. Miles admitted that he thought the memory problem was insurmountable. Dr. Smith decided that the product was worth continuing. He authorized a doubling of the core memory, to 256K. This added about $100 to the cost, and therefore about $500 to the price, of the machine. It also meant that manufacturing operations would have to be changed, since the additional memory chips would complicate the process. Finally, it meant that the elaborate advertising plans which had been made--heavy television and print advertising in the fall aimed at generating high Christmas sales--would have to be shelved, or at least substantially altered.

Tsou complicated matters by insisting that, since the customers would have to pay for 256K, the multitasking feature be kept in the final product. In other words, Tsou insisted that the 1221 be able to

Vice-President:
Alfred Tsou
one secretary

SYSTEM ARCHITECTURE DEPARTMENT:
Manager: Jim Miles
one computer operator
one secretary

Machine architecture:
Section Mgr.: Rudolph Kaiser
Angel Enriquez

OPERATING SYSTEM SECTION:
Section Mgr.: Emery Lee
Tom Dickinson
Bill Jones
Ray Chan
Bill Holmes
MSDOS/UNIX/CPM Based
Adoptions: Alan Mullins
John Moloney
518 File Server for 1209:
Eric Louie, project leader

FILE MANAGEMENT SYSTEM:
Project Leader: Mark Theroux
Tom Davis
Denise Davis
Jack Nelke
Paul Staras
File Interchange with
MSDOS and NICC
Network: ---

OFFICE FUNCTIONS DEPARTMENT:

WORD PROCESSING SECTION:
Section Mgr.: Hans Erhardt
Dave Lodge
Bill Parris
WP Editor:
Mary Becker, project leader
Carolyn Holle
Susan Shapiro
Jeanne Martin
Special Projects:
Narendra Gupta, project leader
Bob Porter
Alex Lanin

INDUSTRY APPLICATIONS SECTION:
Section Mgr.: Sam Fratelli
Document Printing:
Monisha Sashar, project leader
Bill Wright
Typewriter Mode:
Henry Rogers
Forms:
Roger Johnson
Rich Brown
Vertical Market Applications: Michael Byrd

TELECOMMUNICATIONS SECTION:
Section Mgr.: J.P. Chin
Telephone Technology
Projects:
Cary Whipple, project leader
Salah Khelfoui
Misha Petrovich
Rich Wilson
Susan Bradley
Networking support: ---

Figure 8. Standalone Office Products, organization chart, March, 1984

print a document while also running a spreadsheet, or running the CRT Phone application. For the programmers, this meant that the doubling decision provided very little relief. They could now implement the word processing with relative ease, but fitting that in with a second task would be difficult. But Dr. Smith and Tsou relaxed the compatibility requirements, eliminating the document structure compatibility.

Tsou announced shortly after the meeting that he was restructuring the 1221 management team. Sam Fratelli was put in charge of all applications, except the CRT Phone. Erhardt retained technical responsibility for the word processing application, but administratively he now reported to Fratelli. But, as Miles put it, "Hans has been moved laterally. He now reports to Sam, but it's all pretty nebulous." (See Figure 8.)

The Big Decision's Aftermath

After the pressure of Alpha I, the decision to double the memory might have made the engineers very happy. Instead, it created a climate that was almost too relaxed. A couple of weeks later, Bill Wright, Rich Brown and Bill Parris (the engineer in charge of developing the document manager, which is the interface between the editor and the disk drives) talked about the implications of the decision. They agreed that pressure around Alpha II was almost nonexistent. They said that the emphasis was on "tightening up," rather than enhancing, the software. But this was not really what reduced the pressure. "We have changed goals, so Alpha II seems insignificant," Parris said. "Now we have 256K

instead of 128K. We are rethinking multitasking. We're rewriting 'driver' [screen and document managers] codes in assembly language, to save space and add speed, and we're nailing down the functionality.

"Before," Parris continued, "our emphasis had been on cutting down the WP code, while retaining functionality. Now we're streamlining the code. It's like driving from Boston to New York in a Volkswagen to check out the roads, flying back, and driving there again, but in a Porsche [the assembly-language drivers]."

The "Dunce Cap"

Towards the end of April, an Alpha user complained that when she typed a three-page document, she could only get one page to print. Parris, Wright and Rogers set to debugging this problem. At first they could not duplicate the problem, but ultimately they did. After Wright and Rogers decided that the problem was not of their doing, they left Parris alone. He decided that it was a problem in the file management system (FMS). He became somewhat heated about this FMS problem:

> People are always saying "it's WP's fault." Well, sometimes it's someone else's fault. In general, people here don't want to wear a "dunce cap." They don't want to be identified as the ones responsible for a slowdown in the project. For example, when we had the discrepancy between the WP and OS groups on the small mode-large mode C, what we should have done is to tell the managers to push the FCS back a month while we cleaned up the problem. But no one wanted to suggest a slowdown on this issue, even though one would have been good.
>
> When a bug is found, people want to point fingers and make sure that someone else wears the dunce cap. Managers in particular want to avoid wearing dunce caps, and Alfred will never wear one--he'll make sure that one of the managers wears one.

> There is a lot of finger pointing between groups on this project. I think that this is because of the size of the group. We can't all just talk together like in a small group. Trying to communicate through managers leads to a lack of common interests. That extra layer of management creates divisions that lead to conflict. As a counterexample, look at Jack Nelke [who works on the application interface for FMS] and Denise Davis [who works on the disk driver]. They work together really well, even though their technical subsystems are distinct. They are under the same manager, Mark Theroux.

This idea of preserving one's reputation, proved to be a centrally important characteristic of the 1221 organization's frame of reference.

Debugging Between Groups

One day in late April, just before Alpha II, Jack Nelke and Paul Staras, both of the FMS group, were debugging together. They were joined by Cary Whipple of the CRT Phone group. Evidently the problem lay in the interface between the FMS and the telephone application. Nelke and Staras questioned Whipple about the flow of the routine he was attempting to run.

As they attempted to zero in on the problem, each "side" (FMS, CRT Phone) tried to "pin the blame" on the other. At one point, Whipple was convinced that he had isolated the problem in some FMS subroutine. "Sorry," he said, condescendingly, to Nelke and Staras. But in trying to make his accusation definite, he found that he was wrong.

A little later, Nelke and Staras isolated the problem in the CRT Phone code. "Sorry," Nelke said to Whipple. Whipple was visibly uncomfortable when it genuinely looked like his code was responsible for the problem. He tapped his pen vigorously on his pad, and forcibly

expelled air from his mouth. He also did a few "Bronx cheers" and looked down a lot. Everyone decided that Whipple should write some code that would better coordinate the activities of the FMS and the CRT Phone application.

Nelke talked about the incident a few minutes later:

> Yesterday I wrote a new version of the OS, and I told people I'd be responsible for any problems. So last night Cary and other CRT Phone people came to me with some problems. I stayed to correct them. This morning, the CRT Phone people came to me again because their stuff still wouldn't work. So I got involved again, except that I asked Paul if he would help me, since he'd written a routine that was related to this problem.
>
> A little later, I realized that it was a CRT Phone, not an FMS, problem. At that point, I wanted no further involvement. Cary could write his new code knowing that the OS/FMS was not going to be wrong. There won't be any further involvement unless we make changes to the OS/FMS.

But later that afternoon, Nelke, Staras, and Whipple were back in the lab, sitting at the debugger. They were working on the same problem. Whipple said, "I suppose Jack told you it was my problem?" There was some laughter, but it sounded tense. No one wanted to wear the dunce cap.

The Confrontation Meeting

Not everyone took the events which transpired between the two alpha releases as nonchalantly as Parris, Wright and Brown. Many of the engineers were quite angry about all the changes, and about how they had not been consulted on any of it. This was not so true in the word processing group, which had always been managed by consensus. But it was very true of the OS, FMS and forms groups. (The CRT Phone group was

also very unhappy, but that was because of specific problems between its members and the manager, J.P. Chin.) A comment by a member of the FMS group typifies the mood: "Why have I had to completely change my design six times between Alpha I and Alpha II?"

Some of the engineers decided to take some action. Jack Nelke of FMS, Bill Wright of the forms group, and Bill Wardley of OS got together to discuss how the managers should be approached. They decided to confront them in a group. A meeting was arranged. About ten engineers attended, and all five managers were there. Some engineer began by saying that the product was a disaster. This sparked a wide-ranging discussion. A list of issues was made and discussed. One particular concern was held by many engineers--what was the product supposed to be? Was it a low end word processor, or was it a full-blown computer that could even be used for software development?

Several more meetings were held. The major tangible result was that the managers extended a standing invitation to all the engineers to attend the weekly technical status meetings. A few improvements in manager-subordinate communication were also implemented. The perception of the outcome varied a lot. Many of the engineers felt that there was a substantial improvement, particularly in communication between the managers and the engineers. But a large minority felt that the situation was no better afterwards. One engineer in particular felt that his technical supervisor, Mark Theroux, had been "deliberately burned out" by the managers, Jim Miles in particular. Another openly questioned whether NICC was an "ethical company."

Alpha II

Jim Miles was very nervous. It was time for the second alpha release of the 1221 software, and he was concerned about whether the team would have everything ready. Fortunately, Alpha II went fairly well. After the dust had settled, Miles talked about some ideas he had about the 128K version of the 1221, which the company still wanted to build. His idea was that the 1221 come out in two versions. One would be the planned 256K version, at about $4000 with printer. The other would be a cheaper, 128K, version, at about $2200 with printer. The latter would be accomplished by using a cheaper keyboard and a cheaper video display, and by using fewer chips on the board (nine instead of the present twenty-six). He elaborated:

> This has been my idea all along, but I never asserted myself on it until now. Alfred has done two things with my suggestion. First, he's said that this will be the only version of the 128K 1221, and, second, he's telling everyone that he had wanted this configuration as a precondition to even having a 256K version.
>
> The present design came about because a lot of people in hardware kept telling me that it wouldn't cost that much to "blank"--insert the addition of your choice. This resulted in a lot of additions. My idea will mean that the hardware engineers will have to think instead of just soldering chips together.

Miles had felt for a long time that hardware engineers at NICC lacked creativity and commitment.

The Denouement

The month following Alpha II saw many of the veteran engineers in the 1221 project seeking to transfer. This was the very common "post

release syndrome," to some extent, but it was also because of the dissatisfaction which had built up during the project, particularly during the last two months.

The problem of what the 1221 was stretched outside the software development group. Sal Marinaro, the Director of Dealer Marketing in the Indirect Sales Organization, was the person charged with building a distribution channel for the 1221. He had some reservations about how things turned out:

> The original product premise was that there was a market opportunity, above the ET [electronic typewriter] and below the PC [Professional Computer], dedicated to people who were keyboarding professionals. Nine-to-five people were the target group--secretaries, not managers.
>
> At present, there is a perceptual problem with the product. Some see it as an upgrade of the ET; others see it as a limited function PC. If you maintain the product premise (and I do), what happened is that product marketing heard voice number two, and they got off their mission. Thus, they added functionality which is too much for the ET group, and still not enough for the PC group.
>
> We think it fits on the ET side--it was designed for that. It's great, but the price elasticity is so sensitive, it may not work. We have a complete retail channel in place, but its not the ideal segment of the dealer channel. The ideal would be office products dealers who sell ETs. We are trying to recruit that channel.
>
> We could be sitting in a prime market position, but we are not going to after all this.

In mid-June, Alfred Tsou reflected on some of these problems, and on some of the history of the project:

> We couldn't decide if we should keep the 1221 a single-function word processor, thus making it harder to sell, or if we should give it MS/DOS [the IBM operating

system] and undercut the NICC PC. In the end Dr. Smith decided that we should avoid price wars with IBM, and stress the uniqueness of the 1221. We decided to make it a word processor, but to keep the PC market we called it the "NICC Secretarial Computer."

It was recognized that we needed a new generation of workstations. The PC could do this, but that market was controlled by outside forces [IBM]. The 1221 is under our control.

In late March the managers admitted that they couldn't fit everything into 128K, so we switched to a 256K system. We traded cost for timeliness. The internal trigger was the memory problem. The external trigger was the IBM price cut.

April was a bad month. My managers panicked. I slapped them in the face. I stopped any more elimination of functions. Dr. Smith supported me. He OK'd the extra memory, and the idea of keeping lots of functions--multitasking. That is, WP plus an option. My marketing partners were very supportive and never buckled. . . . The 1221 managers wanted to prove that they could build a super-duper machine. They didn't realize that we have an OAS group whose job it is to design high end stuff.

What happened with the 1221 is typical of NICC development efforts. Dr. Smith and I expected it. Lots of people expected it. Most projects have a hiccup. MS started at 64K and ended up at 256K. Software development always sucks up more memory than they've been allocated. Part of the problem is that software development is not totally a science. There's too much creativity.

On July 6th, Dr. Smith dropped a bombshell on everyone in the company. Although the company had evolved into a firm organized around product areas, (OAS, MS, PC, 1221) the decision was made to reorganize into functional form. The rationale was that the company would offer integrated office automation systems; consequently, the functions around which the company would be organized were the functions of office

automation systems--software and hardware, with some breakdown by size of product. Alfred Tsou was immediately put in charge of the software for large host systems, such as the MS.

The 1221 group was kept intact temporarily. Beta I occurred on July 20th. It was the first time that the 1221 system was used somewhere other than NICC. Product Marketing finally decided to call the 1221 the "NICC Office Assistant," to keep in tune with the company's reaffirmation of its office automation roots. FCS occurred in mid-October of 1984. Print and broadcast advertising began at the same time. By early December, the company had sold approximately 5,000 units, which was below the projected figure.

Afterword

The reorganization of July, 1984 ultimately resulted in a new person's being responsible for the 1221. This person decided he could not accept the operating system, mostly because it was not compatible with MS-DOS, the IBM PC operating system. He ordered a wholesale rewriting of code for the 1221.

Some of the 1221 managers resigned. Others were fired. Yet others were stripped of any meaningful supervisory responsibilities. Even Alfred Tsou became very unhappy, and, remarkably, was rumored to be on his way out of the company. Only one manager, Fratelli, found a happy home elsewhere at NICC.

Analytical Highlights from the Ethnography

Politics

There are many points in the narrative where the political goings-on at NICC are very evident. In the early stages, Alfred Tsou's peers were very much against the 1221, either because of staff transfers, or because of elements of the strategic specification with which they did not agree (mainly not putting the 1221 under their purview). They took some steps to try to stamp it out: (1) forcing design changes, (2) refusing to allocate good development systems, (3) allowing staff "left behind" to personally scold staff who were departing for the 1221 project.

Tsou took many steps to try to neutralize this kind of opposition. He used the demos to try to create a favorable impression in other parts of NICC. He used impression management; for example, he tried to run the 1221 project on a shoestring to prove that that kind of development effort could be done efficiently, and he adhered to an aggressive schedule to show the "gung-ho" nature of the 1221 project. In addition, he always reminded his managers of the need for building and maintaining credibility with "other parts of NICC."

Tsou also did some organization building. He allied himself closely with Dr. Smith, and he maintained very close ties with marketing, which he felt could assist him in neutralizing, or even winning over, opposition.

The reformulation of strategy occured in this political context,

with much involvement by the marketing group, when Dr. Smith called the meeting in late March, 1984, to decide the fate of the 1221.

Marketing

In addition to the direct contacts of allied marketing staff with other interested parties in NICC, marketing did a few other things in this project. Marketing staffers wrote the business plan, which had the dual functions of neutralizing opposition ("internal selling document") and beginning the specification process. They were heavily involved in, and largely responsible for, the specification and re-specification of performance, functionality, and memory size criteria as the project went along.

In a key activity, marketing management supported upper management's desire for stringent compatibility with larger NICC systems. Marketing used the demos as a tool to assist in gaining support at NICC, and as a method of monitoring adherence to the specifications. Lastly, marketing was a major participant in the strategic re-formulation.

Technical

These political and marketing actions increased the technical complexity of the task facing the engineers. Design and coding both became more complex, and were partially responsible for bugs, poor performance, poor functionality, and excessive memory usage. These problems were also partially caused by the infrequent integration of

code by the engineers, and by the poor resources at their disposal. The main technical function of the demos was to give the engineers an excuse to integrate their code.

The core group

The ethnography showed many things about the core software development organization of the 1221 project.

Interpersonal communications. Interpersonal communication among members of the 1221 project differed according to organizational level. Managers communicated amongst one another a great deal. They met formally several times a week, and informally almost all the time. The subject matter was always technical. Occasionally, Alfred Tsou would ask them to consider administrative items like affirmative action, hiring, and incentive programs. But usually their communication was technical. When managers communicated with engineers, the subject matter again was almost always technical. The major exceptions to this were the confrontation meetings which occurred near the end of the project.

The pattern among the engineers was different. They had two different modes of communication. One mode was social. When the engineers got together to socialize, there were two distinguishing characteristics: (1) they gathered in groups of three or more, and (2) they tended to stay within their functional work group. For example, three members of the CRT Phone group were talking, and two of them were kidding a third member, a Russian emigree, about his being a "commie."

Another time, four of the members of the File Management System (FMS) group got together to joke about how a local college student engaged in a well-publicized prank had the same name as an FMS engineer.

The other mode of interaction was problem-solving. This mode was almost always one-on-one. When doing problem solving, individuals did stray from their functional work groups a bit. The problem solving mode had two sub-modes. When problem-solving (debugging) within functional work groups, the members tended to speak in "code." They used specialized language that sprang from the actual program. They used terms like "node," "calls," "returns," "FCB," "zeroing out the FCB," "locations," etc. When debugging across functional groups, the members tended to speak in plainer English. For example, when members from three different groups were trying to figure out why an Alpha I user couldn't get her document to print properly, they used terms like "opening the printer," "printing the document," "editing the document," and "printing another page."

Organizational communication. There was little communication across groups, particularly of a social or administrative nature, and technical communication was low.

There was little or no social interaction across the groups. Only twice were exceptions noted. Once was when a member of the CRT Phone group left for another job, and people decided to take him out to lunch. The twenty-five or so people who went were from a variety of groups. The other exception was an impromptu party held for the 1221's secretary, on National Secretary's Day. But this may have proven the

rule more than disproven it. The "party" was characterized by two things: (1) even though everyone was there, they clustered into their functional groups, and (2) the party totally lacked in any warmth or other emotion--no one made a speech, no one thanked the secretary; they just drank their coffee and ate a few cookies, then left. Jim Miles, who was the secretary's immediate supervisor, didn't even make a little speech.

Administrative problems were handled almost exclusively by the manager of a given functional group. Administrative problems were defined as obtaining supplies or documentation, and performance reviews, and to a lesser extent as guidance on specifications.

If technical problems came up, engineers would seek out whoever was responsible, regardless of work group. But they were decidedly more comfortable about approaching a member of their own functional group. Problem-solving interaction between members of different functional groups was more tense, although usually civil. This observation brings us to a phenomenon which dominated communications on this development effort--avoiding the "dunce cap."

Avoiding the "dunce cap". The major influence on the communications between members of the 1221 project was a deep desire to avoid looking bad in the eyes of fellow engineers or managers. One engineer called it "not wanting to be the one to wear the dunce cap." The effects of this ethos were pervasive. The primary effect was to withold information and thereby inhibit communication.

The first example of this phenomenon occurred at the managerial

level. When the managers realized that they couldn't fit the editor and the operating system into the available memory, they first tried to cut out unneeded functions, then they developd an alternative hardware solution, putting the OS on a PROM. Upper management was kept ignorant of these activities until after a solution, the PROM, was selected.

This pattern was repeated after Alpha I. Even though it was apparent that no solutions were available, the managers did not want to be the ones to recommend a change or slowdown in the project. They did not want to wear the dunce caps. Eventually, the problem became so desperate that upper management had to be told.

The third example of this phenomenon was really an imbedded part of the development, one that occurred every day--the unwillingness to share information about bugs. Computer systems are complex, and they are classic systems, in that all the parts are interrelated. Ideally, this requires coordination between the various subcomponents of the system. In many software development projects, part of the coordination of the system is done through the mechanism of source control, which is nothing more than a formal system of notification of changes in programs. In the 1221 project, coordination was left unstructured. Formal code integrations occurred only for the demos and releases, when many errors would be found, lengthening the process of building the system code. Between these integrations, engineers were left to their own devices for eliminating bugs. To insure that they not have to wear a dunce cap, engineers, finding that a piece of code didn't function properly, would spend days trying to prove that the error lay in the

other group's code, only to find that the bug had been found and corrected days earlier, and that the correction had not been publicized.

This problem was exacerbated by the lack of a formal source control mechanism in the project. Had a formal mechanism of change notification existed, groups could have avoided the kind of interaction with which they were most uncomfortable--between-group problem solving. They would have avoided days of effort aimed at keeping dunce caps off their heads. The "dunce cap" syndrome was an ironic one. Groups would spend much time and energy on proving that they weren't responsible for an error or a delay, which led to a larger quantity of uncomfortable interaction. Had errors, and their correction, been made more public, the degree of discomfort would have been reduced.

Contributions from members. One way of inducing contributions from members is to specify a purpose and to get organization members to commit themselves to the attainment of that purpose because they believe in it. That could have happened on this project, but did not. There was much skepticism attached to this project. Some of it was with other groups in NICC, but some was within the 1221 core organization. Tom Dickinson, a veteran engineer who coordinated the code integration process, expressed the problem in classic Barnardian terms:

> It's like putting an addition onto a house. You design the foundation, walls, floors, ceilings, and roof. But then you have to put the foundation in first. If you think that at some point you might want to put in a wood stove, you have to do things in a way that would easily allow you to take out the floor, put in bricks and a flue, etc. If you don't do that ahead of time, you might have to do substantial rebuilding when you decide to make that change. Designing

> and building a computer works the same way. My problem now is that I'm very uncomfortable about conforming to the design we have, because it is so bad. There's a fine line between conforming to keep things moving along and being "balky" because you genuinely believe the design is faulty. I wish I felt better about conforming.

Dickinson was saying that the organization side of his personality, "conforming," was only barely winning out against the individual side of his personality, "being balky." He was saying that the way the 1221 was turning out was only just barely in his zone of acceptance (Barnard, 1938).

As an alternative approach, Alfred Tsou tried to convince people that the 1221 project was worthwhile because it was a "start up," i.e., a new company. Start ups have an almost mythological hold on people in the computer industry, an industry which abounds with stories of people who started in a garage and who were now worth millions of dollars. Most of the members of the 1221 were not impressed with the argument that they were part of a start up. It was difficult to feel like the project was a start up when it was imbedded in the intruigue of company politics. Most of the engineers were also skeptical about Tsou's or Miles's ability to materially reward them the way employees of successful start-ups were typically rewarded. One young female engineer put it succinctly: "Where does Alfred get the idea that this is a start up company? Why aren't we given the same rewards and recognition as in a start up?"

The engineers <u>were</u> promised material rewards, to be delivered after the successful completion of the project. However, there seemed to be some skepticism about those, too. As one project member asked,

"Will we get the things that have been subtly promised to us, like extra vacation, stock, and bonuses?"

Another strong motivation for the engineers was the opportunity to do interesting work. But they felt that this was denied to them. One veteran engineer asked, "Why has management put us into a coding 'box'?" Another asked, "Why is my input into the creative process stifled? Why am I just building somebody else's blueprint?" The engineers complained about, and ultimately confronted their managers on, what they felt was a lack of consultation on technical matters.

Demos. The main function of demos for the core group was to give them some feedback on the quality of the code that they were writing.

Outcomes. The main outcomes in the core group seemed three in number: (1) poor morale, (2) a desire to leave, or actually leaving, in some cases, and (3) the engineers' preoccupation with career development and their futures.

Many of these ideas will be examined in greater detail later, and all will be integrated into an overall model of the implementation process, after we first examine some more structured evidence from this research project.

C H A P T E R V

COGNITIONS ABOUT OBJECTIVES IN THE 1221 CORE ORGANIZATION

As mentioned earlier, this study was partly an in-depth examination of the core organization of the 1221 development project. This was stated more formally in research question one (pages 28 and 29), "What were the initial outcome specifications for the project? Was there an integration in the project about these objectives, or was there conflict and ambiguity between technical and business objectives? Or between the managers and the engineers?"

This is particularly important here because of this group's being a professional organization. Outcomes, subunits, and positions were only partially specified. The method of doing work was largely determined by the members of the organization. The "deliberateness" of the strategy formation is crucially dependent on the extent to which the objectives of the project, as interpreted by the members, fit into an integrated whole.

The Semantic Differential Instrument

Information on this point was obtained from observation and interviewing. But in an effort to triangulate, to try to pin down this phenomenon from multiple perspectives, using multiple methods, this study also used a semantic differential instrument. (The instrument is reproduced in Appendix A.)

The concepts

After several weeks of interviewing and observation in the 1221 project, the author and a colleague close to the 1221 project chose six concepts for the semantic differential instrument. These particular concepts were chosen because they were felt to be representative of how the 1221 project engineers and managers thought of strategic and engineering objectives. The concepts chosen to measure the way the members of the project defined strategic objectives were numbers 1, 3, and 5 below, and the ones chosen to measure engineering objectives were numbers 2, 4, and 6 below:

1. Low end product
2. Technical excellence
3. FCS by May
4. Lots of functionality
5. Compatibility requirements
6. State of the art work

Two explanatory notes are in order here. The objective "FCS by May" was initially "FCS by July", but the date was changed after some of the questionnaires were first distributed. After all the questionnaires were received, the FCS date was changed again, this time to September. This objective was probably not fatally harmed by any of this; instead it became a surrogate for the very aggressive scheduling which characterized this project. Also, "Lots of functionality", which had been considered an engineering objective, turned out to be associated with the marketing strategy, which emphasized the functions and features

of the 1221. This point will become clearer later in this discussion.

Sample and statistical analysis

Completed questionnaires were received from twenty-four members of the 1221 project--five managers and nineteen engineers.

Each objective on the questionnaire was rated on the same twenty semantic differential scales. This allowed for the construction, using stepwise discriminant analysis, of a semantic space, a "definitional space", upon which to array the six objectives. They were then compared for differences and similarities in how they were defined by members of the organization. The analyses were done separately for managers and engineers.

The Managers

The quantitative results for the managers are displayed in Tables 1 and 2 and in Figure 9. Because there are only five managers, the stepwise procedure eliminated all but four of the independent variables, and yielded only one statistically significant dimension.

The four semantic objectives that remain in the analysis were:

1. TIMELY
2. PERMISSIVE
3. PROGRESSIVE
4. REPUTABLE

Table 1 shows that the first dimension loaded most heavily on TIMELY and

TABLE 1

DISCRIMINANT FUNCTIONS AND THEIR COEFFICIENTS FOR THE 1221 MANAGERS

Function	Eigen-value	% of Var-iance	Cumula-tive	Signifi-cance
1	1.49794	62.97	62.97	0.0058
2	0.58081	24.42	87.39	0.1323

Standardized Discriminant Function Coefficients:

	Funct 1
TIMELY	-1.05996
PERMISSIVE	1.17114
PROGRESSIVE	0.36079
REPUTABLE	-0.00623

PERMISSIVE. The negative value for TIMELY suggests that it should be renamed UNTIMELY. Hence, the dimension upon which the managers' scores will be analyzed is defined as one which ranges from UNTIMELY AND PERMISSIVE to TIMELY AND CONSTRAINED.

Table 2 shows that not all the objectives were statistically different from one another. The objectives of "FCS by May" and "Compatibility requirements" were together at one end of the dimension, while "Lots of functionality", "State of the art work", and "Technical excellence" cluster at the other end. These two clusters were statistically different from one another. The objective "Low end product" is statistically different only from "FCS by May."

Figure 9 arrays the six objectives on the one dimension. This diagram illustrates the following:

TABLE 2

SIGNIFICANCES BETWEEN PAIRS OF CONCEPTS
FOR 1221 MANAGERS

Concept / Concept	1	2	3	4	5
2	N.S.				
3	*	**			
4	N.S.	N.S.	*		
5	N.S.	**	N.S.	***	
6	N.S.	N.S.	***	N.S.	***

Key:
1: Low end product
2: Technical excellence
3: FCS by May
4: Lots of functionality
5: Compatibility requirements
6: State of the art work

* = p < .10
** = p < .05
*** = p < .01
N.S.= not significant

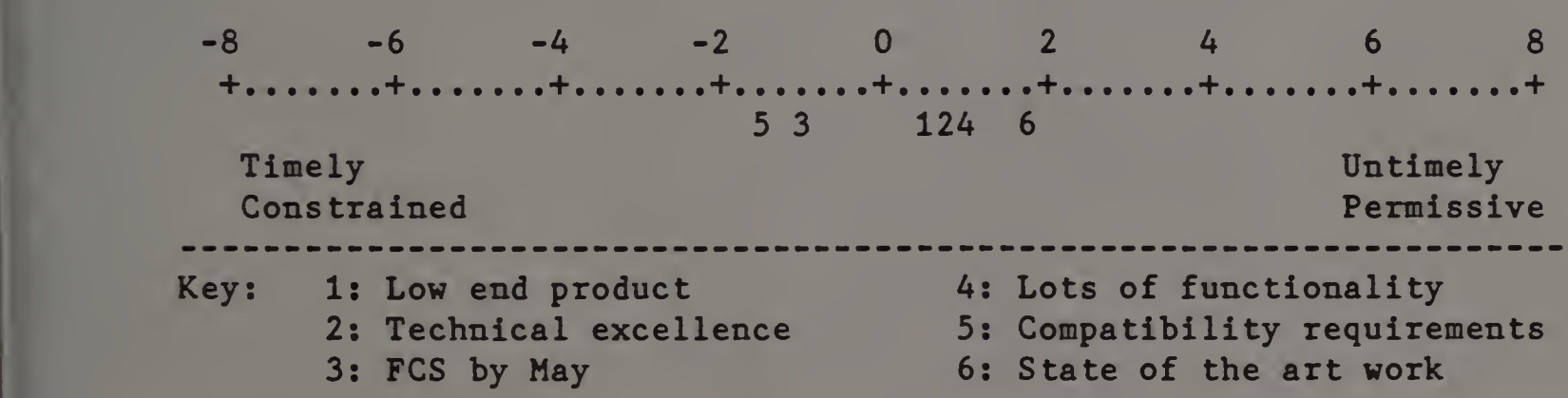


Figure 9. Plot of group centroids on the single significant dimension for 1221 managers

1. "FCS by May" and "Compatibility requirements" were seen as TIMELY AND CONSTRAINED.
2. "Lots of functionality", "State of the art work", "Low end product", and "Technical excellence" were seen by the managers as UNTIMELY AND PERMISSIVE.

These results do allow for a reasonably good interpretation. The aggressive schedule and the compatibility requirements were seen by the managers as necessary evils, things which had to be accomplished in order to succeed against competitive products (TIMELY), but things which severely limit the development operation (CONSTRAINED). Developing a low end product with lots of functionality was seen as difficult under the time constraints (UNTIMELY). Allowing the engineers on the project to work towards the state of the art and towards technical excellence was seen as likely to blow the schedule (UNTIMELY) and frivolous (PERMISSIVE).

There is much evidence from the open-ended interviews that supports this interpretation. The managers were acutely aware of the schedule and of the need for getting a timely and acceptable, if not state of the art, product out to the users. The managers made many complaints about their specific subordinates who kept insisting on building more elaborate systems than were necessary for capturing the market, particularly in the allotted time.

The Engineers

Tables 3 and 4 and Figure 10 display the quantitative

TABLE 3

DISCRIMINANT FUNCTIONS AND THEIR COEFFICIENTS
FOR THE 1221 ENGINEERS

Function	Eigenvalue	% of Variance	Cumulative % of Variance	Significance
1	0.57975	40.72	40.72	0.0000
2	0.36547	25.67	66.39	0.0012

Standardized Discriminant Function Coefficients:

	Funct 1	Funct 2
TIMELY	0.11372	0.48730
PLEASURABLE	0.74696	-0.11251
SOCIABLE	-0.43377	0.12671
HARMONIOUS	-0.10885	0.00514
MEANINGFUL	-0.04150	-1.03172
PROGRESSIVE	0.60820	-0.26313
IMPORTANT	-0.01255	0.61482
FREE	0.20732	-0.51995
POSITIVE	-0.30736	0.65103
WISE	0.41006	0.19533
HARD	-0.18354	-0.10362
STRONG	-0.17303	0.11765

TABLE 4

STATISTICALLY SIGNIFICANT DIFFERENCES BETWEEN PAIRS OF CONCEPTS FOR 1221 ENGINEERS

Concept / Concept	1	2	3	4	5
2	N.S.				
3	***	***			
4	**	**	***		
5	***	**	**	*	
6	*	**	***	**	***

Key:
1: Low end product
2: Technical excellence
3: FCS by May
4: Lots of functionality
5: Compatibility requirements
6: State of the art work

* = $p < .10$
** = $p < .05$
*** = $p < .01$
N.S.= not significant

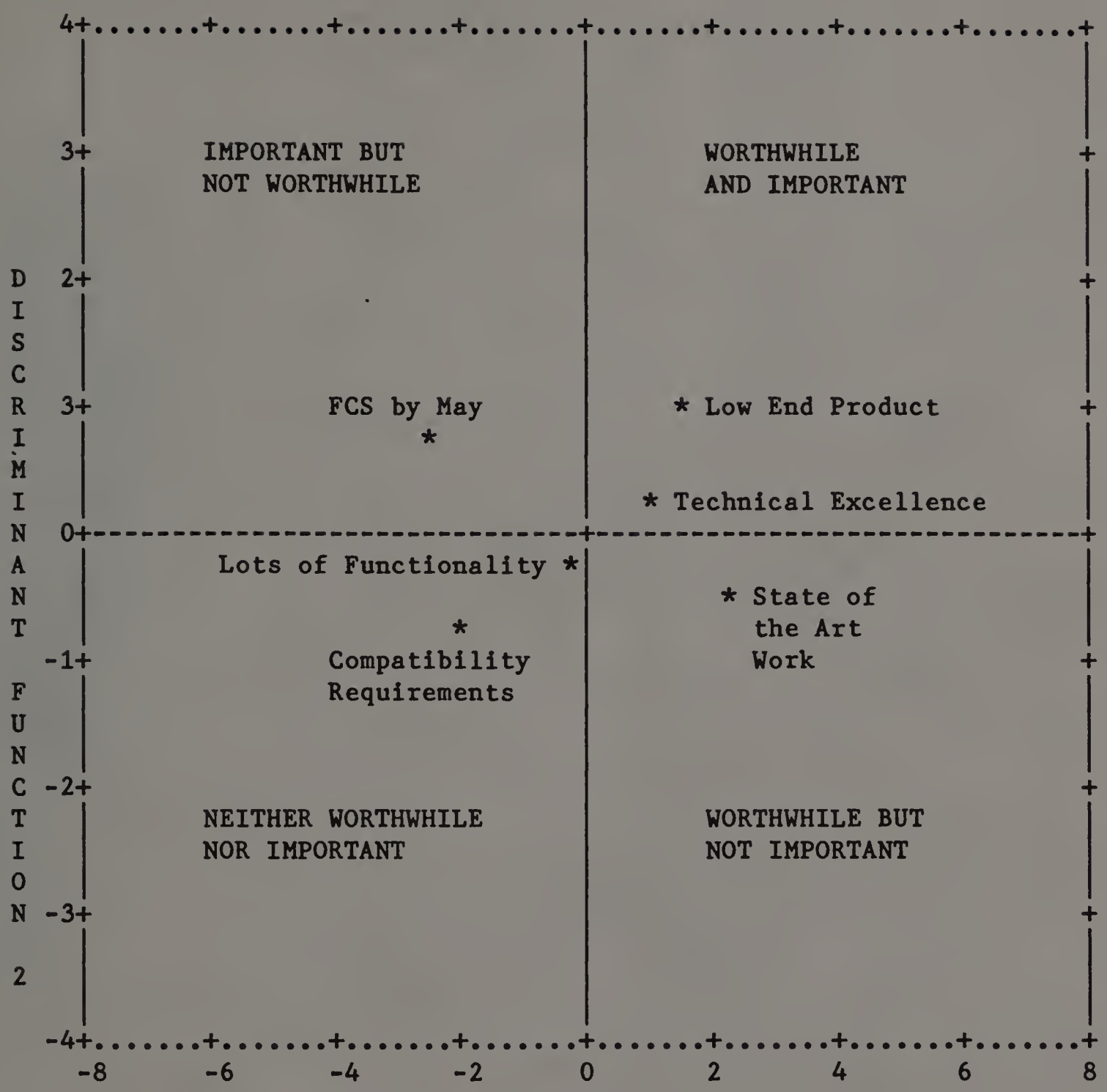
results for the engineers. Because there were nineteen engineers responding, the results were much richer. Table 3 shows that there were two statistically significant dimensions for the engineers. (Actually, there were three, but only the first two were used in the remaining analysis, since two-dimensional plots are more easily interpreted.) The same table shows that the two dimensions load on to twelve semantic

variables (with the appropriate allowances for negative signs):

Dimension 1	Dimension 2
PLEASURABLE	TIMELY
UNSOCIABLE	MEANINGLESS
DISCORDANT	IMPORTANT
PROGRESSIVE	CONSTRAINED
WISE	POSITIVE
SOFT	
WEAK	

The greater richness of the analysis for the engineers also yields a more difficult problem of interpretation. Keeping in mind the subjective nature of multivariate statistical analysis, the first dimension was called WORTHWHILE (i.e., pleasurable, progressive, wise) and the second dimension was called IMPORTANT (i.e., timely, important, constrained, positive). The first dimension seems to connote professional worthiness (pleasant, progressive), while the second dimension seems to imply strategic importance (timely, important). Table 4 shows that these two dimensions statistically discriminate between all the objectives, with the exception of "Low end product" and "Technical excellence." This is an important exception, one that was also true for the managers. The engineers saw no contradiction between technical excellence and a low end product. The possibility of such a conflict was a concern voiced by Alfred Tsou, but it did not materialize.

Figure 10 plots the six objectives in two-dimensional space. The results were extremely revealing. As mentioned above, the engineers placed "Low end product" and "Technical excellence" together in the



Dimension 1: pleasurable, progressive, wise. [WORTHWHILE]
Dimension 2: timely, important, positive. [IMPORTANT]

Figure 10. Plot of semantic differential concepts on the two significant dimensions for 1221 engineers

WORTHWHILE AND IMPORTANT quadrant. They saw the development of a low end machine for the company to be both developmental for them (WORTHWHILE) and strategically important for the company (IMPORTANT).

What the engineers placed in the opposite quadrant was quite interesting. "Compatibility requirements" were seen as NOT WORTHWHILE AND UNIMPORTANT. Many of the engineers chafed under the requirement that they be compatible with the work of other groups within the company. Several expressed a feeling that compatibility had not helped some companies. It is interesting that these requirements were quietly dropped about sixteen months into the 1221 project.

The other objective placed into the NOT WORTHWHILE AND UNIMPORTANT quadrant was "Lots of functionality." As mentioned earlier, this objective was placed in the questionnaire as an engineering, or personal, objective. The results show that the engineers sharply distinguished it from the other two engineering objectives, "Technical excellence" and "State of the art work." They placed it with an explicitly strategic objective, "Compatibility requirements." It is clear from the observations made of the engineers that this objective was a surrogate for the marketing strategy for the 1221, which stressed the functions that were felt to be needed for user acceptance. The marketing forces in the company mandated many changes in the software in order to achieve the proper functionality. Many engineers complained about the way their code looked as a result. Many also wondered aloud about what kind of machine the 1221 had become, stating that it seemed to have evolved into a sophisticated and powerful development system, as

opposed to a low-end typewriter replacement. Figure 10 clearly illustrates that the engineers felt that, on this project, lots of functionality was incompatible with technical excellence and a low end product.

"State of the art work" is in the WORTHWHILE BUT UNIMPORTANT quadrant. The engineers seemed to be saying that while they would have liked to do state of the art work, they realized that it was untimely and relatively unimportant to do so.

Finally, "FCS by May," the surrogate for the project's scheduling, is in the IMPORTANT BUT NOT WORTHWHILE quadrant. In other words, they felt that the aggressive scheduling was unpleasant, regressive and foolish, but also realize that it was timely, important and positive. This mirrors a phenomenon that was frequently seen and heard--almost all the engineers complained about the schedules, yet, in response to a question about what they would change about the project, most said that "to get the product out on time" there might not be an appropriate change. Implicit in these results was the feeling by the engineers that this type of scheduling was incompatible with the development of a good low end product, with technical excellence, and with state of the art work. It is again interesting to note (1) that the management of the company found it necessary to lengthen the schedule substantially in order to complete a salable product, (2) the product was not as low-end as had originally been planned, and (3) it did not perform as well as, or have the functionality that, was expected.

Comparison of the Managers and the Engineers

It seems clear that the gulf between the managers and the engineers in the 1221 project was wide. But let us first examine the areas where there was apparent agreement.

The managers and the engineers seemed to agree that the scheduling was a necessary evil; for the managers, it was timely but constraining, for the engineers it was important but unworthy. The managers seemed to have been able to get grudging acceptance from the engineers on the scheduling. The engineers also seemed to have been committed to the idea of a low end product. They did not have a problem working on a low end product; indeed, they saw it as both worthwhile and important, and did not distinguish it from technical excellence.

There were important differences. While the managers saw the compatibility requirements as necessary evils, the engineers saw them only as evils. The managers saw the functionality issue as a difficult problem to be solved; their subordinates saw it as a pure obstacle, as neither worthwhile nor important. It seemed that the managers did not succeed in gaining commitment by the engineers to these two strategic objectives. For the functionality question, in particular, this was a wide and important gulf. A more subtle difference concerned the objective "State of the art work." The engineers agreed with the managers that it was untimely, but they saw it as progressive, pleasurable and wise, while the managers saw it as permissive or frivolous. This may have been a source of tension between managers and engineers, and there is some evidence from the qualitative data that

this was true.

Conclusion

Superficially, the members of the 1221 project's technical core, the software engineers and their managers, seemed to agree on the objectives of the project. Both groups saw the development of a low end product and technical excellence to be mutually compatible. Indeed, for many organization members, this combination was precisely what drew them to the project. The managers and engineers also agreed that "State of the art work" was not possible (however desirable) on this project--it would have consumed too much time. The two groups also agreed on the need for the tight scheduling, on getting the First Customer Shipment by May (or July).

There were key disagreements, though. As shown in Figure 10, the key members of the 1221 core organization, the engineers, did not accept the validity of two strategic objectives which were important to top management and marketing--the high-end functionality mix, and the requirement that the 1221 be compatible with the V4 group in Office Automation Systems.

Recall from the project narrative that the functionality mix was a central aspect of the business plan formulated by product marketing. Not only was this considered important from the standpoint of eventual end-user acceptance, it was considered important from the standpoint of building political credibility with other, possibly rival, groups within NICC. Several managers mentioned that other groups felt that what the

1221 group was attempting was impossible. Jim Miles enjoyed that, likening the project to a "suicide mission." But, contrary to what Miles said in the narrative, this cross-sectional examination of the organization reveals that there was not widespread agreement with the "suicide mission" ethos. This is evidenced also by the confrontation meetings near the end of the narrative, where several engineers said that they felt that the 1221 had gone beyond what was needed for its original goal--low end word processing.

NICC had made a decision that all of its products be compatible with one another, from the least expensive machine (the 1221), all the way up to the most expensive (the MS). As John Steffano pointed out, this could be accomplished at various levels of rigor. The top management of NICC decided to go for the most exacting compatibility with the V4 document structure. This required the use of much more memory space than would have been necessary under other approaches. Some engineers, particularly Bill Parris, who was in charge of the document manager (which was most directly affected by this policy), complained that the V4 standard was a poor one. Consequently, the compatibility requirements were seen by the engineers as opposed to both the specific low end product goal and to technical excellence in general.

So, while the 1221 core organization was trying to put on its best face for the rest of NICC, it was not completely "coalesced" itself. There was still important disagreement about some key issues where technical and strategic concerns interacted. This disagreement

was between the engineers and the managers. But, and this was more important, it was also a split within the collective cognition of the organization. The members did not think highly of what they were being asked to do.

This kind of disagreement had profound consequences on the success of the project. As noted above, in a professional organization, using an umbrella strategy, agreement on objectives is perhaps the most important control mechanism, because of the autonomy granted the professional worker. Without an "integrated whole" of objectives, there is a risk of losing control of the development effort, i.e., of straying from the "deliberate strategy" path. There is also a risk of losing the commitment of the professional workers, and of engendering conflict and poor communications. All of this may, and in this project did, lead to poor individual and organization performance, and to technical and commercial failure.

C H A P T E R VI

INTERACTION AND COMMUNICATION IN THE 1221 CORE ORGANIZATION

Research question two (page 29) addressed the issue of interaction and communication within the core organization. As mentioned earlier, authors like Barnard (1938) have identified the importance of communications in organizations, and Homans (1950) discussed the particular importance of the activities along the dimensions of technology, administration, and socializing. These questions were measured sociometrically.

Sociometric choice data, obatined by semi-structured interviews, were gathered along four dimensions:

1. Technical: respondents were asked which three people they would approach if they needed to consult with someone on a technical matter
2. Administrative: respondents were asked which three people they would seek out for assistance on administrative matters, such as the obtaining of tools, supplies, and scheduling
3. Social: respondents were asked to name those people with whom they socialized; there was no effort to rank these choices
4. Contacts: respondents were asked to name those people with whom they came in contact during a typical week; these choices were not ranked either

Information on all four of these dimensions was obtained for

each of three points in time: June 1983; January-February 1984; and May 1984. The number of respondents varied with each time point.

Measurements

The data are extensive. They have been converted into two measurements. The first measurement is simply the percentage of a group's overall choice that is made within that same group. The higher this percentage, the more insular, or isolated from other groups, that group is on the given dimension.

The second measurement is the percentage of a group's overall choice that is made within the same software category, viz. systems or applications. In the 1221 project, there was a sharp dividing line

SELECTEES

SELECTORS	SYSTEM	APPLICATIONS
SYSTEM	3 2 1 3 3 2 2 3 3 2 (24)	(0)
APPLICATIONS	2 (2)	3 5 2 3 2 (16) 1

Figure 11. Technical choices, by subsystem, 1221 project, June 1983. Numbers without parentheses indicate choices made by individuals: 1 = third choice, 2 = second choice, 3 = first choice. Numbers in parentheses indicate the total weight of choices made in that quadrant.

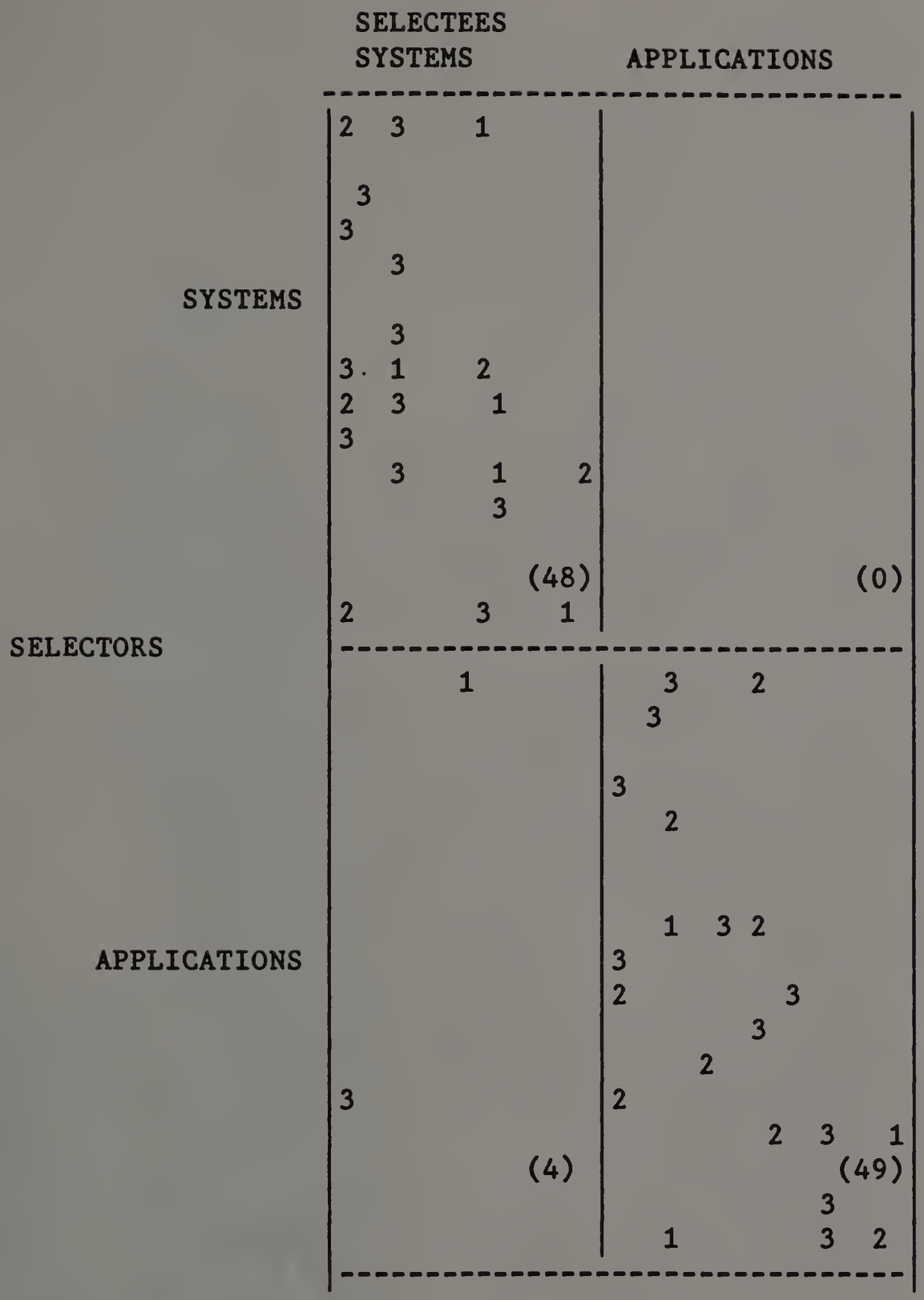


Figure 12. Technical Choices, by subsystem, 1221 Project, Winter 1984. Numbers without parentheses indicate choices made by individual: 1 = third choice, 2 = second choice, 3 = first choice. Numbers in parentheses indicate the total weight of choices made in that quadrant.

SELECTORS	SELECTEES: SYSTEM	SELECTEES: APPLICATIONS
SYSTEM	2 1 2 3 2 32 1 2 3 (22) 1	3 3 21 1 2 (12)
APPLICATIONS	3 2 3 1 2 3 2 3 (19)	31 2 3 12 3 1 2 3 3 2 1 2 1 3 1 2 1 3 1 1 1 32 3 1 2 (53)

Figure 13. Technical Choices, by subsystem, 1221 Project, May 1984. Numbers without parentheses indicate choices made by specific individuals: 1 = third choice, 2 = second choice, 3 = first choice. Numbers in parentheses indicate the total weight of choices made in that quadrant.

		SELECTEES	
		SYSTEM	APPLICATIONS
SELECTORS	SYSTEM	3 2 3 3 2 2 (18) 3	(0)
	APPLICATIONS	3 (3)	3 3 3 3 3 (15)

Figure 14. Administrative Choices, by subsystem, 1221 project, June 1983. Numbers without parentheses indicate choices made by specific individuals: 1 = third choice, 2 = second choice, 3 = first choice. Numbers in parentheses indicate the total weight of choices made in that quadrant.

		SELECTEES	
		SYSTEM	APPLICATIONS
SELECTORS	SYSTEM	2 3 32 3 3 3 3 3 2 3 2 3 2 3 3 2 3 (48)	(0)
	APPLICATIONS	2 2 2 3 2 1 2 1 3 2 1 2 (18)	3 3 3 3 1 3 2 3 3 1 3 3 3 3 2 (49)

Figure 15. Administrative Choices, by subsystem, 1221 project, Winter 1984. Numbers without parentheses indicate choices made by specific individuals: 1 = third choice, 2 = second choice, 3 = first choice. Numbers in parentheses indicate the total weight of choices made in that quadrant.

		SELECTEES: SYSTEM	SELECTEES: APPLICATIONS
SELECTORS	SYSTEM	3 3 23 1 3 2 2 3(22)	1 (1)
	APPLICATIONS	1 2 3 2 2 (10)	3 2 3 2 2 3 3 1 3 1 2 3 3 2 3 3 3 3 (37)

Figure 16. Administrative Choices, by subsystem, 1221 project, May 1984. Numbers without parentheses indicate choices made by specific individuals: 1 = third choice, 2 = second choice, 3 = first choice. Numbers in parentheses indicate the total weight of choices made in that quadrant.

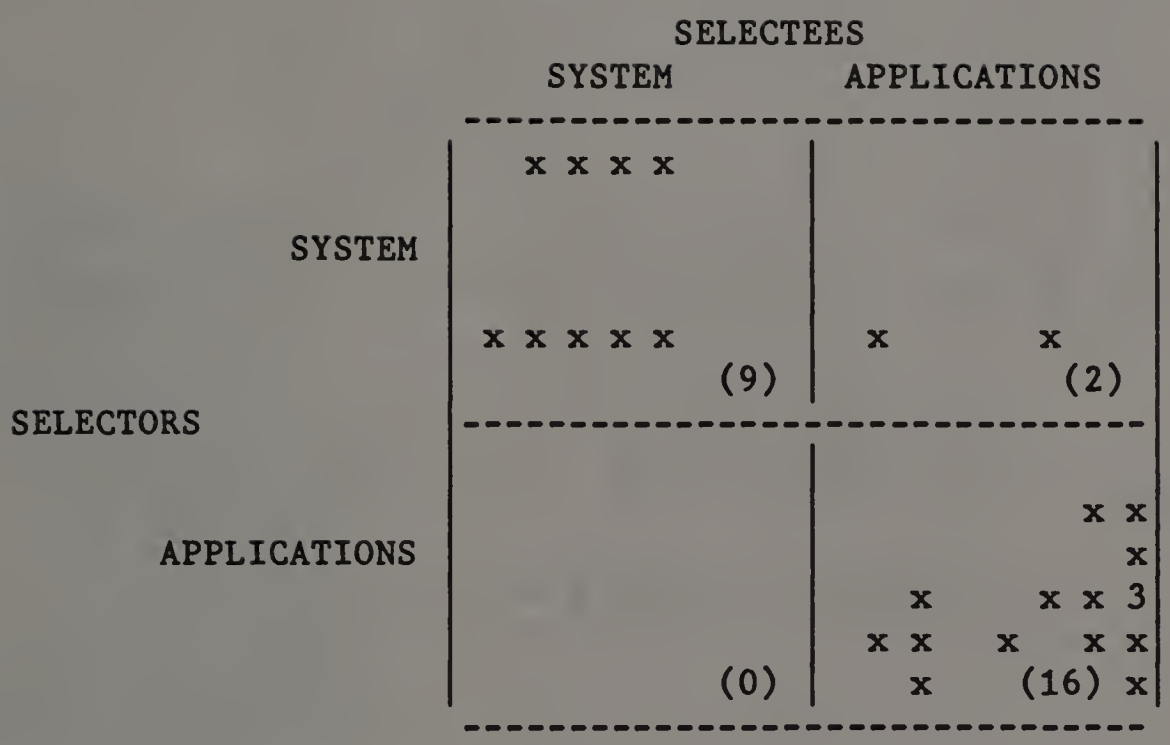


Figure 17. Social Choices, by subsystem, 1221 project, June 1983. X's indicate choices made by specific individuals. Numbers not in parentheses indicate number of choices exceeding one. Numbers in parentheses indicate the total weight of choices made in that quadrant.

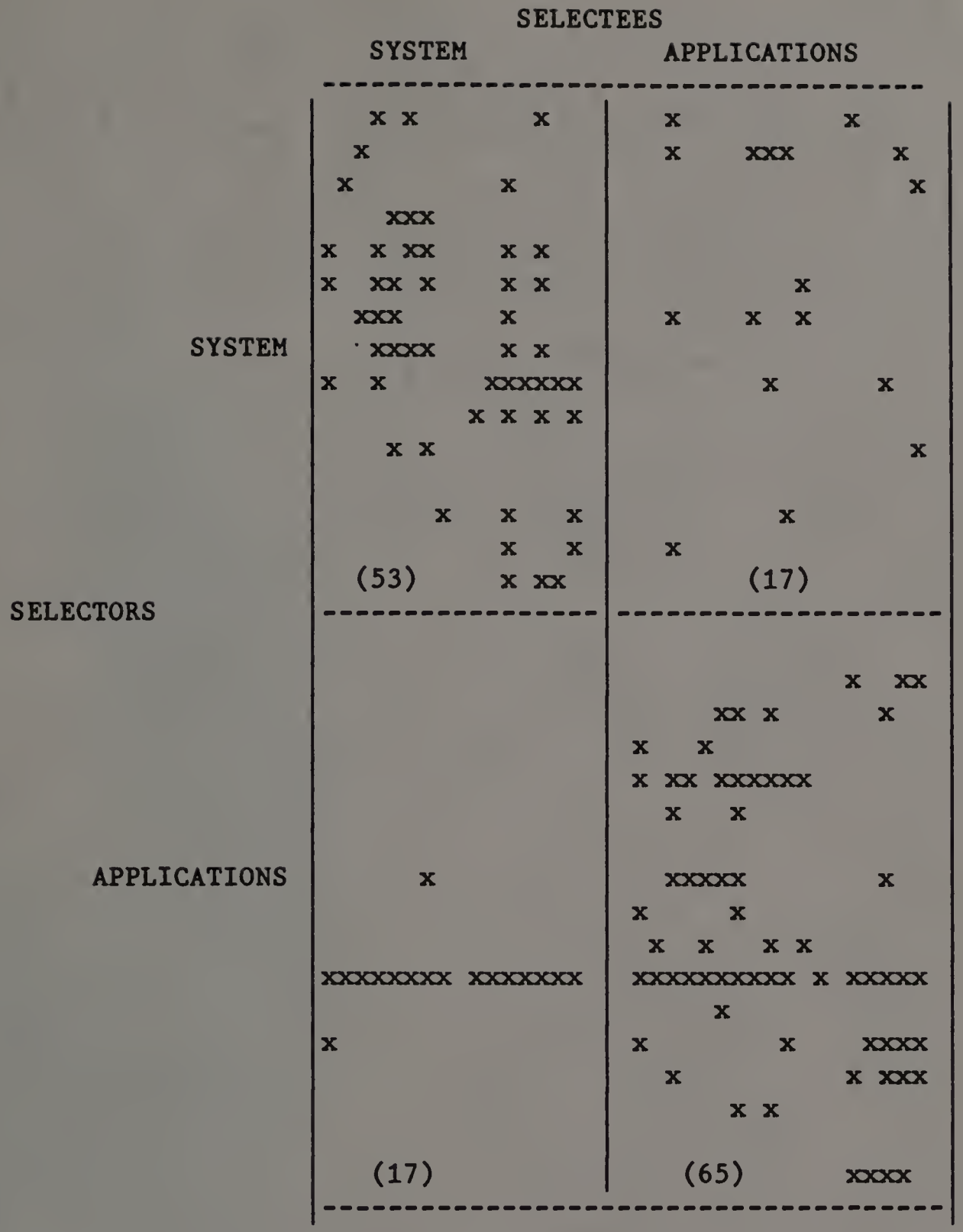


Figure 18. Social choices, by subsystem, 1221 project, Winter 1984. X's indicate choices made by specific individuals. Numbers in parentheses indicate the total weight of choices made in that quadrant.

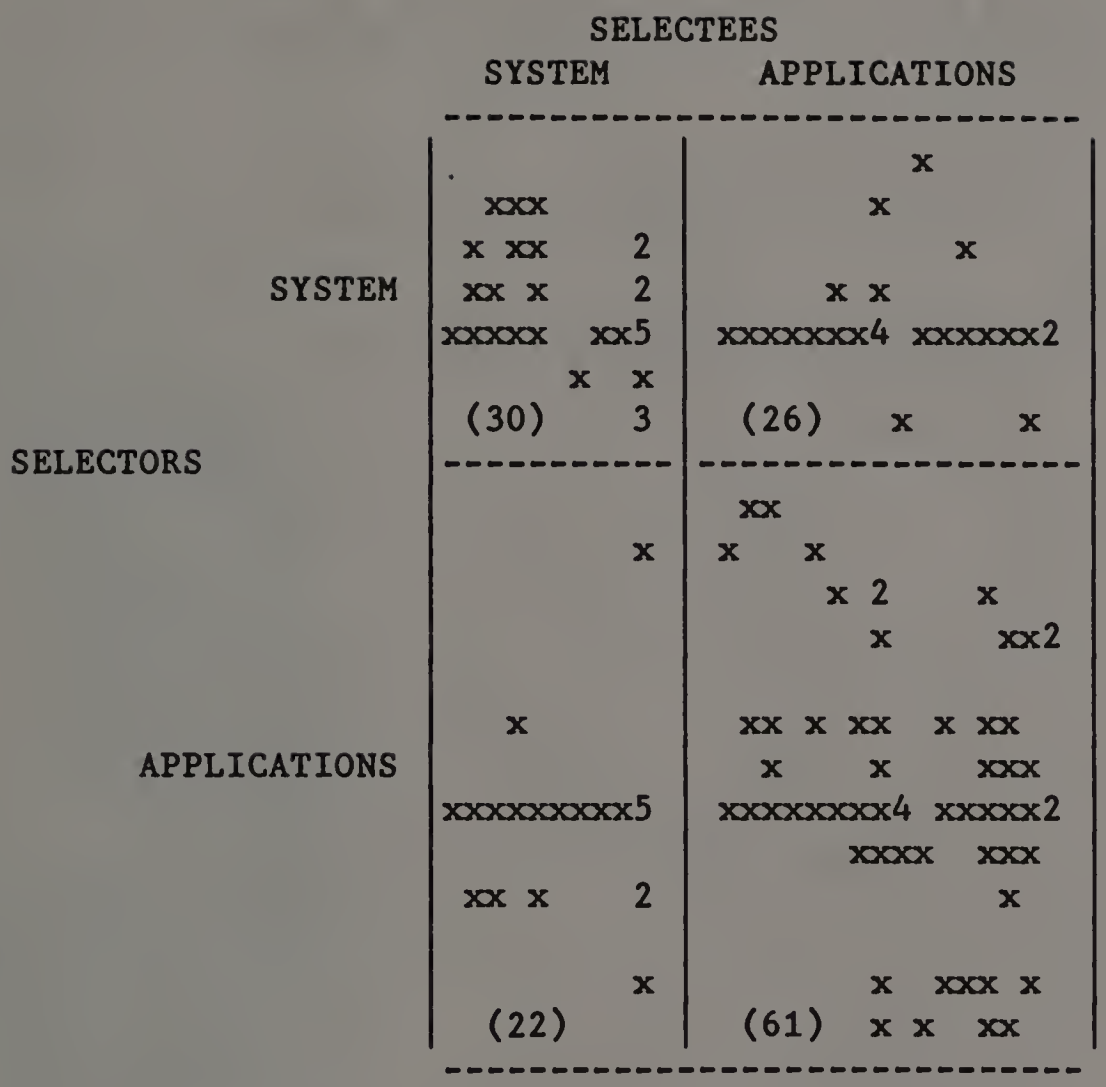


Figure 19. Social choices, by subsystem, 1221 project, May 1984. X's indicate choices made by specific individuals. Numbers not in parentheses indicate choices made in excess of one. Numbers in parentheses indicate the total weight of choices made in that quadrant.

SELECTEES

SELECTORS	SYSTEM	APPLICATIONS	OTH
SYSTEM	1 1 1 . / 1 1 3 / 1 1 1 3 / 1 1 1 2 / 1 1 5 / 1 2 / (43) 1 1 5	1 1 1 1 / 1 / 1 1 1 1 1 2 / 1 1 / 1 / 1 / (17) 1 1	13 / 9 / 2 / 10 / (34)
APPLICATIONS	1	1 1 1 1 / 1 1 1 1 2 1 / 1 1 3 1 1 / 1 1 1 1 2 1 / 1 1 1 1 1 1 2 1 1 / 1 1 1 / 1 1 1 1 / 1 1 1 1 / 1 1 1 1 / 1 1 1 / 1 1 / 1 2 / (106)	7 / 2 / 3 / 4 / 3 / 9 / 2 / 3 / 1 / 1 2 / (34)

Figure 20. Contacts, by subsystem, 1221 project, June 1983. Numbers without parentheses indicate the number of choices made by specific individuals. Numbers in parentheses indicate the total weight of choices made in bounded area.

SELECTEES

SELECTORS

	SYSTEM	APPLICATIONS	
SYSTEM	1 1111 1 111	1 11 11 1 1 1 1	8
	1 1 1 1	11 1	5
	1 1	1 1	2
	1 111 1 1 1	1 1 1	2
	1 1 11	1 111	5
	1 11 1		
	1 1 1	1	1
	1 1		
	1 1 111111	1 1	3
	11 1 1 1 1 1	1 1	
	1 11 11	1 11 1	
	1 1 1 1	1	(29)
SELECTORS	1111 1111 1	1 1	
	1 111 1	1 1 1	2
	1 (76) 1 1 1 1	(38) 1 1	1
APPLICATIONS	1	11111 1 1	3
		1 11 1 1 11	2
	1 1 11	11 11 1 11	1
		1 1 11111 1	1
	1 1	1 11 111111	6
		11 11 1	2
		1 1111 111	3
	11 1	11 111	
	1 1 1	11111 1 11	8
	1111 111	1 111 111 1 11 1	6
	1	1 1 1 1 1	3
	1 1 1 1	1 111 1 1111 1 1 1	15
		1 1 1	
	1	1 1 11 11	1
	1	1 1 1 1	1
	1 111	111 1 1111	2
	1 1	1 11111	8
	11 1 1 1	1	2
		1 1 11 1 1	(72)
		1 1 11	
		1 (138) 1 1 1	1
	1 1 1 (42)	11111	5

Figure 21. Contacts, by subsystem, 1221 project, Winter 1984. Numbers without parentheses indicate the number of choices made by specific individuals. Numbers in parentheses indicate the total weight of choices made in bounded area.

		SELECTEES	
	SYSTEM	APPLICATIONS	OTH
SYSTEM	11 1 / 1 111 1 3 / 11 11 3 / 11 1 11 2 / 1 115 / (45) 1 12 / 1 11 5	1 1 1 1 / 1 1 / 1111 1 / 11 / 1 1 / (17) 1 1	12 / 9 / 2 / 10 / (33)
SELECTORS	1	111 1 1 / 1 1 1112 1 / 1 1 3 1 1 / 11 11 1 1 1 / 1 111 1 / 11 1 12 1	7 / 2 / 3 / 4 / 3
APPLICATIONS	11 1 / 1 1 1 12 / 1 1 / 111 2 1 13 / 1 1 1 / (25)	111111 2 11 1 1 / 1111 11 111112 1 1 / 1 1 1 111 / 11 1 1 11 1 1 / 1 1 111 11 / 1 1111 11 1 / 1 1 11 / 12 1 2 / (105)	9 / 2 / 3 / 1 / (34)

Figure 22. Contacts, by subsystem, 1221 project, June 1984. Numbers without parentheses indicate the number of choices made by specific individuals. Numbers in parentheses indicate the total weight of choices made in bounded area.

TABLE 5

PERCENTAGES, 1221 PROJECT, OF TECHNICAL, ADMINISTRATIVE, AND SOCIAL CHOICES MADE IN JUNE 1983

Group	Percent of Choice Inside Group	Percent of Choice on Same Side of System
Technical Choice:		
FMS	59	100
OS	69	100
WP	76	76
TC	0	0
Administrative Choice:		
FMS	69	56
OS	47	47
WP	68	68
TC	60	60
Social Choice:		
FMS	81	94
OS	0	63
WP	94	100
TC	0	0
Contacts:		
FMS	74	96
OS	20	70
WP	83	86
TC	40	60

FMS: File Management System WP: Word Processing
OS: Operating System TC: Telecommunications

Statistical Significance of these Distributions (taking FMS, OS, and WP only into account):

Technical: $p < .01$ Social: $p < .001$
Administrative: $p < .001$ Contacts: $p < .001$

TABLE 6

PERCENTAGES, 1221 PROJECT, OF TECHNICAL, ADMINISTRATIVE, AND SOCIAL CHOICES MADE IN WINTER, 1984

Group	Percentage of Choices Made in Group	Percentage of Choices in Same Side of System
Technical Choice:		
FMS	50	100
OS	46	100
WP	89	97
FORMS	57	86
TC	35	65
Administrative Choice:		
FMS	89	100
OS	54	93
WP	64	72
FORMS	67	71
TC	56	56
Social Choice:		
FMS	39	70
OS	70	81
WP	48	75
FORMS	60	95
TC	48	70
Contacts:		
FMS	45	63
OS	50	72
WP	64	78
FORMS	40	76
TC	58	72

FMS: File Management System
OS: Operating System
FORMS: Forms
WP: Word Processing
TC: Telecommunications

Statistical Significance of these Distributions (taking FMS, OS, and WP only into account):

Technical: $p < .001$ Social: N.S.
Administrative: $p < .001$ Contacts: N.S.

TABLE 7

PERCENTAGES, 1221 PROJECT, OF TECHNICAL, ADMINISTRATIVE, AND SOCIAL CHOICES MADE IN MAY 1984

Group	Percent Choosing Within the Group	Percent Choosing on Same Side of System
Technical Choice:		
FMS	25	25
OS	22	67
WP	79	92
FORMS	21	58
TC	50	100
Administrative Choice:		
FMS	61	67
OS	33	67
WP	35	58
FORMS	52	74
TC	60	100
Social Choice:		
FMS	43	62
OS	27	38
WP	48	94
FORMS	29	65
TC	60	80
Contacts:		
FMS	33	64
OS	72	80
WP	68	91
FORMS	38	69
TC	100	100

FMS: File Management System
OS: Operating System
FORMS: Forms
WP: Word Processing
TC: Telecommunications

Statistical Significance of these Distributions (taking FMS, OS, and WP only into account):

Technical: $p < .001$
Administrative: N.S.
Social: $p < .001$
Contacts: $p < .001$

between system software and applications software. (See Figure 4, page 58.) Figures 11 through 22 are the sociometric matrices which display the technical, administrative, social, and contact choices for each point in time. Each matrix is divided by software category.

Tables 5, 6, and 7 summarize both measurements for all four dimensions and all three points in time. Information at the bottom of each table shows the results of a chi square test for the statistical significance of the choices made by the Operating System, File Management System, and Word Processing groups. Except for social choice and contacts as measured in January, 1984 and administrative choice in May 1984, all the percentage distributions are statistically significant at the .01 level or better. Figure 23 shows plots of the data for within-group choice. Figure 24 shows plots of the data for within-subsystem choice. These data and plots are analyzed after the next section.

The technical and administrative structure of the 1221 development project was discussed on pages 55 to 59 in Chapter Four. In this chapter, the operating (OS) and file management system (FMS) groups, taken together, will be called the "systems side" of the software. The word processing (WP), Forms, and telecommunications (TC) groups will be called the "applications side" of the software. The bulk of this section will examine the OS, the FMS and the WP application. Some mention will be made of the Forms application, and very little of the TC application.

To some extent it could be expected that elements of the overall

computer system which are technically adjacent to one another would tend to agree more on the proper level of outside-the-group or other-subsystem choice. This will not be formally tested in this chapter, but it will be mentioned in the appropriate places.

Technical Choice

Over time, OS and FMS consistently increased their interactions outside their groups. By contrast, WP technical choice occurred mostly within the WP group throughout the duration of the study, peaking at the midpoint and ending up essentially where it had begun. (See Figure 23a)

Figure 24a shows that for the first two points in time, OS and FMS made 100% of their technical choices on the system side of the project. But by May 1984, they both (but especially FMS) substantially increased their involvement with the other, applications, subsystem. WP decreased its involvement with the systems side from June 1983 to January 1984, and essentially leveled off from January to May 1984.

These statistics show that the WP section was consistently more insular than either the OS or the FMS groups, by either measure. Table 8 shows the correlations between groups over time. The correlation between the OS and the FMS sections is .97 for within-group choice and 1.00 for within-subsystem choice. This supports the idea that OS and FMS would agree on the degree of intra-group choice. The correlation between OS and WP is negative for both within-group and within-subsystem choice, supporting the notion that the groups furthest apart technically would agree the least on technical choices. But the correlation between

FMS and WP, expected to be high because of their adjacency in the overall system, is almost zero for within-group choice (.04) and actually negative for within-subsystem choice (-.29).

This shows that not only was the WP section somewhat isolated from the other two groups taken together, it was isolated from its closest supposed collaborator, the FMS group. Comparison to the other two groups corroborates the idea that the WP group is distinctly different from them. For example, as already mentioned, FMS and OS agreed on intensity of within-group choice, and they changed their choice patterns in very similar fashion. The WP group's movement was in the opposite direction.

Administrative Choice

Figure 23b shows that FMS was always likelier to choose within itself for administrative guidance, with OS and WP relatively lower. Over time, WP consistently dropped its inward choosing, possibly because of the organizational change mentioned above, namely, that the Forms manager was ostensibly given responsibility for the WP group. This would have had the WP engineers going to him, a person outside their group, for administrative help. This explanation is corroborated by Figure 24b, which shows that WP consistently increased its choice of the applications side for administrative help. For both within group choice and choice within their own systems side, OS and FMS peaked in January 1984 and went down by May 1984. The data for administrative choice are straightforward. All three groups exhibited essentially the same

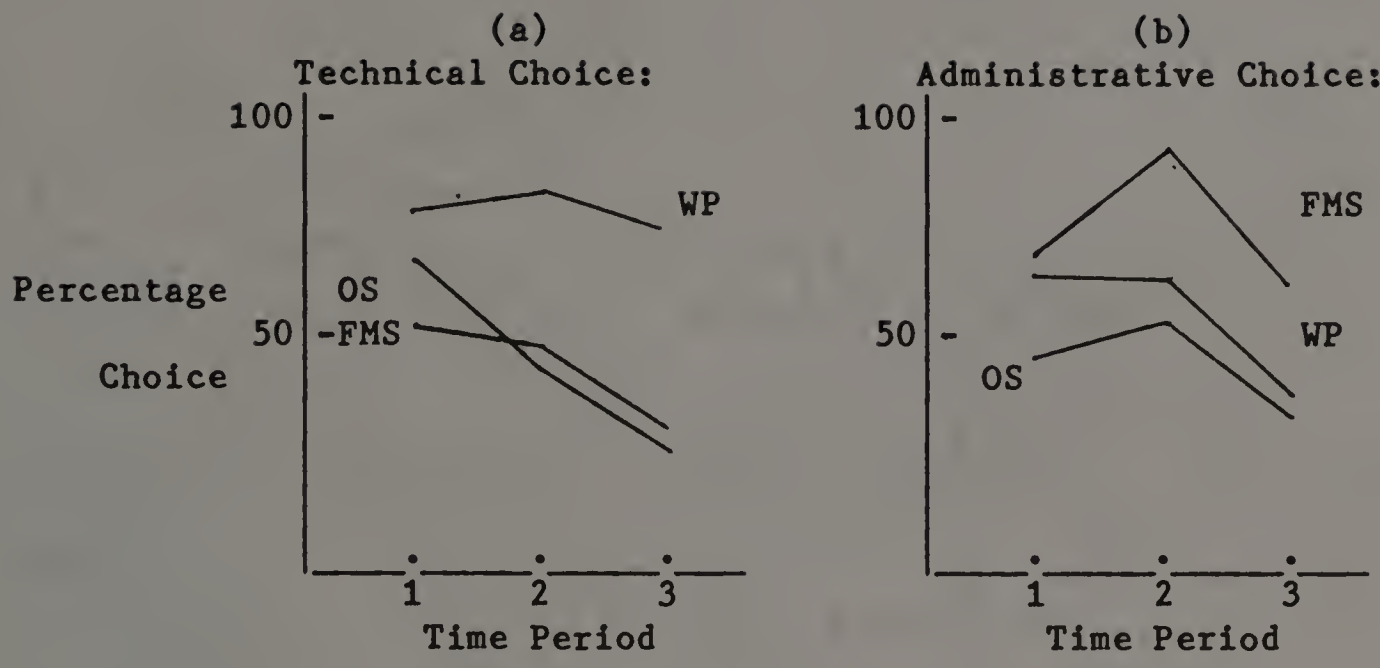


Figure 23. Plots of percentage within-group choice, by type of choice, by group, 1221 project, time periods 1 (June, 1983), 2 (Winter, 1984) and 3 (June, 1984).

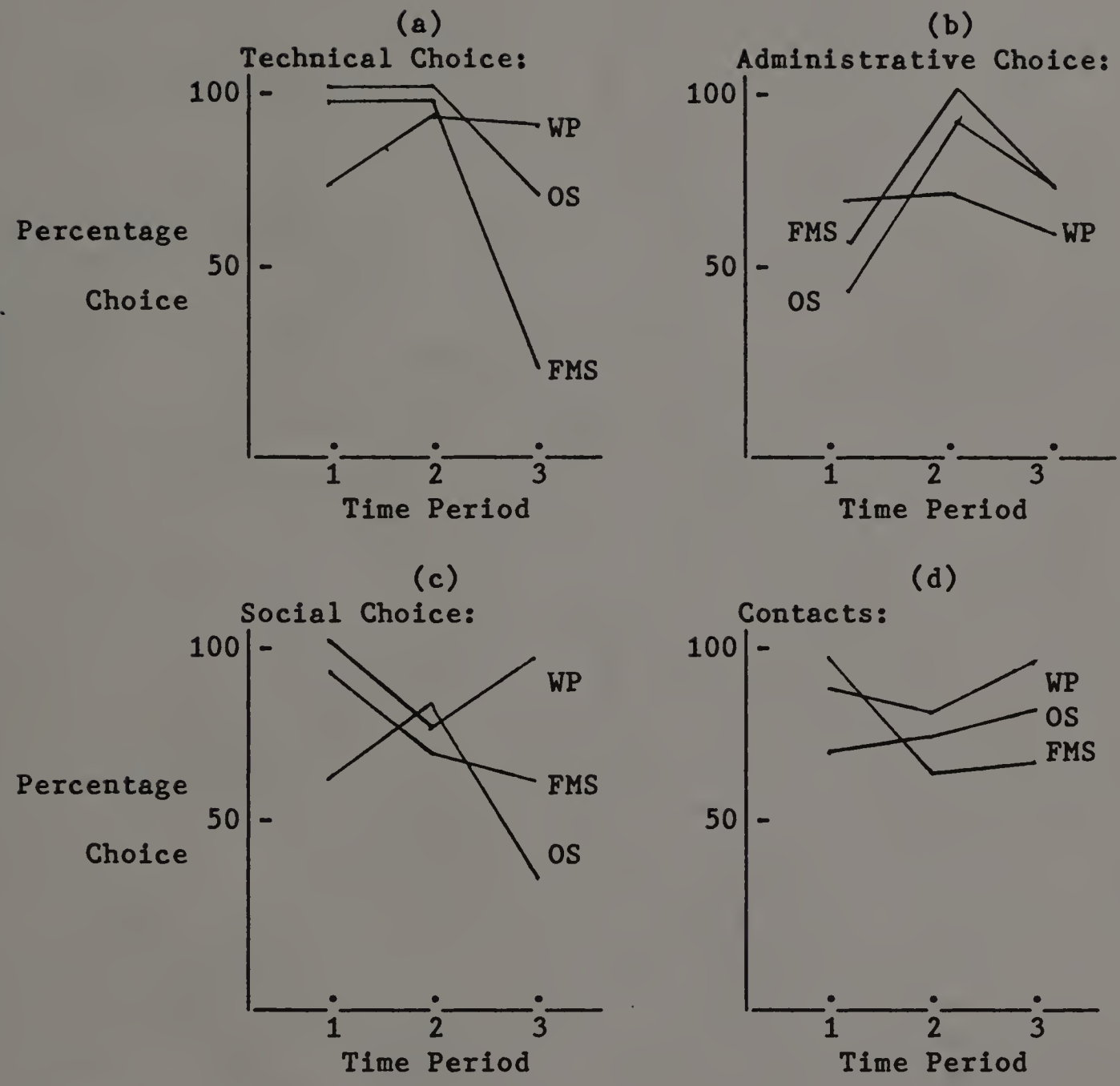


Figure 24. Plots of percentage within-subsystem choice, by type of choice, by group, 1221 project, time periods 1 (June, 1983), 2 (Winter, 1984) and 3 (June, 1984).

TABLE 8

CORRELATIONS BETWEEN GROUPS, 1221 PROJECT, OVER TIME

	Within-group choice			Within-subsystem choice		
	FMS-OS	OS-WP	FMS-WP	FMS-OS	OS-WP	FMS-WP
Technical	0.95	-0.21	0.04	1.00	-0.29	-0.29
Adminis.	0.91	0.90	0.64	0.98	0.07	-0.13
Social	-0.79	-0.74	0.99	0.87	-0.41	0.10
Contact	-0.99	-0.80	0.88	-0.63	0.66	0.16

FMS: File Management System group
OS: Operating System group
WP: Word Processing group

NOTE: The numbers in the cells represent the correlations between the scores on the row variables, for the two groups in the column, over the three time points.

---

pattern for within-group choice, the inverted-V of Figure 23b. (This agreement between the three groups is corroborated in Table 8, where the intercorrelations are quite high.) This pattern indicates that members of all three groups were most likely to go to their own section manager for administrative help, and that this happened most intensely in the middle of the project. As for system-side versus applications-side choice, the three groups moved in a similar direction (more insular) from the beginning to the middle of the project, with OS and FMS becoming more insular than WP. The three groups all became less insular from the middle to the end of the project, with WP the least insular at a 53% applications-side choice level.

Social Choice

For social choice, OS started out the least insular of the three

groups, but in the middle of the project it became the most insular. By the end, it had again become the least insular.

Socially, both WP and FMS had been quite insular at the beginning. This reflects their being intact units from other projects, brought into the 1221 project by the overall manager. Both groups became consistently more "outgoing" as the project wore on. Again, though, Figure 24c shows that the WP group kept its social activity within the applications side, while the OS and FMS groups branched out socially into the applications side. This is emphatically shown in the three figures for social data, numbers 16, 17, and 18. Notice that the "white space" in the upper right hand corners fills up over the life of the project as the OS and FMS groups choose members of the applications side. The converse space in the lower left hand corner has subsections--it remains white where the WP group does not choose the system side, but fills up where the Forms group does choose the system people.

Contacts

The FMS and OS groups exhibited an interesting pattern in the contacts they reported within their respective groups. As Figure 23d depicts, they moved in almost exactly opposite directions, as the correlation of -.99 from Table 8 shows--OS became more insular, FMS less insular. WP became slightly less insular from the beginning to the middle of the project, then essentially leveled off.

If we define residual contact as that contact that is not

intra-group, then most of WP's residual contact was with its applications brethren, the Forms group, while the residual contact for OS and FMS was with each other. Still, a substantial amount of contact for both FMS and OS was with the applications side; the converse cannot be said for the WP group.

Overall Assessment

In almost every case, in almost every time period, these data show that the WP group group was more insular than the other two groups which were followed all the way through. This was most clearly true in the crucial area of technical choice.

In most instances, the OS and FMS groups were in agreement about within-group or within-subsystem choice, which was expected because of their close technical proximity. But neither of them was usually in agreement with WP. Again, this was not always true, but it was most clearly true for technical choice. Figure 24 shows that, except for administrative choice, the WP group always chose more on the applications side than the other two groups chose on the system side. This was especially pronounced for technical choice and social choice.

Figures 13, 19, and 22 (for technical, social, and contact choice, respectively) subtly show that the WP group was much more insular than its sister applications group, Forms, by the end of the project. In all three matrices, there is more white space in the left portion of the upper right-hand quadrant. On the raw data matrices, the WP group was listed first along the margin, i.e. the left hand side.

In the lower left hand quadrant, there is more white space at the top, which again is where the WP group was listed. Together, these mean (1) that most of the selections made by the systems side of the applications side were Forms people, and (2) that most of the applications people who made choices on the systems side were Forms people. Members of the WP group were neither selectors nor selectees of systems engineers.

By May 1984, the OS, FMS and Forms groups had reached a high level of mutual technical and social choice, and a mutually high level of reported contact. The WP group remained relatively isolated on all three, increasing its activities mostly with its sister applications group, the Forms group.

Many of the members of the 1221 project complained about the divisiveness between the groups. Towards the end, this was primarily couched in terms of "system" versus "applications." The sociometric data clearly show that this feeling of division had some foundation in the choice and contact patterns.

They further show that the WP group was the most isolated group. Given the crucial work being done by that group, this non-integration of WP into the rest of the 1221 organization may have had far-reaching consequences. Focusing on technical and administrative choice shows a pattern where the OS and FMS groups became consistently less insular as time went on, but the WP group got more insular.

These data show that the 1221 organization was fragmented. The integrations needed for technical reasons were the only sure mechanism for coordination among the subgroups, and they did not occur with any

great frequency--three demos and two releases in fifteen months. Perhaps they should have occurred more frequently.

The data from the semantic differential suggested that the 1221 organization was not a fully "coalesced" organization. The data here suggest similar things. This was not a cohesive group. It may not have been expected, or even desirable, for the subgroups to engage in much social contact, but it is surprising that the subgroups engaged in so little technical and administrative interaction, even among groups which were technically adjacent.

C H A P T E R VII

THE 1221 ORGANIZATION'S FRAME OF REFERENCE: SUGGESTIONS FROM COGNITIVE MAPPING

Research question three (page 29) asked: "What was the frame of reference which emerged in this organization? What was the pattern of givens, means, and ends in the cognitive map of the project's organization?" This chapter will examine the findings relevant to that question.

Cognitive Mapping: A Brief Summary of the Method

Cognitive mapping was developed in political science to analyze the effects of policy choices upon valued goals. But it has been extended to mapping the "social cognitions" of entire organizations. This was first done by Bougon, Weick and Binkhorst in 1977, when they mapped the Utrecht Jazz Orchestra. This is what was attempted here. It is the first application to a "regular" business organization, and the first to a research and development organization.

There are two kinds of elements in a cognitive map. The first kind are called concepts; these are treated as variables, i.e, can take on different values. Causal assertions are the second kind of element of cognitive maps. These relate variables to each other. The relationships can be either positive (direct) or negative (inverse). The causal assertions are typically arrayed in a matrix called the valency matrix.

The valency matrix

The valency matrix is the tabulation of the direct effects of each variable on each other variable, as measured by the average of all organization members' responses. The total of all the effects for a row of the valency matrix is called the outdegree of that variable. The outdegree is a measure of the potency of the variable. The higher the outdegree, the more potent that variable is, according to the members of the organization. The total of the values in a column of the valency matrix is called the indegree of that variable. Indegree is a measure of how much that variable is caused by the others; it is a surrogate for the goals of the organization. The higher the indegree, the likelier it is that a variable is an end or a goal of the organization, according to its members. (See Bougon et al, 1977.)

Table 9, the valency matrix for the 1221 organization, shows that there were many interconnections in the 1221 organization. To cut down the number of relationships that would be depicted on the cognitive map diagram only (1) the largest two in each column, and (2) any others that were greater than .8 in absolute value, were included. Before discussing that map, one more topic--cumulative reachability--must be addressed.

The cumulative reachability matrix

There are two rules for the analysis of cognitive maps:

Rule I: the indirect effect of a path is positive if the path has

an even number of negative arrows, and negative if it has an odd number.

Rule II: the <u>total</u> effect of point A on point B is the sum of the <u>indirect</u> effects of <u>all</u> paths from A to B.

The first rule is self-evident. The second can be derived mathematically in the <u>cumulative reachability matrix</u>, defined as

$$CR = A + A^2 + A^3 + \ldots + A^{(n-1)}$$

where A is the valency matrix and CR is the cumulative reachability matrix. The exponent to which A is raised shows the influence of one variable on another in a chain the length of the exponent. In other words, A^3 shows the influence of variable A on variable D in the following chain of length three:

A ---> B ---> C ---> D

Any cell in the cumulative reachability matrix represents the total effects, direct and indirect, of the row variable on the column variable. In a sense the values in this matrix indicate how potent the variables are even after "going through" several other variables. It is usually not necessary to raise the valency matrix to the n-1 power. The matrix here was raised to the 7th power; the cumulative reachability matrix for the 1221 organization is shown in Table 10.

A particular cell in the cumulative reachability matrix represents the <u>total</u> effects of the row variable on the column variable. The value in the cell is a measure of the overall effect, through all possible paths, of the row variable on the column variable. The main usefulness of this is that it illuminates the nature of the cycles in the cognitive map. If a cell has a positive value, it means that that variable is on a <u>deviation amplifying</u> cycle. That is, the

cumulative effects of the row variable on the column variable tend to lead to "more" of the column variable. If, on the other hand, the cell is negative, then that cell represents a deviation counteracting loop or cycle. This means that the cumulative effect of the row variable on the column is such that more of the row variable leads to less of the column--deviations are "counteracted." The information in the cumulative reachability matrix may facilitate the interpretation of the interrelationships in the complete system.

Variables in the Cognitive Map

In all the tables and diagrams which follow in this analysis the fourteen variables are abbreviated because of space constraints. Here is a list of the fourteen variables exactly as they appeared on the questionnaire (which is partly reproduced in Appendix C).

1. The management we have experienced on this project
2. The schedules and deadlines we have had on this project
3. The poor communications and the competition among the groups in the 1221 organization
4. The commercial success of the 1221
5. Company politics
6. The bad tools and scarce resources we've experienced on this project
7. Poor morale and dissatisfaction
8. Working on this project
9. The lack of a solid product definition
10. The personal career development of an engineer

11. Leaving the 1221 project
12. The quality of an engineer's performance
13. The lack of consultation of the engineers on technical matters
14. The technical success of the 1221

Analysis of the cognitive maps of the 1221 organization

Tables 9 and 10 show the valency and cumulative reachability matrices, respectively, for the complete sample. Figure 25 shows the resultant cognitive map. The second step of the analysis was to break the data down by managers and engineers. The managers' matrices are shown in Tables 11 and 12, and the engineers' matrices are shown in Tables 13 and 14. The cognitive map for the managers is shown in Figure 30, and that for the engineers is shown in Figure 31.

The Complete Sample: The Matrices

Outdegrees, or potency

Table 9 shows that the most potent variable for the organization was the type of management they experienced on the project. This was no surprise. This variable was mentioned by everyone in the self-Q interviews.

The second most potent variable was "lack of a solid product definition." In the theory section it was mentioned that one important element of implementation was the interplay between intended strategy

TABLE 9

VALENCY MATRIX, ENTIRE 1221 PROJECT SAMPLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Out degree	Rank
Management	0	0.89	0.78	0.59	0.59	0.82	0.78	0.56	0.71	0.41	0.93	0.11	0.70	0.56	8.42	1
Schedules	0.48	0	0.67	0.37	0.26	0.41	0.93	0.07	0.53	0	0.85	-0.54	0.89	-0.39	6.37	4
Poor comm.	0.19	0.22	0	-0.37	0.36	0.52	0.89	-0.26	0.67	-0.26	0.74	-0.63	0.56	-0.70	6.36	5
Comm. suc.	0.30	0.63	-0.04	0	0.63	0.04	-0.30	0.56	-0.04	0.52	-0.26	0.37	-0.07	0.07	3.82	11
Politics	0.78	0.82	0.56	-0.19	0	0.59	0.78	-0.04	0.67	0	0.59	-0.22	0.22	-0.22	4.89	7
Bad tools	0.33	0.33	0.56	-0.44	0.11	0	1.00	0	0	-0.10	0.81	-0.56	0	-0.56	4.80	8
Poor mrale	0.33	0.19	0.74	-0.37	0.22	0.04	0	-0.30	0.07	-0.26	0.93	-0.63	0.30	-0.56	4.93	6
Invlvmnt.	0.22	0.15	0.07	0.63	0.12	0.04	0.32	0	0.04	0.59	0.37	0.19	0.04	0.70	3.48	12
Bad prodef	0.67	0.63	0.85	-0.56	0.33	0.33	0.85	-0.22	0	-0.19	0.69	-0.46	0.50	-0.58	6.86	2
Career	0.15	-0.04	-0.08	0.23	0.15	0	-0.12	0.50	0	0	0.40	0.89	-0.04	0.62	3.21	13
Leaving	0.12	0.27	0.12	-0.39	0.27	-0.08	0.58	-0.15	0.15	0.28	0	0.08	0.12	-0.43	3.02	14
Indiv perf	0.31	0.24	-0.27	0.81	0.04	-0.08	-0.27	0.27	-0.15	0.77	-0.14	0	-0.08	1.00	4.42	10
No consult	0.27	0.65	0.77	-0.31	0.12	0.50	0.92	-0.14	0.62	-0.27	0.85	-0.58	0	-0.69	6.68	3
Tech. suc.	0.31	0.08	-0.08	0.64	0.46	0.04	-0.54	0.69	-0.15	0.65	-0.46	0.46	-0.08	0	4.65	9
Indegrees	4.45	5.13	5.57	5.89	3.67	3.47	8.26	3.75	3.80	4.29	8.02	5.70	3.58	7.07	71.88	
Rank	8	7	6	4	12	14	1	11	10	9	2	5	13	3		

and emergent strategy. This part of the cognitive map illustrates how an ill-formed intended strategy, when combined with poor management, poor communications, tight schedules and virulent company politics, can lead to a realized strategy which is not what was intended, and can have adverse human resource outcomes as well. The cumulative reachability matrix showed that the sum of all direct and indirect effects on the variable "bad product definition" was positive for each of the other variables. This implies that there was a deviation amplifying loop in the cognitive map, a loop which ensured that the realized strategy would continue to be more emergent than deliberate.

The third most potent variable was "lack of consultation of engineers on technical matters." There is much discussion in the literature about the need to include people in the decision making of an organization. This is not so much linked to effectiveness as it is linked to individual motivation, or what Chester Barnard called "obtaining contributions" from organizational members. Close examination of the valency matrix shows that this variable has its greatest effect on "poor morale," which in turn is strongly linked to "leaving the 1221 project." In other words, failing to include the engineers in decisions did not elicit contributions from organizational members; the contrary was true in the minds of the members of this organization.

The fourth and fifth most potent variables were "the schedules and deadlines we have had on this project" and "the poor communications and the competition among the groups in the 1221 organization,"

respectively. These are both aspects of what Barnard (1938) called "communications." It is interesting to note that the three things which Barnard called the critical functions of executive leadership--defining purpose, obtaining contributions from members, and communications--are all represented in the five most potent variables of the 1221 organization's cognitive map.

Indegrees, or goals

As mentioned earlier, indegrees measure the degree to which a variable is an "outcome," "goal," or "end." The highest outcome in the cognitive map of the 1221 organization was "poor morale and dissatisfaction." To anyone who knew the organization, this is not a surprise. The second highest outcome was "leaving the 1221 project." The amount of turnover in this organization, particularly in the last two months of this study, was probably the most noticeable thing about it. It was widely observed and discussed by people both in and out of the 1221 organization.

The third highest outcome variable was "the technical success of the 1221," which is something one would expect should be a desired outcome or goal. The fourth highest variable was "the commercial success of the 1221," another desirable outcome variable. It is interesting to note that both of these "desirable" outcomes had indegree totals below the top two, negative, outcomes. This was particularly true for "commercial success." The fifth outcome variable was "the quality of an engineer's performance." All the members of this

organization were committed to personally doing well.

Cumulative reachability

The cumulative reachability matrix for the complete sample (Table 10) can be summarized succinctly--all five top outcome variables were adversely affected by all the other variables.

"Commercial success" (column 4), "quality of individual performance" (column 12) and "technical success" (column 14) have negative signs from top to bottom. That means that these three variables were on deviation-counteracting loops--decreases in any of the variables (including these variables themselves) will lead to increases in the three, and increases in the other will lead to decreases in the three. It seems that commercial, technical, and personal success were their own punishment in this organization. "Poor morale and dissatisfaction" (column 7), and "leaving the project" (column 11) have positive values from top to bottom. These two negative outcome variables were on deviation-amplifying loops--more of anything, including themselves, will lead to more of these, less of anything will lead to less of these. In this organization's cognitive map, dissatisfaction and turnover fed on themselves and got worse.

So this system developed, in the minds of its members, into one which (1) worked against technical and commercial success, (2) worked against high quality individual performance, (3) generated poor morale, (4) encouraged turnover, and (5) gave rise to intense company politics.

Another noteworthy thing in Table 10 is that the variable

TABLE 10

CUMULATIVE REACHABILILITY MATRIX, ENTIRE 1221 PROJECT SAMPLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Out degree	Rank
Management	0.5	0.9	2.7	-3.1	0.2	1.2	3.9	-2.3	1.8	-2.3	3.5	-3.3	1.8	-4.0	31.5	1
Schedules	0.2	0.4	1.9	-2.5	-0.1	0.7	2.8	-1.9	1.2	-2.0	2.4	-2.5	1.2	-3.1	22.9	3
Poor comm.	-0.1	0.1	1.1	-1.9	-0.2	0.4	1.7	-1.5	0.7	-1.5	1.4	-1.8	0.7	-2.2	15.3	6
Comm. suc.	0.4	0.5	1.0	-0.8	0.3	0.5	1.4	-0.5	0.7	-0.5	1.3	-1.0	0.7	-1.1	10.8	7.5
Politics	0.2	0.5	2.0	-2.5	-0.0	0.8	2.9	-1.9	1.3	-1.9	2.6	-2.6	1.3	-3.1	23.6	2
Bad tools	-0.1	0.0	0.8	-1.3	-0.2	0.2	1.2	-1.0	0.5	-1.1	1.0	-1.3	0.5	-1.6	10.8	7.5
Poor mrale	-0.1	0.0	0.7	-1.3	-0.2	0.2	1.1	-1.0	0.4	-1.1	0.9	-1.2	0.5	-1.5	10.2	9
Invlvmnt	0.4	0.5	0.9	-0.7	0.2	0.4	1.2	-0.4	0.6	-0.4	1.2	-0.8	0.6	-1.0	9.3	10
Bad prodef	0.0	0.3	1.6	-2.3	-0.2	0.6	2.4	-1.8	1.0	-1.9	2.1	-2.3	1.0	-2.8	20.3	4
Career	0.3	0.4	0.5	-0.2	0.3	0.3	0.7	-0.1	0.4	-0.0	0.7	-0.3	0.4	-0.4	5.1	14
Leaving	0.0	0.1	0.5	-0.8	-0.0	0.2	0.8	-0.6	0.3	-0.6	0.7	-0.8	0.3	-0.9	6.7	11
Indiv perf	0.4	0.5	0.6	-0.1	0.4	0.4	0.8	0.0	0.4	0.1	0.8	-0.3	0.4	-0.3	5.4	13
No consult	-0.1	0.2	1.4	-2.1	-0.2	0.5	2.1	-1.7	0.8	-1.7	1.7	-2.1	0.9	-2.6	17.9	5
Tech. suc.	0.4	0.5	0.7	-0.2	0.3	0.4	0.9	-0.1	0.5	-0.1	0.9	-0.4	0.5	-0.5	6.3	12
Indegrees	3.2	5.0	16.4	19.8	2.8	6.8	23.9	14.9	10.7	15.2	21.3	20.5	10.7	25.0	196.1	
Rank	13	12	6	5	14	11	2	8	9.5	7	3	4	9.5	1		

"company politics" rose to the second most potent variable when all direct and indirect effects are taken into account. This is again not a surprise to one who knew the organization; intra-company politics were a frequent topic of conversation in the organization. A closer look at the politics line of Table 10 shows that the five highest values on that line were for the five leading outcome variables discussed above, with "technical success" leading the way. Company politics were in deviation-counteracting loops for technical and commercial success, and quality of individual performance, meaning that politics tended to depress these forms of good performance. Politcs were in deviation-amplifying loops for dissastisfaction and turnover, tending to increase those negative outcomes.

Conclusions

In summary, this was an organization which knew what it wanted for success--good management, a solid product definition, inclusion of everyone in technical decisions, effective schedules, and good communications. It did not realize any of these. The result was technical and commercial ineffectiveness (in the view of the members), poor individual performance, poor morale, and turnover.

The Complete Sample: The Maps

Figure 25, which was constructed from Table 9, shows the cognitive map for the entire organization. Please remember that this map represents only the aggregate causal beliefs of the members of the

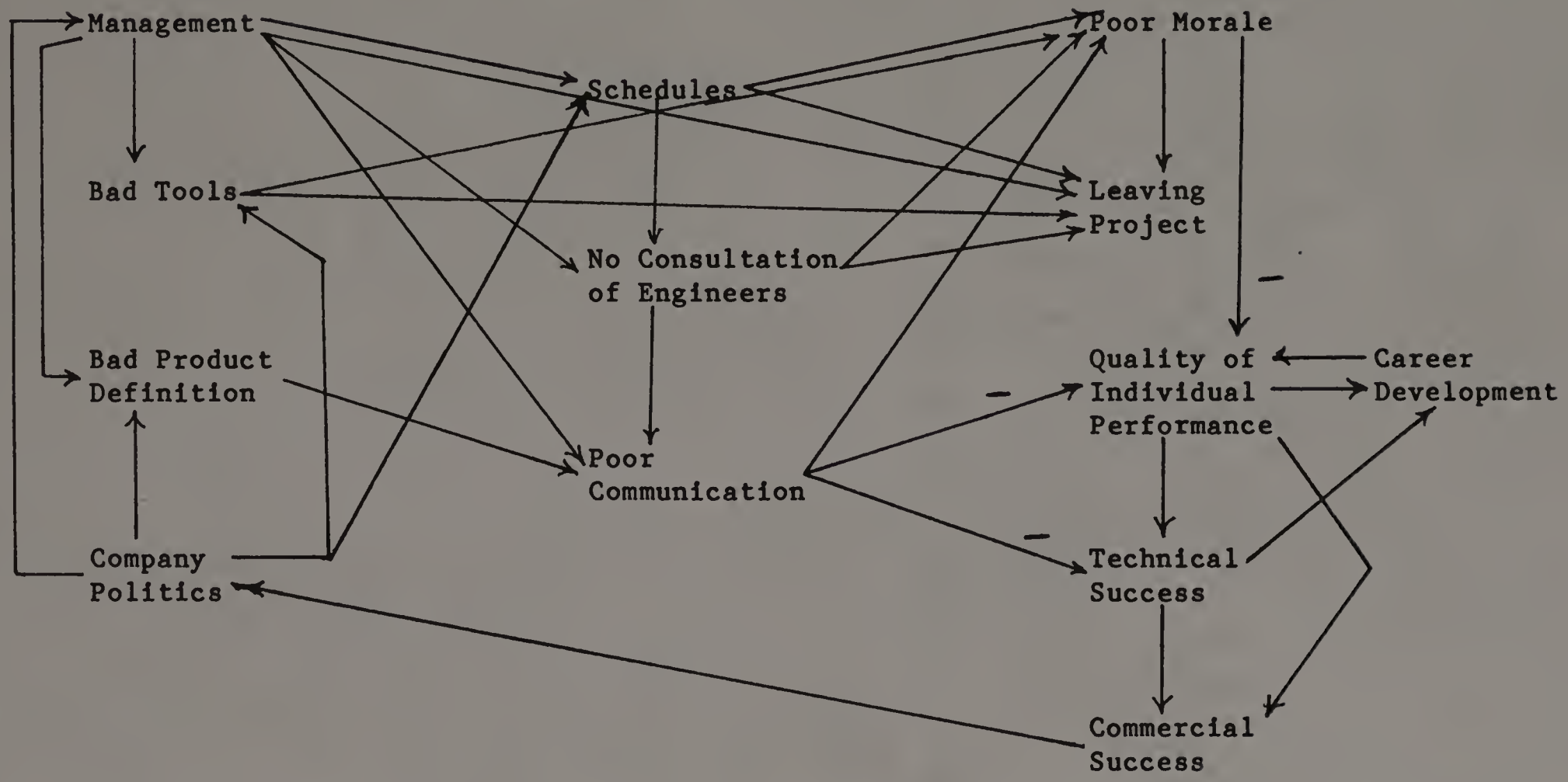


Figure 25. Cognitive Map, entire 1221 organization. All relationships are positive unless labelled negative.

1221 organization about the interrelationships between the fourteen variables, and not some sort of "objective reality." Also, variable 8, "Involvement in the Project," was dropped, since it scored low on both indegree and outdegree (11th and 12th, respectively).

To see whether a particular chain through the map is potent, one examines the cell in Table 10 which has the row and column coordinates corresponding to the beginning and end of the chain, respectively. Even though Figure 25 was distilled from all possible relationships, it is still complex. Figures 26 through 29 show only portions of the complete map, with greater clarity.

Figure 26 shows the "success cycle." It focuses on technical and commercial success, and on career development. This diagram shows the key role of communications. The poor communications on this project had a direct negative effect on technical success. They also had an indirect negative effect on both technical and commercial success through the variables "poor morale" and "quality of individual performance." In other words, the quality of an individual's performance was the key to commercial and technical success, but the two variables which caused performance, poor communication and poor morale, both created a negative loop, a loop for "failure" instead of success. The members of the organization felt the same way about the outcome of career development.

Figure 27 focuses on motivation, dissatisfaction and turnover. If we define motivation as something that gets workers to perform well, then we should focus on what influences the "quality of individual

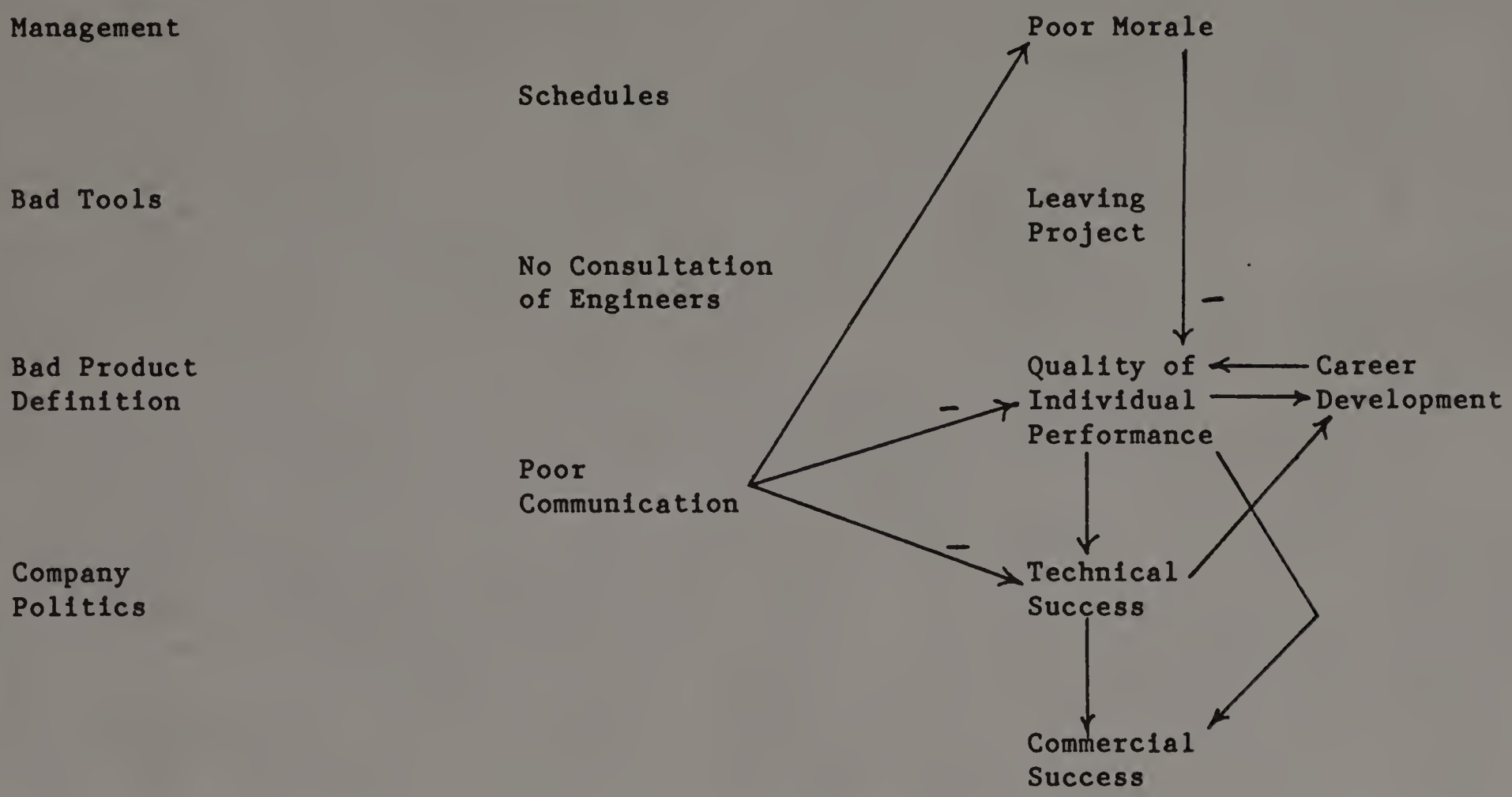


Figure 26. Success cycle, 1221 organization cognitive map. All relationships are positive unless labelled negative.

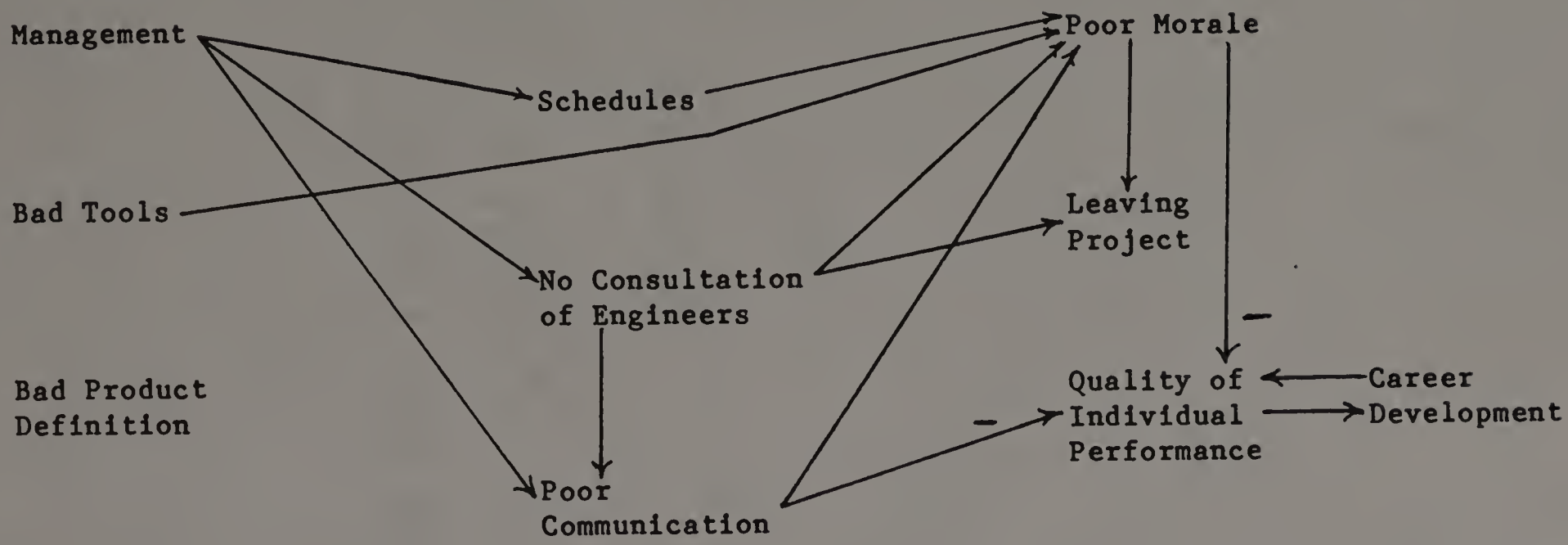


Figure 27. Performance, dissatisfaction, and turnover, 1221 organization cognitive map. All relationships are positive unless labelled negative.

performance." The only positive causal assertion for quality of individual performance came from "career development." The other two causal arrows aimed at quality of performance were "poor morale" and "poor communication," both negative. This map creates an image of people performing well only for their own career advancement--doing well to maintain or enhance their reputations, since the organization has given them no other reason to perform well.

The story is the same for satisfaction. Every arrow leading into "poor morale" was positive, meaning that all the linked variables promoted dissatisfaction. This led in turn to turnover, to "leaving the project."

Figure 28 illustrates the effects of poor product specification. Only one causal arrow led from "bad product definition," and it caused poor communication. This led, either directly or indirectly, to poor morale, turnover, poor individual performance, technical failure and commercial failure. Table 10 shows that poor product specification had its strongest cumulative effects on these variables, and that those effects were all deleterious. This has important implications. It could mean that formulation of purpose and objectives is not merely an ivory-tower exercise for top management, but that clear strategic purposes and objectives are seen as crucially important by those who actually carry out the implementation. This shows the critical importance of specifying an agreed-upon umbrella strategy in a professional organization. It also demonstrates one dynamic which may tend to make strategies more emergent than deliberate

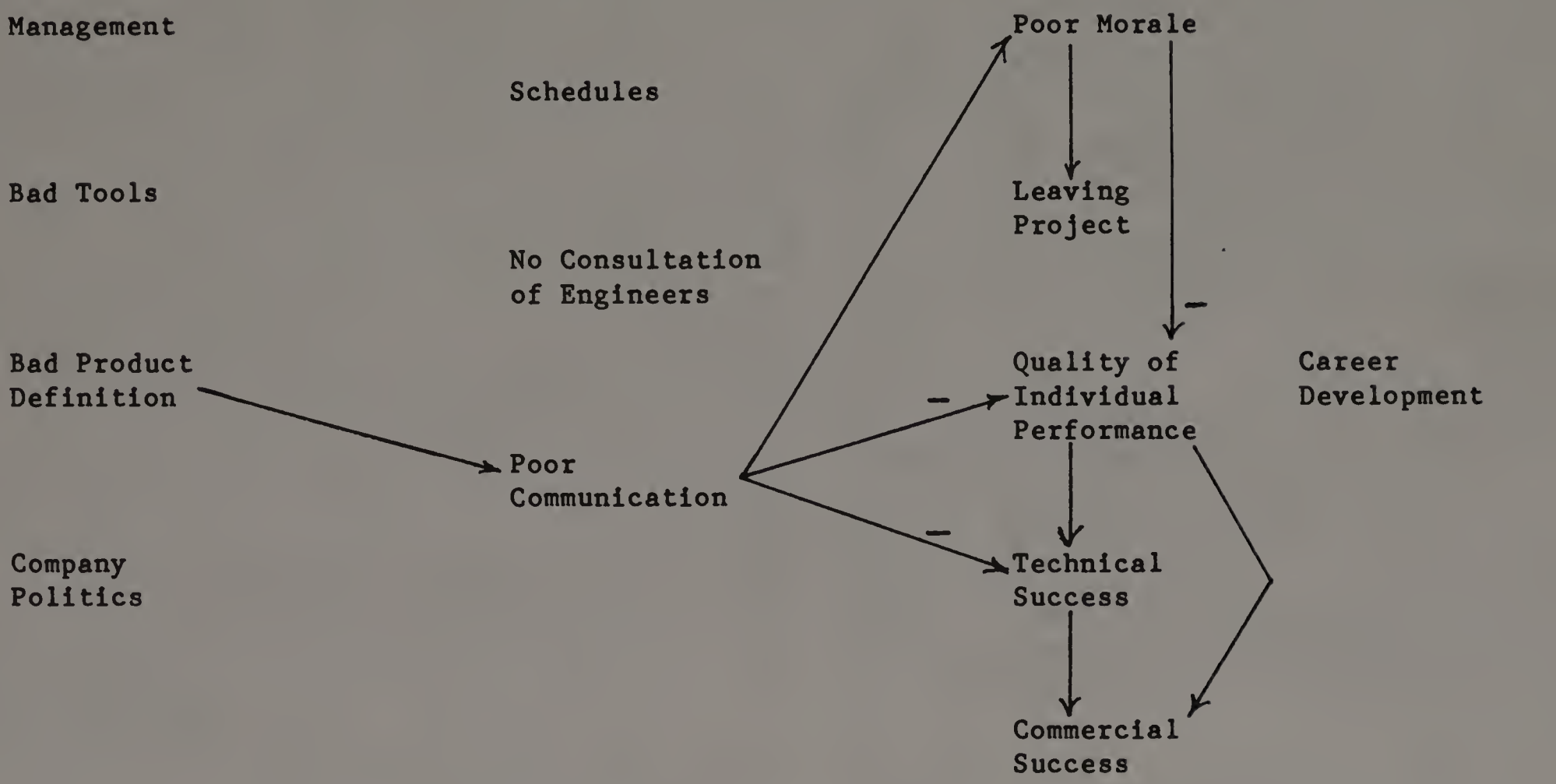


Figure 28. Effects of poor product definition, 1221 organization cognitive map. All relationships are positive unless labelled negative.

in this type of organization, namely: an unclear intended strategy leads to poor communication, which leads to a realized strategy of technical and commercial failure.

Before moving on the the next figure, let us pause for two definitions which will help in making the next argumemt. Let us define power as "the ability to have others in the organization do one's will despite their own resistance." And let us define politics as "the definition, allocation, and use of power in an organization." As the ethnography showed, the exercise of power, i.e., politics, was rampant at NICC. The members interpreted these activities in a distinctive way, a way which was captured in the cognitive map with the variable "company politics". Figure 29, which is the last of the "detail" diagrams, focuses on the effects of "company politics." Recall that this variable had strong cumulative effects on the five outcome variables (Table 10). This is clearly shown on the map. One way was by promoting a poor product definition, which led to the kinds of things discussed above. The other way it affected things was by causing the "bad tools" used by the organization. Many people related in conversation that they were tied to NICC and Tektronix equipment, for political reasons, even though development equipment from other vendors was superior and could have facilitated (and speeded up) the development effort. What is really intruiging about the effects of politics is that there was a feedback loop leading to politics from commercial success. As commercial success increased, so did company politics. But since all the loops leading into commercial success were negative, we have a deviation counteracting

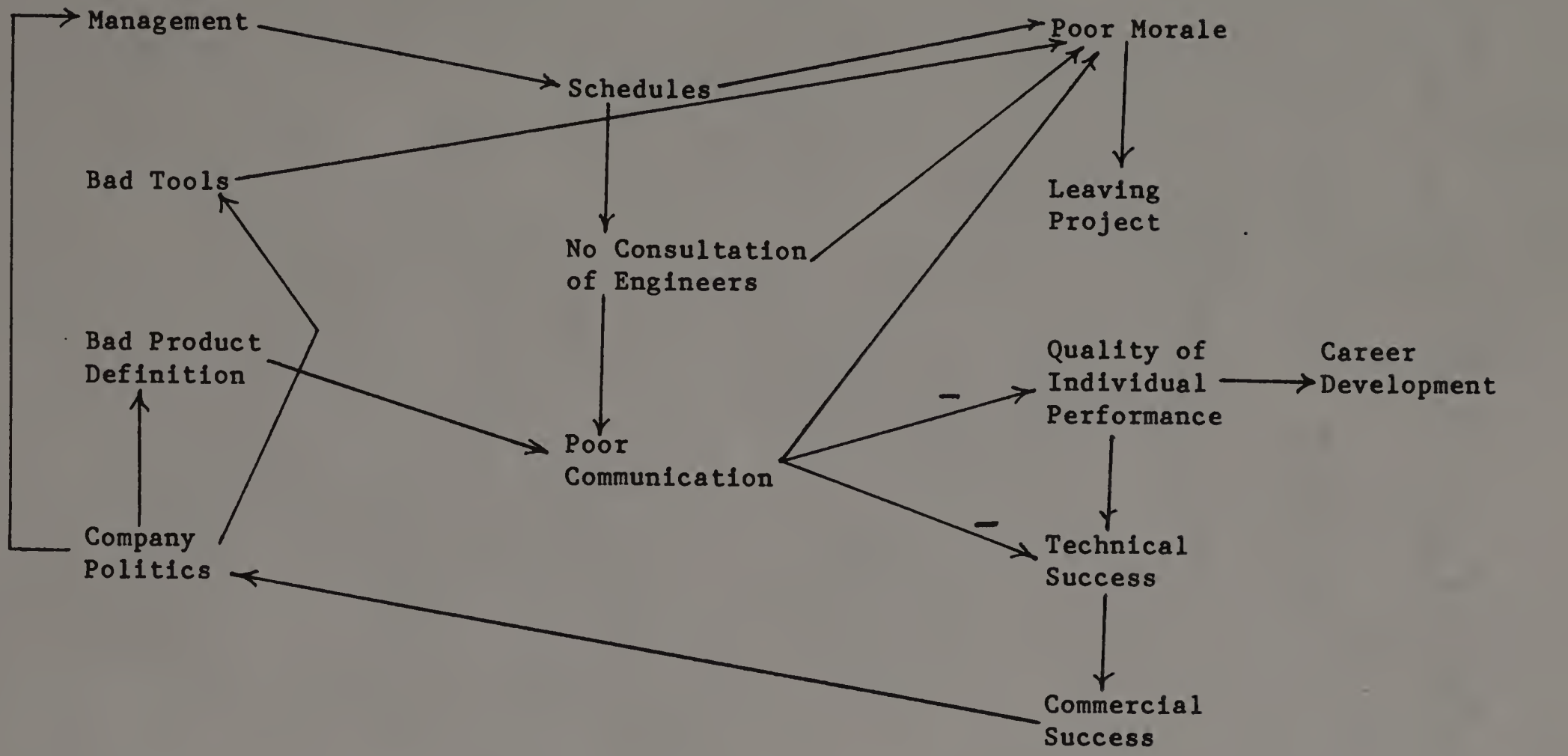


Figure 29. Political effects, 1221 organization cognitive map. All relationships are positive unless labelled negative.

loop--if politics decrease, commercial success increases, leading to an increase in politics, which cuts back on commercial success. This implies that, in the minds of the 1221 organization's members, the dominant effect of company politics was to impede the realization of the intended strategy. Politics seemed to be a prominent factor for ensuring that strategy would emerge rather than be deliberate.

This ends the section on the organization as a whole. The next section compares the managers and engineers.

The Managers Compared to the Engineers: The Matrices

Tables 11 and 13 are the valency matrices for the managers and engineers, respectively. Tables 12 and 14 are the cumulative reachability matrices for the managers and engineers, respectively. Rather than conduct an exhaustive analysis of each of these matrices alone, the next sections briefly compare and summarize the results from the two groups.

Potency

Here are the seven most potent concepts for each group:

	Managers	Engineers
1.	Management	Management
2.	Poor communication	Schedules
3.	Technical success	No consultation of engineers
4.	Commercial success	Bad product definition
5.	Bad product definition	Politics
6.	Individual performance	Poor communication
7.	No consultation of engineers	Bad tools

TABLE 11

VALENCY MATRIX, MANAGERS, 1221 PROJECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Out Degree	Rank
Management	0.0	0.8	0.4	1.0	0.8	0.8	0.4	1.0	-0.2	1.0	1.0	1.0	0.0	1.0	9.4	1
Schedules	0.4	0.0	0.6	0.4	0.4	0.4	0.8	0.0	0.2	0.0	1.0	-0.4	0.8	-0.6	6.0	8
Poor comm.	0.6	0.2	0.0	-0.4	0.6	0.8	0.8	-0.2	0.4	-0.2	0.4	-0.8	0.6	-0.8	6.8	2
Comm. suc.	0.4	0.4	-0.2	0.0	0.8	-0.2	-0.6	0.4	-0.4	0.6	-0.6	1.0	-0.2	0.6	6.4	5
Politics	0.6	0.8	0.8	-0.4	0.0	0.4	0.6	0.2	0.4	-0.2	-0.2	-0.2	-0.2	-0.4	5.4	10
Bad tools	0.4	0.8	0.6	-0.2	-0.4	0.0	0.8	0.0	0.0	-0.1	0.6	-0.4	0.2	-0.4	4.9	12
Poor mrale	0.2	0.6	0.6	-0.8	0.2	-0.2	0.0	-0.2	0.2	0.0	0.6	-0.6	0.6	-0.8	5.6	9
Invlvmnt.	0.6	0.4	0.0	0.8	0.0	0.2	0.0	0.0	0.2	1.0	0.0	1.0	0.0	1.0	5.2	11
Bad prodef	0.4	0.8	0.6	-0.6	0.6	0.2	1.0	-0.4	0.0	0.2	0.4	-0.4	0.0	-0.8	6.4	2
Careers	0.2	0.0	-0.2	0.2	0.2	0.0	-0.8	0.8	0.0	0.0	-0.4	1.0	0.0	0.8	4.6	13
Leaving	0.0	0.4	0.4	-0.4	0.0	-0.4	0.2	-0.2	0.2	0.2	0.0	-0.2	0.6	-0.8	4.0	14
Indiv Perf	0.6	-0.2	-0.8	0.4	-0.2	-0.2	-0.4	0.4	-0.6	0.8	-0.4	0.0	-0.4	1.0	6.4	5.5
No consult	0.4	0.6	0.8	-0.4	0.2	0.2	0.8	-0.2	0.2	-0.2	1.0	-1.0	0.0	-0.4	6.4	5.5
Tech. suc.	0.6	0.2	-0.4	1.0	0.6	0.0	-1.0	0.8	-0.4	0.8	-0.1	0.8	0.0	0.0	6.7	3
Indegrees	5.4	6.2	6.4	7.0	5.0	4.0	8.2	4.8	3.4	5.3	6.7	8.8	3.6	9.4	84.2	
Rank	8	7	6	4	10	12	3	11	14	9	5	2	13	1		

TABLE 12

CUMULATIVE REACHABILITY MATRIX, MANAGERS, 1221 PROJECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Out De-gree	Rank
Management	0.4	0.2	-0.2	0.6	0.3	0.1	-0.3	0.6	-0.2	0.6	-0.3	0.7	-0.1	0.7	5.3	14
Schedules	-0.3	0.4	1.3	-1.5	-0.1	0.2	1.7	-1.1	0.8	-1.1	1.5	-1.9	0.9	-2.1	15.0	7
Poor comm.	-0.5	0.5	1.5	-1.9	-0.2	0.2	2.0	-1.5	1.0	-1.4	1.9	-2.5	1.1	-2.6	18.7	2
Comm. suc.	0.5	-0.1	-0.9	1.4	0.3	-0.0	-1.3	1.1	-0.6	1.1	-1.1	1.7	-0.6	1.8	12.6	9
Politics	-0.2	0.4	1.0	-1.1	-0.1	0.2	1.3	-0.8	0.6	-0.8	1.2	-1.5	0.7	-1.6	11.5	11
Bad tools	-0.3	0.3	1.0	-1.2	-0.1	0.1	1.3	-0.9	0.6	-0.9	1.2	-1.6	0.7	-1.7	11.9	10
Poor mrale	-0.5	0.3	1.3	-1.7	-0.2	0.1	1.7	-1.3	0.8	-1.3	1.6	-2.1	0.9	-2.2	16.0	6
Invlvmnt.	0.5	-0.0	-0.7	1.2	0.3	0.0	-1.0	1.0	-0.5	1.0	-0.9	1.5	-0.5	1.5	10.7	12
Bad prodef	-0.4	0.4	1.4	-1.7	-0.2	0.2	1.8	-1.3	0.9	-1.3	1.7	-2.2	1.0	-2.3	16.9	4
Careers	0.5	-0.2	-1.0	1.4	0.2	-0.0	-1.3	1.1	-0.7	1.1	-1.2	1.8	-0.7	1.9	13.2	8
Leaving	-0.3	0.2	0.8	-1.1	-0.1	0.1	1.1	-0.8	0.5	-0.8	1.0	-1.3	0.6	-1.4	10.1	13
Indiv Perf	0.6	-0.3	-1.4	2.0	0.3	-0.1	-2.0	1.6	-1.0	1.6	-1.8	2.5	-1.0	2.7	18.9	1
No consult	-0.5	0.5	1.5	-1.9	-0.2	0.2	2.0	-1.4	1.0	-1.4	1.8	-2.4	1.1	-2.6	18.4	3
Tech. suc.	0.7	-0.2	-1.2	1.8	0.3	-0.0	-1.7	1.5	-0.9	1.5	-1.5	2.3	-0.9	2.4	16.8	5
Indegrees	6.4	4.0	15.2	20.5	2.7	1.7	20.5	16.1	10.2	15.9	18.6	26.1	10.7	27.41	96.1	
Rank	11	12	8	3.5	13	14	3.5	6	10	7	5	2	9	1		

Technical success, commercial success, and quality of individual performance are on the managers' list, but not on the engineers' list. It is interesting that the managers find technical and commercial success, usually outcome variables, to also be potent causal variables. This is perhaps an indication of how fixated on outcomes the managers were during this project. Perhaps they viewed commercial and technical success to be so important that they, by themselves, could influence the other variables. The managers, who were mostly inexperienced, were also concerned with the performance of the engineers under their command. This is reflected in their valency matrix.

Schedules, company politics, and bad tools are on the engineers' list but not the managers'. It is not clear why the managers did not see the schedules as being potent, since they seemed to be a pervasive element of the climate in the 1221 organization. It is also interesting that the engineers thought company politics were potent, but the managers did not. Perhaps the managers were so embedded in the politics that they did not see the effects in as dispassionate a way as did the engineers. There was also some evidence that when the engineers said "politics" they were talking about power struggles among the 1221 managers, and not just the effects from the rest of the company. Maybe the managers did not see their disagreements as being anything but technical, but the engineers saw those as somehow ethical or political. The result on bad tools may have come about because the managers were somewhat removed from using those development tools on a daily basis. In contrast to the engineers, they may have felt positively about the

mandated use of NICC equipment, either for reasons of cost, or genuine belief in the superiority of that equipment, or because they had been successfully socialized into thinking that way by upper management.

Goals

Here are the top seven goal variables (as measured by indegree) for each group:

	Managers	Engineers
1.	Technical success	Leaving the project
2.	Quality of indiv. perf.	Poor morale
3.	Poor morale	Technical success
4.	Commercial success	Poor communications
5.	Leaving the project	Commercial success
6.	Poor communications	Schedules
7.	Schedules	Quality of indiv. perf.

In contrast to the potency lists, these two lists have identical contents; only the order differs. Clearly, the engineers felt that the outcomes of this project, for them, were negative--leaving the project and poor morale. The managers also recognized the salience of poor morale in this project, placing it third on their list. They saw technical success as the paramount outcome; the engineers place _that_ third. It is interesting that both groups listed _commercial_ success relatively low--the managers placed it fourth, the engineers placed it fifth. In many conversations and meetings, Alfred Tsou stressed both technical excellence _and_ commercial success. Yet the managers and engineers appear to have weighted technical success much higher than commercial success, and they weighted other outcomes (morale, turnover, individual performance, and communications) higher than commercial

TABLE 13

VALENCY MATRIX, ENGINEERS, 1221 PROJECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Out Degree	Rank
Management	0.00	0.91	0.86	0.50	0.55	0.82	0.86	0.46	0.96	0.27	0.91	-0.09	0.86	0.46	8.50	1
Schedules	0.50	0.00	0.68	0.36	0.27	0.41	0.96	0.05	0.68	0.00	0.82	-0.55	0.86	-0.36	6.50	2
Poor comm.	0.14	0.18	0.00	-0.27	0.23	0.50	0.77	-0.09	0.68	-0.27	0.68	-0.46	0.50	-0.55	5.32	6
Comm. suc.	0.18	0.64	0.05	0.00	0.55	0.18	-0.23	0.50	0.05	0.50	-0.14	0.27	0.00	0.00	3.27	11
Politics	0.73	0.77	0.50	-0.14	0.00	0.68	0.73	0.00	0.64	0.05	0.68	-0.14	0.27	-0.14	5.45	5
Bad tools	0.23	0.32	0.59	-0.41	0.14	0.00	1.00	0.00	0.00	-0.10	0.73	-0.50	-0.05	-0.50	4.55	7
Poor mrale	0.27	0.14	0.73	-0.27	0.18	0.05	0.00	-0.23	0.00	-0.27	0.91	-0.55	0.23	-0.46	4.27	8
Invlvmnt.	0.14	0.14	0.09	0.59	0.10	0.05	0.43	0.00	0.09	0.46	0.41	-0.05	0.05	0.64	3.21	12
Bad prodef	0.64	0.55	0.77	-0.41	0.18	0.36	0.73	-0.23	0.00	-0.24	0.67	-0.33	0.52	-0.48	6.10	4
Careers	0.05	0.00	-0.05	0.14	0.14	0.00	0.10	0.43	0.05	0.00	0.62	0.81	0.00	0.52	2.91	13
Leaving	0.14	0.19	0.10	-0.24	0.33	-0.05	0.52	-0.05	0.10	0.43	0.00	0.14	0.05	-0.33	2.67	14
Indiv Perf	0.29	0.20	-0.10	0.76	0.10	-0.05	-0.10	0.19	-0.05	0.71	0.10	0.00	0.05	1.00	3.68	10
No consult	0.19	0.62	0.81	-0.29	0.10	0.52	0.91	-0.14	0.62	-0.24	0.76	-0.48	0.00	-0.76	6.43	3
Tech. suc.	0.24	0.05	0.00	0.55	0.43	0.05	-0.43	0.67	-0.10	0.62	-0.33	0.33	-0.10	0.00	3.89	9
Indegrees	3.72	4.69	5.32	4.93	3.28	3.72	7.75	3.02	4.00	4.16	7.75	4.69	3.53	6.19	66.74	
Rank	10.5	6.5	4	5	13	10.5	1.5	14	9	8	1.5	6.5	12	3		

TABLE 14

CUMULATIVE REACHABILITY MATRIX, ENGINEERS, 1221 PROJECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Out Degree	Rank
Management	0.9	1.1	3.1	-3.1	0.3	1.5	4.3	-2.2	2.0	-2.4	3.8	-3.2	1.9	-4.3	34.0	1
Schedules	0.5	0.6	1.0	-0.6	0.3	0.6	1.4	-0.3	0.7	-0.3	1.3	-0.7	0.7	-0.9	10.0	9
Poor comm.	0.1	0.1	0.9	-1.3	0.2	0.3	1.2	-1.0	0.5	-1.1	1.0	-1.2	0.5	-1.6	10.7	8
Comm. suc.	0.5	0.6	1.4	-1.0	0.3	0.7	1.8	-0.7	0.9	-0.8	1.7	-1.2	0.9	-1.6	13.9	4
Politics	0.5	0.7	2.1	-2.2	0.1	1.0	2.9	-1.6	1.3	-1.8	2.6	-2.3	1.3	-3.0	23.5	2
Bad tools	0.0	0.0	0.6	-0.9	-0.1	0.2	0.8	-0.7	0.3	-0.8	0.6	-0.8	0.3	-1.1	7.2	12
Poor mrale	-0.0	0.0	0.5	-0.8	-0.1	0.1	0.7	-0.6	0.2	-0.7	0.5	-0.7	0.3	-1.0	6.2	14
Invlvmnt.	0.4	0.5	1.1	-0.8	0.2	0.6	1.4	-0.5	0.7	-0.6	1.3	-0.9	0.7	-1.2	10.9	7
Bad prodef	0.2	0.3	1.4	-1.7	-0.1	0.6	2.0	-1.3	0.8	-1.5	1.7	-1.7	0.9	-2.3	16.5	3
Career	0.4	0.5	0.9	-0.5	0.3	0.5	1.2	-0.3	0.6	-0.3	1.2	-0.7	0.6	-0.8	8.8	11
Leaving	0.2	0.2	0.6	-0.6	0.0	0.3	0.9	-0.5	0.4	-0.5	0.8	-0.7	0.4	-0.9	7.0	13
Indiv Perf	0.6	0.7	1.3	-0.7	0.4	0.7	1.7	-0.4	0.9	-0.4	1.6	-0.9	0.8	-1.2	12.2	6
No consult	0.1	0.1	1.1	-1.6	-0.2	0.4	1.5	-1.2	0.6	-1.4	1.3	-1.5	0.7	-2.0	13.6	5
Tech. suc	0.5	0.6	1.0	-0.6	0.3	0.6	1.4	-0.3	0.7	-0.3	1.3	-0.7	0.7	-0.9	10.0	9
Indegrees	4.8	6.1	17.8	17.9	2.5	8.2	24.6	12.8	11.1	14.3	21.6	18.5	11.1	24.71	96.1	
Rank	13	12	6	5	14	11	2	8	9.5	7	3	4	9.5	1		

success.

The Managers Compared to the Engineers: The Maps

Figures 30 and 31 show the cognitive maps for the managers and the engineers, respectively.

The maps are generally similar. There are only a few differences in the direct linkages. One is about the variable "bad product definition." The engineers saw this as linked, positively, to only one other variable, "poor communication." The managers saw the lack of a solid product definition as positively linked to "schedules" and "poor morale," and as negatively linked to "technical success." Another difference is about the causes of bad tools--the managers see those as caused only by the management of the project; the engineers see them as caused by company politics as well. Speaking of company politics, both maps have the feedback loop, from commercial success to politics, that was seen in the complete map.

Aside from the larger number of relationships, what made the managers' map more difficult to draw was that the variable "quality of individual performance" was, for the managers, both a potent variable and a high outcome variable. This yields an odd result. Table 14, the cumulative reachability matrix for the engineers, shows that all the direct and indirect effects of each variable have negative (adverse) effects on the two critical outcome variables of commercial and technical success (columns 4 and 14, respectively). The same matrix for the managers, Table 12, shows that there are some positive values for

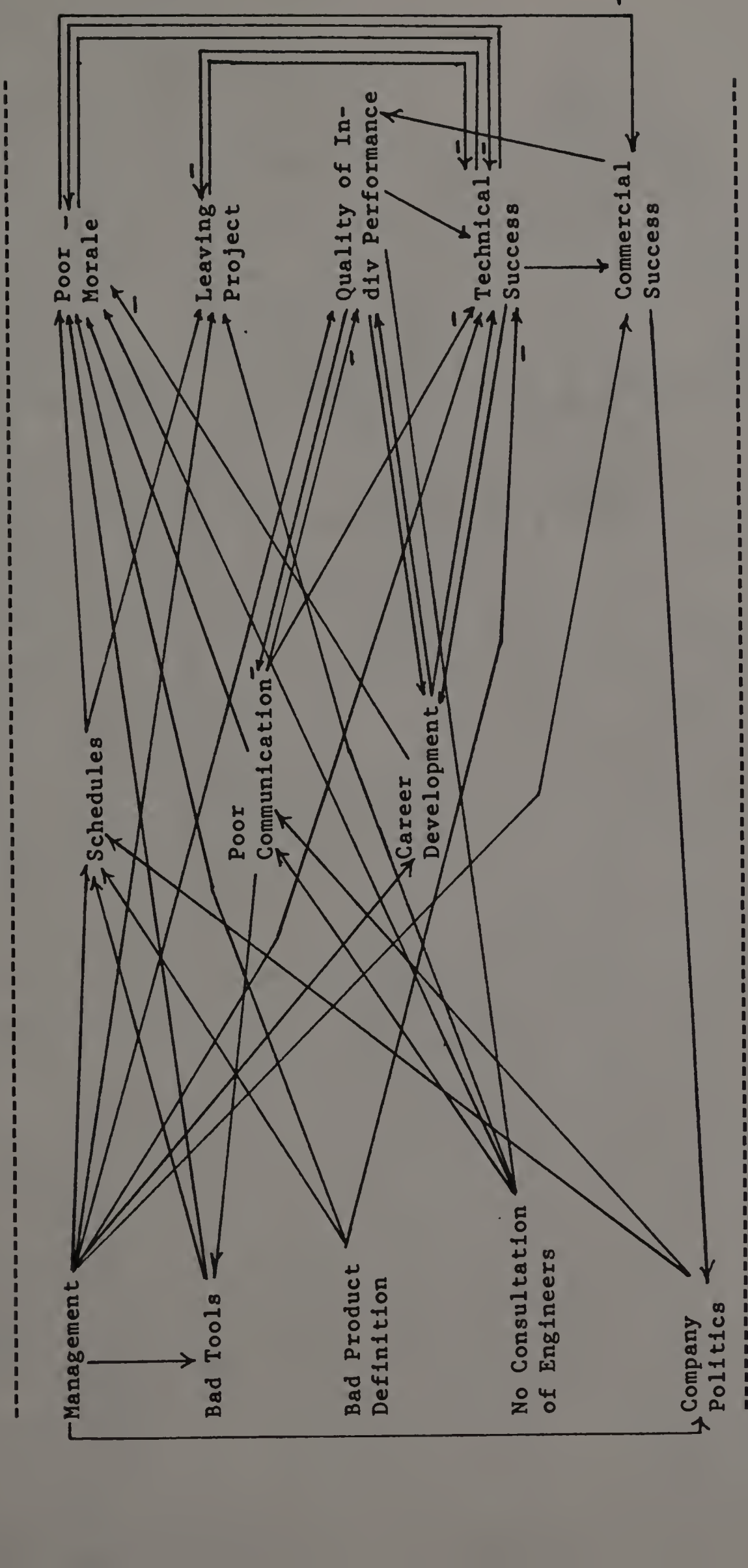


Figure 30. Cognitive map, managers, 1221 organization. All relationships are positive unless labelled negative.

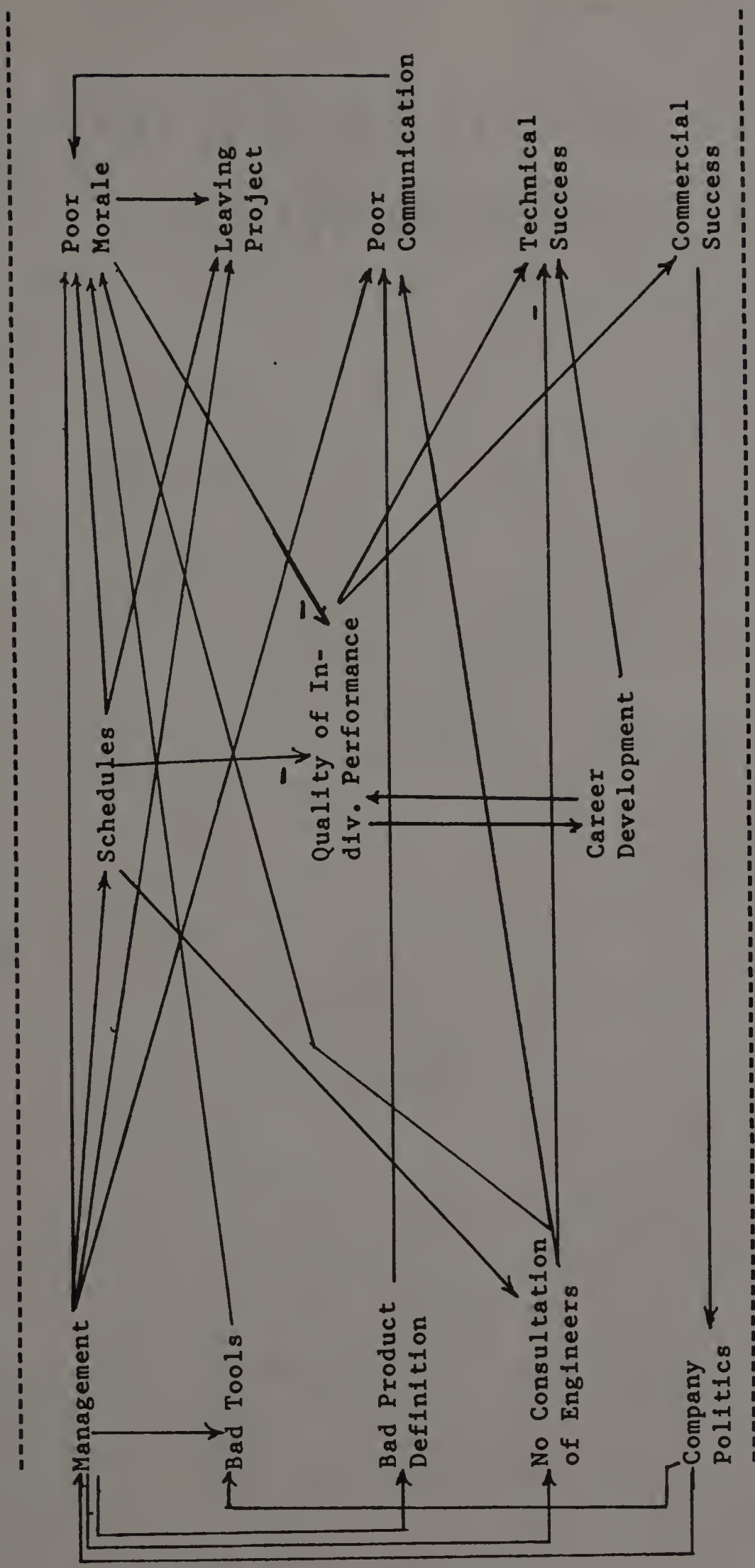


Figure 31. Cognitive map, engineers, 1221 organization. All relationships are positive unless labelled negative.

commercial and technical success. One of those is quality of individual performance. Although there may be some negative loops in the managers' map, on balance they felt that the quality of individual performance on this project was a positive influence on success. They also valued it as an objective. The engineers mildly agreed on the latter, but disagreed that it was a positive influence on outcomes for this project.

This is an important difference. Recall from Figure 26 that quality of individual performance was crucial to the "success cycle" in the complete map. The managers felt that they had created an organization which positively affected the quality of the performances of their subordinates, which led to a positive effect on success. The engineers, on the other hand, felt that their performance quality was adversely affected, which in turn adversely affected commercial and technical success. In terms of the frame of reference created by the members of this organization, these two points of view could not be more different. In the end, it seems that the engineers' view was at least partially vindicated.

Implications of These Results for the Frame of Reference of the 1221 Organization

From the ethnography, the semantic differential data, and the sociometric data, we know at least two important things about the 1221 core organization: (1) agreement on objectives did not exist, and (2) the organization was fragmented in its technical, administrative, and social communications and interaction patterns. In this chapter, we

begin to see how these two pieces fit into a larger frame of reference enacted by the 1221 core organization.

Communications and the umbrella strategy

Variables which can be reasonably construed as hurting communications (poor management, no consultation of engineers, the schedules, and poor communications), and a variable which can be reasonably construed as indicating a lack of clarity on objectives and intended strategy (lack of a solid product definition), make up the five most potent variables in the cognitive map. The communications problems all led to negative outcomes--poor morale, turnover, technical failure, commercial failure, and poor individual performances. The lack of a solid product definition (lack of commitment to the intended umbrella strategy) led to the same negative outcomes.

Both of these phenomena were on deviation-amplifying loops, i.e., the negative outcomes made the poor communications poorer and the unclear intended strategy less clear, which made the outcomes "more negative," and so on.

Organizational politics

As the ethnography showed, organization politics played an important role in the 1221 project, indeed at all of NICC. In the cognitive map, organization politics was the terminus of a deviation counteracting loop--much political activity ultimately led to commercial failure, which led to decreased political activity; conversely,

commercial success led to greater political activity. This implies that, in the minds of the 1221 organization's members, the dominant effect of company politics was to impede the realization of intended strategies--politics were a prominent means for ensuring that strategy would "emerge" rather than be deliberately "executed."

Conclusion

We see how these three elements of the frame of reference--the quality of communications, the clarity of intended strategy, and organizational politics--interact, resulting in emergent, as opposed to deliberate, strategy. In the 1221 organization, the emergent strategy was negative, both in the view of the members (as manifested in the cognitive map) and in the view of the marketplace, which did not accept the product.

An important question is: "Could we reach the same conclusions about the interplay between intended and emergent strategy if the characteristics of the map were more positive?" The answer is not straightforward. If all the signs in the cognitive map were reversed (communications were great, clarity about intended strategy was high, and organizational politics were supportive), and the outcomes were generally seen as different and better than expected, then the answer would be "yes, the conclusions are the same." But if all the signs were reversed and the outcomes were simply the straightforward execution of the intended strategy (i.e., Mintzberg's deliberate strategy), then the answer would be "no, conclusions are not the same", and the conclusions

reported in this section would hold only when the outcomes are negative. Obviously, this question needs further research.

C H A P T E R VIII

THE DYNAMICS OF EMERGENT STRATEGY: AN INTEGRATED MODEL OF IMPLEMENTATION IN THE 1221 PROJECT

The previous four chapters presented material designed to answer research questions one, two and three, which were focused in-depth on the core organization in the 1221 development effort, namely, the software development group. No space was given to research questions four and five. Research question four, on page 29, asked:

> How did the members of the organization extend the initial, partial, outcome specifications into subunit outcomes? How did the subunits extend those into overall organizational outcomes? Putting it another way, what was the interplay between the project's intended strategy and its emergent strategy?

Question five (pages 29 and 30) asked:

> How useful are the political models of strategy formulation, specifically the Narayanan and Fahey (1982) model, in explaining the process of implementation?

This chapter will (1) review and integrate the results of the in-depth study of the core organization, (2) examine the context and process in which the core organization was imbedded, and (3) combine all the findings into one integrated model of the implementation process. Points two and three will serve as answers to research questions four and five.

The Core Organization

Members of the software development group agreed with the

abstract idea of building a good, inexpensive standalone word processor. Unfortunately, the results indicate that they did not feel that the approach used in this project would do that. They did not feel good about the basic design, and they did not feel good about the specifications which emerged during the effort.

The core organization was an "uncoalesced" one. The group was fragmented administratively, technically, and socially. Communication was poor, partly because of poor management, partly because of the technical complexity of the task, partly because of a lack of mutual assumptions about many things, and partly because of the ethos of not wanting to wear the "dunce cap." Consultation of the members was also poor.

Resources, from development systems to floppy disks, were inadequate. The members felt that this was caused by organizational politicking by 1221 managers, particularly the general manager, Alfred Tsou. Lastly, the schedule was perceived as too aggressive, even though the members agreed that some sort of aggressive schedule was needed to get the project completed in a timely way.

The results of these factors were threefold:

1. a skepticism about the technical and commercial viability of the emerging computer system
2. poor morale and high turnover
3. a focus on the one possible tangible outcome--career development

In abbreviated form, this was the frame of reference which characterized the 1221 software development group, the core

organization. This frame of reference was not formed in a vacuum. The core organization was imbedded in a much larger organization, the Northeast International Computer Company. Figure 32 shows the core organization's frame of reference arrayed at the bottom, with the larger context above it. To answer research questions four and five, we must examine the software development group's relationship with this larger context. To this we now turn.

The Integrated Model

The implementation process studied here proceeded on four parallel tracks--political, marketing, technical, and "institution building." Figure 32 shows the model graphically.

The activities of the core organization, which we have been examining in detail so far in this paper, are drawn along the bottom track, "institution building," of Figure 32. This track was called the "institution building" track because the core organization started from scratch and, along the lines of the ideas discussed in Chapter I, built its institutional character, enacted its frame of reference.

The three other tracks were briefly examined earlier, after the ethnography, in Chapter IV. The track immediately above the institution building track in Figure 32 is the technical track. It was placed there because, despite all the other influences on them, it was through technical requirements that the core organization members were most affected. The technical track acted as a quasi-buffer between the social and administrative systems of the core organization and the

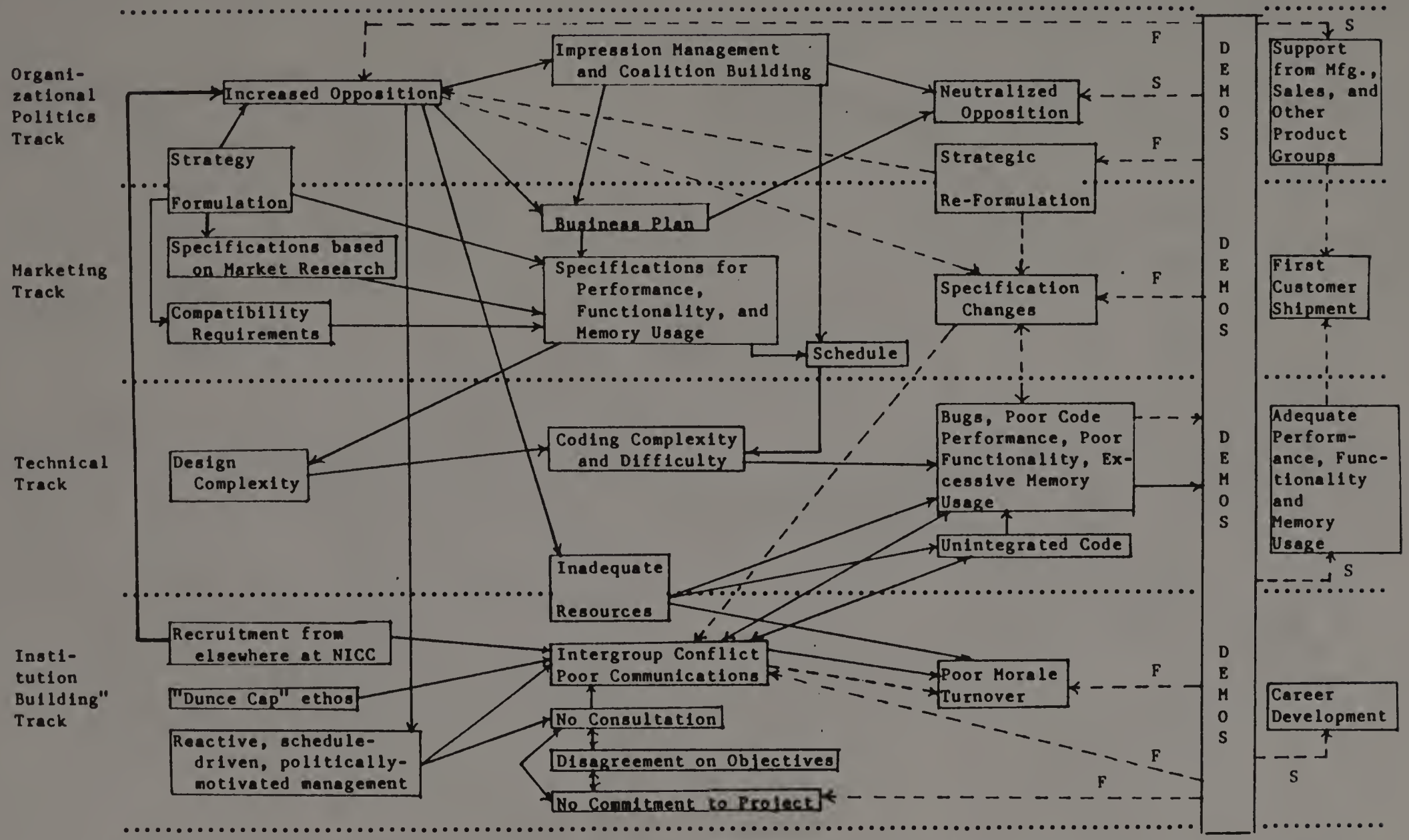


Figure 32. Integrated implementation model, 1221 project. Solid lines (——) are initial activity flows. Dotted lines (- - -) are feedback-based activity flows. S = success feedback; F = failure feedback. All flows are direct, positive relationships unless labelled negatively.

activities of the marketing group and the politics in the rest of NICC.

Next is the marketing track. Marketing is broken out from the rest of the NICC organization for two reasons:

1. in this project, for the first time at NICC, top management explicitly increased the role of marketing in the development effort (which is why John Steffano played such a prominent role)
2. most of the changes in specifications either originated in, or were filtered through, the marketing department

Arrayed along the top of Figure 32 is the organizational politics track. It is important here to keep some distinctions in mind. Recall that politics was defined earlier as "the definition, allocation, and exercise of power in an organization," and that power was defined as "the ability to have others in the organization do one's will despite their own resistence." The variable used in the cognitive map to measure how the engineers interpreted the exercise of power at NICC was "company politics." Although is may be slightly confusing, the term "company politics" as it is used in this chapter refers to the organization-wide exercise of power, and not to the engineers' interpretation of it. The point is that, as the ethnography showed, much of the activity of the core organization was attempts to exercise power against other coalitions in the NICC organization, or attempts to create power for itself (by building legitimacy) which it could then marshall against salient interest groups. Also, much of the core's activity was forced on it by specific actors in the wider company environment exercising their power, either directly or through the

marketing buffer or the technical buffer. The interpretation of these power moves was captured in the cognitive map variable "organization politics." Since this term is so descriptive, it will be used in this chapter.

Cutting across all four tracks were the demonstrations and releases mentioned in the narrative. These are superimposed across all four tracks because they served a purpose in all four tracks, albeing not the same one in each. In the institution building track, they were the only mechanism for bringing the whole group together administratively and socially. In the technical track they were the only mechanism for integrating the complex code needed for the 1221 product. For the marketing track they served as means for monitoring how closely the project was holding to the specifications that marketing felt were needed for this product to meet customer needs. Lastly, the demos and releases served as an important impression management tool at the organizational political level.

Except for poor morale and turnover, which were part of the frame of reference of the core organization, and are therefore placed to the left of the demos in Figure 32, the outcomes are arrayed along the right margin of the figure. "Causal" flows are shown by lines connecting the elements--solid lines represent initial flows, while dashed lines represent the result of some sort of feedback, either from a demo or some other source.

Figure 32 is complex. The phenomenon which it is intended to describe is complex. It is impossible to escape this. The verbal

description of this phenomenon is likely to be correspondingly complex. Rather than describe each track separately, which is impossible because of all the interrelationships, the model will be described in more of a quasi-sequential, interconnected-flow way.

The Intended Strategy

This project began with the formulation of a strategy. This was not a top-down, analytical effort. It resembled the process described in Bower (1970), where an idea is hatched at a lower level, given impetus by someone with some influence, and finally approved by top management. Here, Alfred Tsou and Jim Miles had the idea for a low-end, high-functionality word processor. Even though their paper received some notoriety as a creative effort, it did not get the backing of anyone who could move it further. Then, when the vice president lamented the lack of creativity and momentum at NICC, Tsou's and Miles's paper suddenly was in a position to receive some support. It did, and top management gave its approval to the project. This process closely resembles the Narayanan and Fahey (1982) political formulation model:

1. Activation: Tsou and Miles get their idea
2. Mobilization: their paper gets the attention of some others in the organization (but nothing much happens)
3. Coalescence: suddenly the idea is seized upon by some top managers who see it as one avenue for shaking NICC out of its seeming lethargy; these top managers form a powerful coalition favoring the concept of the 1221

4. Encounter: the idea is submitted to many people in the company for their comments; some coalitions resist it
5. Decision: the dominant coalition decides to form a separate organization to build the 1221

The outcome of this process was a particular intended strategy: (1) the 1221 would be a low-cost word processor that would be an alternative to electronic typewriters; (2) it would be capable of sophisticated word processing functionality; (3) it would operate within the constraint of 128 kilobytes of core memory; and (4) it would operate at a speed rivaling larger, clustered word processors.

Unfortunately, this general vision of the product was not translated into a clear, generally-accepted definition of the product, as was shown in both the semantic differential results and the cognitive map. There was no agreement on the desirability of the compatibility requirements. There was a really crucial lack of agreement, on the part of the software developers, about the desirability and importance of the particular product characteristics which emerged from their interaction with marketing. And the cognitive map showed that members believed that the product definition was unclear.

This disagreement and lack of clarity led to poor communication, as demonstrated in the ethnography, the sociometric choice data, and in the cognitive map. These factors led in turn to negative outcomes. The ethnography showed how these led to poor code integration, and thereby to technical problems. Important outcomes in the cognitive map were dissatisfaction, turnover, and poor individual performance. In that

map, perhaps the most important outcomes were technical failure and commercial failure; this is another way of saying that the intended strategy was not realized.

This lack of clarity and lack of acceptance of the intended strategy, and poor communication (along with the correlated effects), are some of the reasons why the intended strategy did not proceed along a deliberate path to realization. The intended strategy was what Mintzberg and Waters called an "umbrella strategy." They state that "the central leadership must monitor the behaviour of other actors to assess whether or not the boundaries are being respected" (1985: 263). The assumption underneath this assertion is that the umbrella and its boundaries are clear, understood, and accepted, a sort of "feedforward" control. In the 1221 project, this was unfortunately not the case, as we saw above.

Mintzberg and Waters state that in response to straying outside the boundaries, central management has three choices: to stop them, to ignore them, or to adjust to them. In the 1221 project, management first ignored, and then adjusted to, the emergent strategy.

One of the main lessons learned about the interplay between intended and emergent strategy from the 1221 project is that strategic project management in a professional organization like this one can be thought of as a series of contingencies. Ideally, the "umbrella of intentions" should be as well-specified as possible (which, admittedly, is difficult in a professional organization). Failing this, management must be prepared to do either of the following: (1) be very activist

about stepping in when the emergent strategy deviates dysfunctionally from intentions, or (2) be prepared to accept the deviations and adjust to them, if the changes are not fatal to the strategy.

But these were only some of the reasons why the realized strategy was more emergent than delibarate. Organizational politics were another important factor.

The Politics of Implementation

There were three direct outcomes of the decision. First, it created opposition among other product managers at NICC, some of whom felt the 1221 should have been placed under their supervision, rather than split off from other activities. Opposition was also fostered by the recruitment of personnel for the 1221 project from existing units at NICC. Second, the decision was the impetus behind marketing research. This was the opposite of the classical marketing model, where the firm's product strategy is the result of market research. (Since the interface between the marketing staff and the dominant coalition was so fluid during the formulation phase, in Figure 32 this activity was placed on the boundary between those two tracks.) Third, top management specified that the product had to be technically compatible with larger NICC systems.

The first two of these points suggest that the encounter stage of Narayanan and Fahey's model does not end with the decision. The opposition which was created necessitated much impression management and coalition building by the 1221 core (particularly its chief

representative, Alfred Tsou), with the objective of at least neutralizing this opposition. One manifestation of this was an activity in the marketing track--the publication of the business plan. The author, John Steffano, admitted that the document was, "being charitable," only fifty percent business plan. Both he and his boss admitted that it was mostly an "internal selling document."

The business plan was the closest thing to a direct assault on the rival interest groups. Tsou did not believe in direct assaults, although his rivals did not have the same qualms. For example, they were able to deny good development equipment to the 1221 engineers for a long time. They were also able to force changes during the design stage of the project that made things more difficult for those engineers. For the most part, Tsou did not respond in kind. He believed in "encirclement and subtlety." So he mostly relied on results and impressions to achieve his political results. The results were communicated mostly through the demonstrations and releases. (These will be discussed later.) He also insisted on using NICC equipment for the development, even though it was inferior to some other kinds of equipment available to the organization, to flatter the rival managers of those NICC units. Lastly, he kept a tight rein on the 1221's budget--the engineers even had a difficult time getting floppy disks. This was because he wanted to prove to the rest of the organization that the 1221 project could be successful and come in at or under budget.

The ethnography and the cognitive map both show that politics affected product definition as well, i.e., directly altered the intended

strategy. If emergent strategy is characterized by unintended or non-rational activities which serve to alter the realized strategy in such a way that it does not resemble the indended strategy (Mintzberg, 1978), then clearly organizational politics were a major force behind emergent strategy in the 1221 project. Even though these activities did result in the partial neutralization of the opposition, the activities in the political track negatively affected activities in the technical and institution building tracks. The result of these effects was to change the intended strategy. A different strategy emerged (Mintzberg, 1978). As Figure 32 shows, these political effects were either direct or indirect (i.e., through the marketing track).

The direct effects were on the managers of the 1221 project and on the resources available to the engineers on that project. The managers were acutely sensitive to meeting the schedule, because of the political benefits of doing so. Their emphasis on these external forces led them to neglect certain internal aspects of the institution building track, and all this was at least partially responsible for the poor communications, the intergroup conflict, and the lack of consultation which characterized that track. The inadequate resources made the engineers' technical jobs more difficult, which led to problems with the software. They also led to poor morale and turnover, according to the cognitive map. The latter also showed that the engineers felt a direct effect of politics was on their schedules. They were probably correct, as meeting the schedule was a key element of Tsou's impression management with the rest of NICC.

The Marketing Track

The indirect effects of the political tract were mostly through the marketing track. The business plan, the compatibility requirements, and the specifications for performance, functionality, and memory size all increased the technical complexity of the software development. This increased complexity led to problems with the software, which in turn exacerbated the problems within the institution building track.

When it appeared that the performance, functionality, and code size constraints would not be met, it was usually the marketing track which acted on the problems. The almost constant example was the ubiquitous presence of John Steffano. He became another manager under Alfred Tsou, even though he nominally was reporting to another manager altogether. A more distinct example of the effects of marketing was the meeting of the three key 1221 managers that Steffano called when it first appeared that the project might not meet the specifications. As Figure 32 shows, when the result of a demo, release, or review of the software was the identification of a problem, it was marketing which mandated changes in the specifications, although it frequently did so through the 1221's five managers. These changes in the specifications led to greater problems in the code, and also led to more of the activities in the institution building track that ultimately led to poor morale and turnover.

Marketing acted as a buffer between the project engineers and the political track in another way. The compatibility requirements, which were mandated by agents in the political track, were not popular

among the engineers affected by them. But marketing was steadfast in insisting on meeting them. (This was despite some private reservations held by John Steffano.)

The Demos

The "demos" in Figure 32 mean any kind of review of progress by any one or several of a variety of actors at NICC. The demos usually took the form of code integrations by the software development group, followed by literal demonstrations to other groups at NICC. Towards the end they took the form of releases of prototype products to users within the company. Less frequently, they were informal reviews of progress by Miles, Steffano and one or two other interested managers. The demos cut across all four tracks.

At the institution building level the demos served to encourage communication among the engineers, who were almost forced to work together. Positive feedback from the demos led to a decrease in the negative elements present in the frame of reference of the core group, and to a feeling that the engineer was enhancing his or her career development. At the technical level, they served to integrate the code, which was being written in pieces, but which had to run in concert. Positive feedback from the demos in this track resulted in adequate performance, functionality, and memory usage. For the marketing track, the demos served as a mechanism for marketing managers to monitor the progress of the development, and to build commitment among the sales force. They also served as a means for assessing what changes had to be

made to the specifications. At the political level, the demos were mostly impression management--if the feedback were positive, they were designed to prove to political actors, both hostile and neutral, that the 1221 was indeed a viable, and valuable, product, worthy of their support, or at least their tolerance.

The Realized Strategy

At this level, the continuing negative feedback from the demos led to one of the most dramatic moments in the project--a reformulation of the strategy of the project. This mostly took the form of ratifying the memory usage that seemingly was needed to get the job done, from 128K to 256K. The reformulation also specified multitasking, and the rewriting of major code elements from the high-level language "C" to assembly language. The increased memory size necessitated a retail price increase of about $500.

This action by top management was really just a ratification of the characteristics of the product which had emerged over the year and a half of development. It was not a top-down reformulation. It was an authorization to continue with the project, along the lines in which it had emerged. The choices facing top management at that point were three: (1) they could have scrapped the project, (2) they could have started over, from scratch, or (3) they could have taken what was there and gone with it. They chose the last.

When thoughtful people in the company looked up at the end of the project, people like the sales manager, they saw a product which was

not exactly what had been envisioned at the beginning. It was not aimed directly at any segment. It seemed to be too powerful, and too expensive, to be an electronic typewriter replacement. Yet it was not powerful enough to be a personal or professional microcomputer. In terms of the specific intended strategy (p. 202), the product which emerged was too expensive, used double the intended memory, and had reduced functionality and performance.

All of this shows the effects of organizational politics on the intended "umbrella" strategy. As predicted by most of the political models, organizational politics are a force acting to force the intended strategy off the "deliberate" track, and onto either the "unrealized" track (which seems extreme) or the "emergent" track (which seems likelier, and which happened here in the 1221 project).

What was learned about the interplay between intended and emergent strategy here was that central management must take politics into account. This can take several forms. If politics are rampant in an organization, central management can break the implementating organization off from the rest of the company--this was attempted here, but not vigorously, or successfully, enough. Or central management can use its own political clout to insulate the project from the rest of the company, in a kind of brute force solution. In another approach, following the ideas of Bourgeois and Brodwin's crescive model, central management can neutralize the politics by effective "premise setting," i.e., setting, and getting acceptance for, a clear umbrella strategy; this notion was empirically supported in the 1221 project's cognitive

map--the cumulative reachability matrix shows that the cumulative effect of "bad product definition" on "company politics" is negative; in other words, the better the specification, the better the premises, the lower the level of organizational politics. This conclusion should be treated with some caution; remember that this is the situation as manifested in the causal schema of the 1221 project staff; it does not necessarily follow that this phenomenon exists objectively, although there are plausible reasons for thinking that it does, as seen above. Failing any of these approaches, central management can decide to see where the politics take the project (i.e., use "deliberate emergence"), and then adjust, or abandon, it.

Conclusion

As Figure 32 shows, the reason why the 1221 project drifted away from deliberateness is complex. In each of the four tracks, much shifting and adjustment went on throughout the project.

The institution building track

The groups in this project started out somewhat segmented, and they never really got together, socially or technically. Communication was poor, conflict was high, consultation of the engineers was poor. There was much confusion and suspicion. The "dunce cap" ethos resulted in much duplicated effort, which raised the negative issues to higher levels. The members of the software development organization were scrambling throughout this project.

The technical track

The engineers in the various groups did not agree on what product they were building, nor did the managers. Some thought they were building a high-end word processor (Hans Erhardt and his group). Others were unsure of how to proceed--for example, the confusion between the word processing and operating systems groups over which mode of the C language to use. As a result, the technical aspects of this project were never truly set, or even fully understood.

The marketing track

Because of the political problems and the technical problems, the marketing people were forced into a mode of constant adjustment. To appease political rivals, they had to alter the original specifications, and they had to insist on compatibility with other software groups at NICC. Because of the problems the 1221 engineers had with their software, marketing was constantly reassessing what could be expected from the product in the way of functionality, performance, and memory usage. Often, these reassessments were done with no involvement of the engineers.

The political track

The adjustments in this track were mostly maneuvering among the various interest groups. Tsou and his 1221 group were forced to do certain things (compatibility, limiting to NICC equipment) because of political concerns. Their rivals (the PC group, the Microsystems group)

had to adjust when it appeared that the 1221 was vulnerable (e.g., at the beginning, when they denied it hardware support), and when it was succeeding (after Demo III). Neutral groups (e.g., manufacturing, sales) "came around" when it appeared that the 1221 would actually get built and distributed.

Summary

In essence, the answer to research question four, about the interplay between the intended strategy and the emergent strategy, was that all the adjustment which went on in the four tracks was simply too complex for the system to keep a tight rein on the intended strategy, to be able to turn it into a deliberate strategy. What would have been needed for that to happen was (1) an intense effort to increase consensus and cohesion in the 1221's core software development coalition, (2) a better and more solid product specification, or at least one that was better understood, and (3) much better insulation from the political vicissitudes at NICC.

The model described in this chapter provides an answer to research question five, also. The political models of strategy formulation clearly are applicable, in some form, to strategy implementation. Here, it was clear that the encounter of the core coalition with other coalitions extended after the decision to proceed with the formulated strategy. Indeed, since their was both an emergent and an explicit reformulation of the strategy for the 1221, perhaps all that is really needed to turn Narayanan and Fahey's (1982) model into an

implementation model is to add a sixth box called "continued encounter," with a feedback loop to the decision box.

This research project was a specific, detailed look into that kind of "black box." It showed that the continued encounter process took place along four parallel, but heavily interrelated, tracks:

1. An "institution building" track, where a core organization or coalition is enacted by its members
2. A technical track, where the core organization's or coalition's task is specified and carried out
3. A marketing task, which has the manifest function of selling the product to the public, and the latent function of being a partial buffer between the core group and the rest of the company in the encounter process
4. An organizational political track, which is the arena where the "encounter", a complex and potent process, takes place.

C H A P T E R IX

DEFINITIONS AND IMPLICATIONS

Toward a Definition of Implementation

Chapter I postponed the task of formulating a formal definition of implementation, adopting instead a working definition. That task can no longer be postponed, and will be taken up in this chapter. First, a brief review of conceptualizations of strategy is in order.

For Bower and Doz (1979), strategy is the outcome of four sub-processes: (1) cognitive, (2) social, (3) organizational, and (4) political. The administration of those four sub-processes is the task of the chief executive. For Mintzberg and Waters strategy is "a pattern in a stream of actions" (1985: 257). Their research looks at patterns characteristic of organizations over long periods of time; it does not examine the processes which lead to these patterns, but does say that realized strategy comes in two varieties. One is deliberate, which is when an intended strategy is executed in a straightforward way. The other is emergent, which is when stategy evolves in unintended and possibly even non-conscious ways.

This study blends elements of Bower and Doz, and Mintzberg and Waters, in studying implementation. Like their work, it shows that formulation and implementation are distinguishable conceptually but not in practice. Like Bower and Doz, it shows that implementation is an amalgam of many complex subprocesses; here, those subprocesses were (1) "institution building," (2) technical, (3) marketing, and (4)

organizational political. Like Mintzberg and Waters, it shows that realized strategy is a combination of deliberate strategy and emergent strategy--the final product roughly resembled the intended product, but it was also significantly different, in terms of cost, functionality, and characteristics like memory size.

The main contribution is that the link between Bower and Doz's ideas and Mintzberg ideas were elaborated. The interrelationships between the four layers of the implementation effort were extensively specified. The implications of the myriad links were also specified, espcially the effects on the intended strategy. That is, the mechanism for emergent strategy was exposed: the many adjustments between the (1) the enacted frame of reference of the core software development group, (2) the technical system of that group, (3) the marketing function, and (4) organizational politics.

The frame of reference which developed among the members of the core group was distinctive. It included their interpretation of goings on at the company, and many of the effects observed at a macro level, especially the political ones, were incorporated in the cognitive map of the group. This map proved to be highly predictive of ultimate events surrounding the 1221, such as the technical and commercial failure, the dissatisfaction, the turnover, and the adverse effect on career development, all of which followed the project.

A definition of implementation

All of this leads to the formal definition of implementation which was implied earlier:

> A complex combination of processes, including social, organizational, political and cognitive (frame of reference building), whereby an organization forms, over time, a pattern of strategic content, a realized strategy.

This realized strategy may contain some elements of a rational, intended strategy; it may also contain elements which emerged non-rationally. The emergent elements are the result of the large amount of interplay among the subprocesses.

Because of these emergent elements, it is not useful, in practical terms, to separate formulation and implementation. Intentional strategic directives do trigger some implementational activity, particularly in machine bureaucracies. But other possibilities are that emergent results (1) may be ratified by so-called "formulators" (which is what happened here), or (2) may significantly constrain future intended ("formulated") strategy, or (3) may be ignored by central management, or (4) may be allowed to develop in experimental fashion. It is certainly more useful to adopt Mintzberg's term "strategy formation" (1977) instead of the "formulation followed by implementation" dichotomy. Alternatively, the term "strategy realization" could be used. Both terms imply a more seamless, less rigidly intentional process, which reflects the reality as seen in this study, and by Bower (1970), Mintzberg (1977, 1978), Mintzberg and Waters (1985), Pettigrew (1977), and Quinn (1980).

Implications for Practicioners

Strategy formation or realization (implementation) involves the management of many processes. It is not simply the blending of technical specifications with rudimentary incentive systems. It involves the management of activities in four distinct areas:

1. activities in the core group, including organizational goals, specifications, and communications, leading to a healthy frame of reference
2. technical activities
3. marketing activities
4. organizational political activities

Strategy formation also involves management of the interrelationships between those clusters of activities. One example is how core group processes like poor communications and the development of a "dunce cap" ethos inhibit technical activities. Another example is how organizational political necessities lead to marketing's mandating changes, which cause technical problems, in turn leading to the core group's re-interpreting organizational reality to include dysfunctional outcomes; all these factors may then, as happened here, actually result in organizational ineffectiveness.

Implementation is not a simple, straightforward process, as this study demonstrates. Merely knowubg this may be useful to overburdened managers, who may be feeling inadequate because things aren't going smoothly. This is particularly true of the political track, an area

which many managers refuse to believe even exists, or in which they may not feel effective. Managers will also benefit from learning that all four tracks are interrelated, that it is not sufficient to do well on only one track. indeed, it may not even be possible to do well on only one track if the other three are mismanaged, given the interdependence among the four tracks.

This research also highlighted the ubiquity of emergent strategy. It is very likely that in any implementation effort there will be elements in the realized strategy that do not correspond to the intended strategy--one should not strive for 100% adherence to the specifications. On the other hand, the seemingly easy slide into an "emergent mode" requires that managers be sensitive to the adequacy of the intended strategy and other mechanisms for keeping realization activities under the strategic umbrella. Here, the semantic differential data showed that there was important lack of agreement on crucial elements of the strategic specification. The cognitive map showed that "lack of a solid product definition" was related, in the minds of the core group's members, to a whole gamut of negative outcomes. The cognitive map and the sociometric data showed that this relationship was aggravated by the poor communications that characterized the group.

Lastly, the study showed that for this organization, the cognitive map which was developed was quite powerful. It incorporated things which were measured using other methods, and it proved to be very predictive of actual outcomes in the project. If this kind of finding

is borne out by future studies, it will mean that managers might be helped by being aware of the cognitive maps of their organizations.

Implications for Scholars

What this study tells us about present theory and knowledge

The results of this study show decisively that the non-rational and political models of strategy formation are good descriptors of strategic implementation. This study provides support for Mintzberg's and Waters's (1985) model of "umbrella strategy." The latter is a strategy where the central management of the organization, usually a professional bureaucracy or adhocracy (Mintzberg, 1979) can only partially specify the strategic intent, by laying down general outlines, an "umbrella," under which the strategy must fit. Relative "emergence" versus "deliberation" is determined by how, and how well, central management deals with deviations from the umbrella. The 1221 organization was a good choice for examining this model, since it was a hybrid between a professional bureaucracy and an adhocracy, and it operated under an umbrella strategy. There is one caveat about the results here--it is not clear how generalizable they are to implementation efforts involving organizations which differ from the kind represented by the 1221 software development group. This caveat applies to much of the discussion in this chapter.

The findings here also provided some support for Bourgeois's and Brodwin's (1984) "crescive model" of strategy implementation. In the

1221 project there was no top-down, analytical formulation of strategy followed by the top-down imposition of implementation. So this project did not resemble their Commander Model. There was no involvement of a management team in some sort of group process, with the end of developing a strategy to which those managers had some commitment. So it did not resemble Bourgeios's and Brodwin's Collaborative Model. There was also no effort to effect change in an organization-wide way, either through applied behavioral science (the Change Model), or through cultural manipulation (the Cultural Model). In the 1221 project, the strategy grew from within the company with the adoption by central management of the Tsou and Miles paper, and the project itself was allowed to emerge. This supports the Bourgeios and Brodwin Crescive Model. Using the same reasoning and evidence, the 1221 findings also support the ideas of Burgelman (1983).

These results also support Pettigrew's political model of strategy formulation. The project had its genesis in demands generated by a powerful top-management coalition; this coalition saw that its demands might be met by the adoption of Tsou's and Miles's ideas. The rest of the project could certainly be characterized as dominated by power mobilization, as various interest groups at NICC vied to either support or disable the 1221 development efforts. And, as was seen above, the results here gave direct support to Narayanan and Fahey's (1982) micro-political model of strategy formulation.

The study does add to Mintzberg's and Waters' notion by showing that it is not enough for the central management to articulate and

monitor an umbrella strategy--it must gain acceptance of a clearly understood umbrella strategy.

Lastly, the study underlined the lack of a true dichotomy between formulation and implementation, and supported the notion of strategy formation or realization.

Questions this study answered

Was there conflict or misunderstanding between the strategic intent and the frame of reference of the project staff? And did it matter? The semantic differential results showed that there was conflict and misunderstanding between the strategic intent and the way that intent was cognitively interpreted by the members of the organization. This was shown in the cognitive map also. Given the nature of this organization, the existence of these problems clearly mattered. Indeed, in their cognitive map, the engineers indicated that they believed that these problems would lead to many negative outcomes, including technical and commercial failure. They were proven right in the end.

Were coordination and communication adequate in the project organization? And did it matter? The sociometric results and the ethnography showed that coordination and communication were not adequate in the 1221 project. That the engineers realized this was manifested in the cognitive map. For the same reasons as were mentioned in the previous paragraph, it definitely mattered that conditions were like this.

Was there a distinctive frame of reference created by this organization, and did it help us understand some of what happened in the project? It is hoped that this paper has demonstrated in painstaking detail that a distinctive frame of reference was enacted by the project staff. This frame of reference proved to be extremely helpful in understanding what happened on this project. Some of the "objective" characteristics of the project, such as the unclear umbrella strategy and the poor communications, were ingested by the group, interpreted by them, and included in an organizational cognitive scheme. Some "objective" outcomes--technical failure, commercial failure, dissatisfaction, turnover, and lack of career development--were accurately predicted by the cognitive map.

Did this research uncover, and help us understand, the interplay between intended and emergent strategy? This research answered this question in the affirmative for organizations like the 1221, which was a complex hybrid between a professional bureaucracy and an adhocracy. It showed that in that kind of organization the degree of "emergence" in the realized strategy depended on (1) the clarity of, and commitment to, the strategic intentions, and (2) the virulence of politics in the organizational context within which such intentions are attempted.

Did the study help us to understand the usefulness of the political models of strategy formation? This was one of the clearest outcomes of this research. The Pettigrew (1977) and Narayanan and Fahey (1982) models of strategy formulation were decisively supported. To some extent, the latter was elaborated as well.

Future research

This study opens up a wide range of possible future studies. For one thing, it identifies four classes of variables which might be important for future studies:

1. institution building variables: ones related to the frames of reference of core organizational groups, and ones measuring communications, interaction, and cognitions about goals
2. technical activity variables
3. marketing activity variables
4. organizational political variables

Perhaps even more important, the study raises the issue of the interrelationships among these classes of variables. For example, what would this process look like in an organization where the givens and means were more positive, such as one where the strategic specification was clear, people agreed on it, communications were good, and organizational politics were supportive? Would the results be more "deliberate?" Or would the realized strategy still be "emergent," except in a more positive way? Is the pattern of the 1221 typical of implementation efforts, hindering the answering of this question?

There are other, larger questions: How important is the frame of reference in implementation? Here, the core group's frame of reference had its finger on the pulse of what was happening, and what would happen--is this typical? Here, the project was not truly innovative, was not developing or using cutting edge technology; would the results,

particularly concerning the vagueness of the intended strategy, be the same in a more "innovative" project? How does the paradigm developed in this study apply to non-technical organizations? How does it differ between manufacturing and service organizations? Between profit and not-for-profit organizations? Are the classes of variables the same? Are the interrelationships the same? Are the dynamics described in this paper the same, or does one track or another dominate in various organizations? Are these phenomena contingent on the type of industry in which the organization is acting? Are they organization-specific? Would organizations <u>always</u> benefit from keeping tighter reins on the intended strategy? Or does that cut off the possibilities for departures from intended strategy that actually result in better products or services? Are there no benefits to vagueness?½

Because this was a case study, it was difficult to generalize, and it was also difficult to find ways to contrast the variables in such a way as to answer some of these important questions. In effect, this study generated more questions than it answered, although it <u>did</u> answer some. The intent of the study was to examine the literature, to develop a different view of implementation, to specify the implications of that view (in the form of research questions), to draw upon the empirical results here for some modest substantiation of that view and its implications, and to construct a model for future testing and elaboration. In some ways this project was trying to do the same thing as the 1221 project, but with even less specification up front, and fewer controls along the way--it was more emergent than the 1221

project. Perhaps that is appropriate for a creative, one hopes innovative, scholarly work. In any case, it is hoped that the realization, be it deliberate or emergent, is useful, and leads to much fruitful work in the future.

A P P E N D I X A

SEMANTIC DIFFERENTIAL QUESTIONNAIRE, 1221 PROJECT

Questionnaire Instructions

The purpose of this questionnaire is to measure the meanings of certain things to people of the 1221 project by having them judge them against a series of descriptive scales. In completing this questionnaire, please make your judgements on the basis of what these things mean to you. On each page of this booklet you will find a different concept to be judged, and beneath it a set of scales. You are to rate the concept on each of these scales in order.

Here is how you are to use these scales:

If you feel that the concept at the top of the page is very closely related to one end of the scale, you should place your check mark as follows:

fair ___X___:___:___:___:___:___:___ unfair

or

fair ___:___:___:___:___:___:___X___ unfair

If you feel that the concept is quite closely related to one or the other end of the scale (but not extremely), you should place your check mark as follows:

strong ___:___X___:___:___:___:___:___ weak

or

strong ___:___:___:___:___:___X___:___ weak

If the concept seems only slightly related to one side as opposed to the other side (but is not really neutral), then you should check as follows:

active ___:___:__X_:___:___:___:___ passive

or

active ___:___:___:___:__X_:___:___ passive

The direction toward which you check, of course, depends upon which of the two ends of the scale seem most characteristic of the thing you're judging.

If you consider the concept to be neutral on the scale, both sides of scale equally associated with the concept, or if the scale is completely irrelevant, unrelated to the concept, then you should place your check mark in the middle space:

safe ___:___:___:__X_:___:___:___ dangerous

IMPORTANT:

(1) Place your check marks in the middle of spaces, not on the boundaries:

THIS NOT THIS
___:___:_X_:___:___X___:___

(2) Be sure you check every scale for every concept--do not omit any.

(3) Never put more than one check mark on a single scale.

Do not look back and forth through the items. Do not try to remember how you checked similar items earlier in the questionnaire. Make each item a separate and independent judgement. Do not worry or

puzzle over individual items. It is your first impressions, the immediate "feelings" about the items, that we want. On the other hand, please do not be careless, because we want your true impressions.

Thank you for your time and effort.

Compatibility Requirements

good	____:____:____:____:____:____:____	bad
optimistic	____:____:____:____:____:____:____	pessimistic
complete	____:____:____:____:____:____:____	incomplete
timely	____:____:____:____:____:____:____	untimely
pleasurable	____:____:____:____:____:____:____	painful
sociable	____:____:____:____:____:____:____	unsociable
harmonious	____:____:____:____:____:____:____	dissonant
permissive	____:____:____:____:____:____:____	restrictive
successful	____:____:____:____:____:____:____	unsuccessful
high	____:____:____:____:____:____:____	low
meaningful	____:____:____:____:____:____:____	meaningless
progressive	____:____:____:____:____:____:____	regressive
important	____:____:____:____:____:____:____	unimportant
constrained	____:____:____:____:____:____:____	free
positive	____:____:____:____:____:____:____	negative
reputable	____:____:____:____:____:____:____	disreputable
wise	____:____:____:____:____:____:____	foolish
hard	____:____:____:____:____:____:____	soft
strong	____:____:____:____:____:____:____	weak
excitable	____:____:____:____:____:____:____	calm

Lots of Functionality

good	____:____:____:____:____:____:____	bad
optimistic	____:____:____:____:____:____:____	pessimistic
complete	____:____:____:____:____:____:____	incomplete
timely	____:____:____:____:____:____:____	untimely
pleasurable	____:____:____:____:____:____:____	painful
sociable	____:____:____:____:____:____:____	unsociable
harmonious	____:____:____:____:____:____:____	dissonant
permissive	____:____:____:____:____:____:____	restrictive
successful	____:____:____:____:____:____:____	unsuccessful
high	____:____:____:____:____:____:____	low
meaningful	____:____:____:____:____:____:____	meaningless
progressive	____:____:____:____:____:____:____	regressive
important	____:____:____:____:____:____:____	unimportant
constrained	____:____:____:____:____:____:____	free
positive	____:____:____:____:____:____:____	negative
reputable	____:____:____:____:____:____:____	disreputable
wise	____:____:____:____:____:____:____	foolish
hard	____:____:____:____:____:____:____	soft
strong	____:____:____:____:____:____:____	weak
excitable	____:____:____:____:____:____:____	calm

First Customer Shipment by May

good	____:____:____:____:____:____:____	bad
optimistic	____:____:____:____:____:____:____	pessimistic
complete	____:____:____:____:____:____:____	incomplete
timely	____:____:____:____:____:____:____	untimely
pleasurable	____:____:____:____:____:____:____	painful
sociable	____:____:____:____:____:____:____	unsociable
harmonious	____:____:____:____:____:____:____	dissonant
permissive	____:____:____:____:____:____:____	restrictive
successful	____:____:____:____:____:____:____	unsuccessful
high	____:____:____:____:____:____:____	low
meaningful	____:____:____:____:____:____:____	meaningless
progressive	____:____:____:____:____:____:____	regressive
important	____:____:____:____:____:____:____	unimportant
constrained	____:____:____:____:____:____:____	free
positive	____:____:____:____:____:____:____	negative
reputable	____:____:____:____:____:____:____	disreputable
wise	____:____:____:____:____:____:____	foolish
hard	____:____:____:____:____:____:____	soft
strong	____:____:____:____:____:____:____	weak
excitable	____:____:____:____:____:____:____	calm

"State of the Art" Work

good	____:____:____:____:____:____:____	bad
optimistic	____:____:____:____:____:____:____	pessimistic
complete	____:____:____:____:____:____:____	incomplete
timely	____:____:____:____:____:____:____	untimely
pleasurable	____:____:____:____:____:____:____	painful
sociable	____:____:____:____:____:____:____	unsociable
harmonious	____:____:____:____:____:____:____	dissonant
permissive	____:____:____:____:____:____:____	restrictive
successful	____:____:____:____:____:____:____	unsuccessful
high	____:____:____:____:____:____:____	low
meaningful	____:____:____:____:____:____:____	meaningless
progressive	____:____:____:____:____:____:____	regressive
important	____:____:____:____:____:____:____	unimportant
constrained	____:____:____:____:____:____:____	free
positive	____:____:____:____:____:____:____	negative
reputable	____:____:____:____:____:____:____	disreputable
wise	____:____:____:____:____:____:____	foolish
hard	____:____:____:____:____:____:____	soft
strong	____:____:____:____:____:____:____	weak
excitable	____:____:____:____:____:____:____	calm

Low End Product

good	____:____:____:____:____:____:____	bad
optimistic	____:____:____:____:____:____:____	pessimistic
complete	____:____:____:____:____:____:____	incomplete
timely	____:____:____:____:____:____:____	untimely
pleasurable	____:____:____:____:____:____:____	painful
sociable	____:____:____:____:____:____:____	unsociable
harmonious	____:____:____:____:____:____:____	dissonant
permissive	____:____:____:____:____:____:____	restrictive
successful	____:____:____:____:____:____:____	unsuccessful
high	____:____:____:____:____:____:____	low
meaningful	____:____:____:____:____:____:____	meaningless
progressive	____:____:____:____:____:____:____	regressive
important	____:____:____:____:____:____:____	unimportant
constrained	____:____:____:____:____:____:____	free
positive	____:____:____:____:____:____:____	negative
reputable	____:____:____:____:____:____:____	disreputable
wise	____:____:____:____:____:____:____	foolish
hard	____:____:____:____:____:____:____	soft
strong	____:____:____:____:____:____:____	weak
excitable	____:____:____:____:____:____:____	calm

Technical Excellence

good	____:____:____:____:____:____:____	bad
optimistic	____:____:____:____:____:____:____	pessimistic
complete	____:____:____:____:____:____:____	incomplete
timely	____:____:____:____:____:____:____	untimely
pleasurable	____:____:____:____:____:____:____	painful
sociable	____:____:____:____:____:____:____	unsociable
harmonious	____:____:____:____:____:____:____	dissonant
permissive	____:____:____:____:____:____:____	restrictive
successful	____:____:____:____:____:____:____	unsuccessful
high	____:____:____:____:____:____:____	low
meaningful	____:____:____:____:____:____:____	meaningless
progressive	____:____:____:____:____:____:____	regressive
important	____:____:____:____:____:____:____	unimportant
constrained	____:____:____:____:____:____:____	free
positive	____:____:____:____:____:____:____	negative
reputable	____:____:____:____:____:____:____	disreputable
wise	____:____:____:____:____:____:____	foolish
hard	____:____:____:____:____:____:____	soft
strong	____:____:____:____:____:____:____	weak
excitable	____:____:____:____:____:____:____	calm

A P P E N D I X B

INTERVIEW QUESTIONS, 1221 PROJECT

Preliminary instructions

After introductions, the interviewer reviewed the research project, saying that it was an effort to understand how development projects are carried out. Respondents were then told that the purpose of the interview was to get information about how the project was actually carried out, and that the best way to get this was to find out directly from the people involved. They were told that in this interview the researcher would ask questions and make notes, that it was a very straightforward interview.

Confidentiality was discusses. Respondents were told that they were free to not answer any or all questions, that no one would know. Data would be identified by code number, and would be aggregated. No quotations would be used without written permission.

Because the university and the company had applied for a federal grant, a university committee, which oversees the rights of people involved in research, required a release form to be read and signed by all respondents. All interviewees signed the form.

The questions

What is the name of your position?

How long have you been in this position?

How long have you been at NICC?

Where had you done similar or related work before?

How long had you worked elsewhere?

What things do you do in your present position?

To whom do you report?

Who reports to you?

On what project(s) are you currently working?

How long have you been working on it (them)?

When will it (they) be finished?

We are interested in learning about the workflow on the project. When your project(s) is (are) finished, where does it (do they) go (to what person, position, or unit)? How will it (they) be used by them?

Who assigned you to this (these) project(s)?

Upon what things that someone else has done does this (do these) project(s) build, use, extend, or depend?

How do you determine how to do your assigned project? (probes: using established methods, using basic knowledge, solving problems, developing solutions, creating new things)

If you have a very general, philosophical question on a technical matter, whom would you consult first? If that person were not available, to whom would you go next? Is there a third person to whom you would go? Can you give illustrations of what you have gone to others for? [NOTE: these questions are where the technical sociometric data were gathered.]

When you have problems or need assistance in handling some

administrative aspect of the project, e.g., specifications, schedule, or tools, to whom would you go for assistance first? To whom would you go next? Is there a third person to whom you would go? Give some illustrations of what you have gone to others for. [NOTE: these questions are where the administrative sociometric data were gathered.]

Who are the people here with whom you socialize? [NOTE: these questions are where the social sociometric data were gathered.]

Think about yesterday (or the last working day). What activities did you do? Use as simple a term as will identify what was done, e.g., attend meetings, code, debug, etc. How much time did you spend on each, within a quarter of an hour?

Was this typical of last week? What activities would have to be added, and deleted, to make it represent last week? How much time (hours per day) was spent on these activities last week?

In the period of a week, with which people do you come in contact? List names and what groups they are with. Which of these would you see frequently, i.e., once a day on average?

Are there any people with whom you came in contact during the last month who are not on this list? List names and groups.

Of the people on both lists, with whom do you initiate contact, and who initiates contact with you? Obviously, some people can be on both lists.

A P P E N D I X C

COGNITIVE MAPPING INSTRUMENT

Instructions

A little while ago I conducted a series of distinctive interviews with several members of the 1221 project, where the respondents were asked to question themselves about their view of the 1221 project. These interviews were the first step in a process designed to uncover the aggregate frame of reference of the 1221 organization, in the form of a map of the concepts which members think are important, and how those concepts fit together.

The self-questioning interviews yielded a very large number of questions. From those I attempted to distill concepts. I had an opportunity to check some of my distillation with some of the respondents, and found that I was on the mark virtually all the time. I think that this was largely a function of the clarity of thinking and the consensus among the members of the 1221 organization whom I interviewed.

Once all the individual concepts were distilled from the questions, I set about finding out which of these many concepts were found in the cognitive fields of most of the members, or, in other words, where were the overlapping concepts, so that we could begin finally to construct the aggregate map. Here are the fourteen concepts that were held in common by the respondents:

1. The management we have experienced on this project
2. The schedules and deadlines we have had on this project
3. The poor communications and the competition among the groups in the 1221 organization
4. The commercial success of the 1221
5. Company politics
6. The bad tools and scarce resources we've experienced on this project
7. Poor morale and dissatisfaction
8. Working on this project
9. The lack of a solid product definition
10. The personal career development of an engineer
11. Leaving the 1221 project
12. The quality of an engineer's performance
13. The lack of consultation of the engineers on technical matters
14. The technical success of the 1221

These are the fourteen things that were on the minds of half or more of the organizational members questioned. The only step that remains for the construction of the aggregate cognitive map is for you members of the 1221 organization to indicate how these fourteen concepts are interrelated. That is the purpose of today's session.

The remainder of this document will present you with all possible pairs (except of a concept with itself) of the fourteen concepts. For each pair you will be asked to indicate your opinion about whether the first concept causes the second concept. You will have three choices for each pair:

1. No [concept A does not cause concept B]
2. There is a positive relationship [that is, increasing concept A results in an increase in concept B, or decreasing concept A results in a decrease in concept B]
3. There is an inverse relationship [that is, an increase in concept A results in a decrease in concept B, or a decrease in concept A results in an increase in concept B]

An example

Let me present a very simplistic example to illustrate the procedure. Assume that we have queried several high school students about their view of high school, and the result is that only three concepts "overlap" in this sample:

1. Good grades
2. Studying
3. Watching TV

We want to find out how these three concepts are interrelated in the minds of group members. Here is one question we could ask:

Does studying cause good grades?

If a student felt that studying caused him or her to get good grades, it would be an example of a positive relationship, and he or she would answer the question as follows:

(check one)

[0] ___ No
[+1] X There is a positive relationship.
[-1] ___ There is an inverse relationship.

Another question we might ask is:

Does watching TV cause good grades?

If the student feels that watching TV lowers grades, while not watching TV helps keep grades high, it is an example of an inverse relationship, and the student would answer the question as follows:

(check one)

[0] ___ No
[+1] ___ There is a positive relationship.
[-1] X There is an inverse relationship.

This is somewhat tricky, because the student in effect is saying that TV watching causes bad grades. The only way that the student can indicate this is by checking the line that says that there is an inverse relationship between TV watching and good grades. THIS MAY BE THE CASE FOR SOME OF THE CONCEPTS YOU ARE BEING ASKED TO INTERRELATE, SO PLEASE BE ALERT TO THIS WAY OF THINKING ABOUT RELATIONSHIPS.

Lastly, an example of another question we must ask, in order to ascertain all the interrelationships, is:

Do good grades cause watching TV?

Assume that our mythical student believes that his or her TV watching patterns have nothing to do with what grades he or she gets. This question would therefore be answered as follows:

(check one)

[0] X No
[+1] ___ There is a positive relationship.
[-1] ___ There is an inverse relationship.

* * * * *

This concludes the example and all other explanations. Please proceed directly to the first pair of concepts. If you have any questions, I will be here for whatever time it takes. I estimate the needed time to be about one half hour.

Representative Questions

Does the management we have experienced on this project cause the schedules and deadlines we have had on this project? (check one)

[0] ___ No
[+1] ___ There is a positive relationship.
[-1] ___ There is an inverse relationship.

Does the management we have experienced on this project cause the poor communications and the competition among the groups in the 1221 organization? (check one)

[0] ___ No
[+1] ___ There is a positive relationship.
[-1] ___ There is an inverse relationship.

Does the management we have experienced on this project cause the commercial success of the 1221? (check one)

[0] ___ No
[+1] ___ There is a positive relationship.
[-1] ___ There is an inverse relationship.

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