ORGANIZATION OBJECTIVES AND MANAGERIAL CONTROL

by

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ABSTRACT

The central problem in this thesis is the study of the effect an organization objective has for managerial control. We have hypothesized: 1) to the extent that an objective is possible, workable, and operational, that is, feasible, it will more probably be accepted by relevant organization members; and 2) to the extent that an objective is feasible and accepted by relevant organization members, it is probable that the initiating group will assume control over its direction. The notion of organizational acceptance holds special problems. The initiating group in gaining acceptance from other organizational members usually must sacrifice some of its control over the formulation and/or implementation of its proposed objective. This introduces the concept of bargaining as a goal-setting device.

We have attempted to test these propositions using mainly interview data collected in a large and diversified steel tube manufacturing operation. The central management group of this vast concern ten years ago introduced a research project into "getting involved in the use of computers". Development of this imprecise organization objective has progressed to the point where the firm has now committed itself to a third generation "real-time" computer for the purposes of achieving integrated data processing through-

out the fourteen companies involved in the manufacturing complex, and the eventual establishment of a centrally administered integrated control system. There are three major groups involved in the computer application - an individually organized computer unit, the central coordinating administrative body, and the companies.

We have analysed the data relating to this organizational objective with the help of a cyclic model that we devised. During the development of an objective, various processes occur. These are: 1) search - the process of looking for alternative courses of action, their consequences, and attempting to arrive at a "satisfactory" conclusion; 2)consolidation - the process whereby a proposed objective becomes relatively stabilized and formalized as a result of interest group and subgoal formation; and, 3)conflict/change or change/conflict - the process whereby the balance of costs and benefits is disrupted such that conflict occurs and change is implied, or, the process where internal or external events cause change in the established relationships sufficient to incur conflict. Because we believe these processes to be recurring, we have used this cyclic model as a means to describe and explain the development of the organization objective.

The findings of our research tend to corroborate our hypotheses. Following are some of our main conclusions:

1)the search process becomes more focused and well defined as the objective develops through successive cycles; 2)the "perceived" workability of an objective presents as great a pressure for acceptance as does its "actual" workability; 3)interest group and subgoal formation caused by specialization of function tend to create difficulties in communication and thus endanger a "successful" implementation of the objective; 4)the process of bargaining increases in conflict and change situations; 5)conflict acts as both a control over and a stimulator of change; and, 6)the tighter the desired control, the more precise must be the objectives.

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I. Introduction

This is a case study of a steel tube manufacturing division of a large international holding company. Our purpose is to explain how an organizational objective develops and what ramifications this development has for management control. We have accomplished this purpose by analysing this corporation's initial decision to "get involved in the use of computers", through a period of ten years to its latest specified objective to "attain integrated data processing throughout the steel tube division".

The bases for this study are two. On the one hand, the Chairman of the corporation, very much aware that his vast organization was in a state of rapid change, was keenly interested in the prospect of independent, unbiased, social science research into some of the problems that his managers were undoubtedly confronting. On the other hand, this firm presented some exciting possibilities for the sociological study of an organization as a control system. Research had already progressed to the stage where it was imperative to test some propositions in order that subsequent investigation of managerial control might continue. An examination of these two bases should reveal both some background of this study and a justification for its

inception.

First, the senior management of this firm was faced with a diversity that was becoming increasingly difficult to evaluate. The steel tube division consists of fourteen companies organized into six groups on a product and process basis. These companies range: in size from under 100 employees to over 3,500; in technology from essentially jobbing plants to continuous tube production operations; in products from hypodermic needle tubing to huge steam boilers; and in markets from the situation where one customer represents ninety percent of total sales to the case where literally thousands of customers account for the sales picture. To complicate things even further, these companies are dispersed rather widely geographically, although there is a concentration of them in one industrial area.

A number of other features are also significant. The chairmanship of this corporation recently changed hands. The new man, together with his executive committee, is intensely committed to the concept of planning and is extremely interested in all information-generating techniques available. In addition, a slight recession and increased local and foreign competition resulted in demands for more knowledge and information on which to base decisions. These three factors - an increasing diversity in manufacturing operations, a change in senior management

personnel, and a slight recession in trading conditions - all contributed toward an increasing preoccupation with control systems. The decision to purchase electronic data processing equipment represents one of the methods whereby the senior management of this firm attempted to achieve integrated control. The decision to endorse sociological research into the elements of managerial control represents one of the methods whereby this same management group could assess the effects of its control activities.

The second reason for this particular study can be outlined briefly by referring to the activity of the social science research unit headed by Miss Joan Woodward.[1] Recently termed "the task analysis approach to the study of organizations", investigation originally began about ten years ago with the study of 100 manufacturing firms located in the south of England.[2] These investigations revealed that firms are organized in relation to a multi- dimensional scale of technology. It was later determined that the middle range of technology, that is, large batch and assembly-line production, held special problems. Unlike the situations in unit and small batch production on the one hand, and continuous process production on the other, production objectives cannot be incorporated through work experience, and so a separate control system has to be established to ensure that these objectives are met.[3]

> The separation of production administration from production operations, the rationalization and prescription of production methods and the continuous attempts to push back the physical limitations of production result in the emergence of a control system that depends in part on the physical work flow and in part on top management policy. The degree of precision with which standards are set, the system used to generate and evaluate control information and even the explicitness with which objectives and plans are defined, are related to managerial policy rather than to technological limitations and constraints. [4]

The above conclusion has resulted in intensive research focused on the so called middle range of technology. A new emphasis on managerial control, now included as yet another dimension of technology, has thus been fused with the original project. Consequently, the opportunity to study the fourteen firms comprising the steel tube division, all exhibiting large batch or mass production characteristics, was warmly welcomed by the research unit.

Initially, Miss Woodward conducted an investigation of all six divisions contained within this corporation. She concluded in her first report[5] that subsequent research would be more fruitful if limited to the largest and most complex of the manufacturing divisions (i.e., steel tubes), and the companies within this division were treated as an integrated system of resources, the distribution of which would have to be determined by further investigation.

A second study was launched on this basis.[6] It concluded that in order to be compatible with the eventual establishment of a single control system to which senior divisional management was committed, "the objectives of the division needed to be made more explicit and communicated more effectively to the companies".[7]

These studies, in turn, have let to the subject for inquiry in this thesis. The scope of the investigation is as follows. Concerned with industrial organization in large batch and mass production operations, we have focused on managerial control as a significant and identifying characteristic of this type of technology. Central to any problem of control is the notion of objectives, for one can control only in relation to some sort of standard or goal. Consequently, we have chosen to study the development of one, albeit encompassing, organizational objective and attempt to explain the course of its development in terms of managerial control. By this method, we hope to devise a set of explanatory propositions concerning the pervasive yet evasive notion of control.

The two bases of this study are in a way complementary. We have just stated how control in relation to some objective is crucial to the theoretical explanation of a significant area of organizational activity. Similarly, the practical workings of organization are very much involved with the aspect of control. In fact, the organi-

zational objective that we have chosen for study is the achieving of integrated control. Consequently, it is reasonable to assume that what is learned in theoretical endeavor can be applied to practical problems and vice versa.

We will pursue this investigation with a detailed examination of the problem. We will define what an organizational objective is, how it is formed, and present a cyclic model that describes the course of its development. This analysis will highlight the problems of control that occur as early as the formation of objectives, for rarely, if ever, do the members of an arbitrarily defined group such as "management" approach a problem in the same way or offer the same methods for its solution. Consequently, we subscribe to the view of the firm as a political coalition.[8]

Subsequent to the theoretical presentation of the problem, we will describe briefly the historical and situational background of the research setting. Following a discussion of the methods we have used to conduct this research, we will analyse the data using the cyclic model that we propose in the theoretical section. Finally we will present our conclusions and attempt to tie in with the mainstream that the growing literature on organizational theory is producing.

II. Theoretical Framework: The Problem for Research

An organizational objective is a bargain struck by several of its members on a relatively comprehensive level and maintained largely by precedent.[9] According to Simon, there is a hierarchy of objectives or bargains, "each step downward in the hierarchy consisting in an implementation of the goals set forth in the step immediately above".[10] This notion implies that the decision or goal hierarchy is roughly parallel to the management hierarchy, that is, the upper levels are involved with succeedingly comprehensive task areas. In other words, although bargains are made on every organizational level, those made on the higher levels affect organizational activity in a more all-embracing manner. It is the task of management to regulate and coordinate these bargains or goals on all organizational levels.

> The function of management, in any economic unit, is to coordinate the mass of bargains so that they equate inflow and outflow at a level and with a composition that provides for everyone on whom that result depends a cost of agreement lower than the cost of disagreement. Whatever discretion and income remain unallocated after all bargains have been coordinated accrue to management as a basis for managerial initiative and achievement. To maintain the balance at a preferred level management must continually manipulate and renegotiate bargains.[11]

This view of organizational objectives conflicts with the representation of the firm as a harmonious unit with the goals of the chief executive being the goals of the other organizational members either as a result of payments made (wages, interest, kind, etc.) or because these goals represent the "common interest". Although this model is analytically more simple, it has been charged that it is empirically not valid and that "actual organizational goals cannot normally be described in terms of a joint preference ordering"[12]. In order to present an empirically realistic model of organizational behavior in relation to goal formation and control activity, we will attempt to describe how an organization objective is formed and the likely course of its development.

Feasibility of objectives

One of the first things that any management group must consider in relation to its objective is whether or not it is feasible. Feasibility of an objective is necessary for its implementation and acts as a powerful force toward its acceptance by other organizational members.[13] Feasibility at the initial point of objective formulation can be equated with possibility. In other words, is the intended objective contained within limits of possible implementation? For example, are there the required kinds of resources and in sufficient quantity and of the desired

quality? Feasibility at this stage involves basic questions concerning capital, labor, plant and equipment, and raw materials. Gradually, as these problems become resolved, attention is turned toward more concrete plans, schedules and techniques for implementation.

Questions of feasibility range on a continuum that become more focused and specific as the objective is defined more precisely and is advanced toward implementation. For example, an objective's workability, that is, "how simply and clearly its underlying conception ... [can] actually be implemented", forms an important point on the feasibility continuum. No matter how possible an objective is, if there is no program that elaborates and spells out in terms of "concrete administrative activities" and which leads to a "workable allocation of decision-making responsibilities", then it must either be doomed to failure or else revised so that in fact there is a workable program for its implementation.[14]

One of the final points on the feasibility continuum is the operationality of the intended objective, that is, "the extent to which it is possible to observe and test how well goals are being achieved".[15] For example, the explicitness of an objective affects its operationality. Explicitness involves: a) the degree to which priorities are stipulated, b) the extent to which methods for implementation are stated; and c) the extent to which these

priorities and methods are related to some sort of time schedule.

Another aspect affecting the operationality of an objective is the extent to which it is limited or continuous.[16] It is much easier to appraise whether the objective to construct a specified building on a specified site has been achieved than it is to determine whether the objective to maximize profit in the cigarette industry has been achieved. By limiting a so called continuous objective, operationality can be attained. Thus, the continuous objective of profit maximization in the cigarette industry can be changed to the limited and operational objective of returning thirty per cent on capital employed for the present financial year.

The relative concreteness or abstractness of an objective also affects its operationality.[17] We are here referring to an objective as expressed in the product.

> This is a matter of tangibility and is verbally expressed by such questions as the precision with which the product can be described, the specificity with which it can be identified, and the extent to which it can be measured and evaluated. [18]

If an organization is heavily research and development oriented, the nature of its product will not be as concrete as in the organization that mass produces a well defined and standard set of products. In some non-man-

ufacturing organizations, for example, products become quite abstract and intangible causing managements to specify only areas of activity rather than specific activities designed to produce specific products.

These three factors - the explicitness, limitedness, and abstractness of an objective - all affect its operationality.

> Goals that are included in the definition of the situation influence choice only if there are some means, valid or illusory, for determining the connections between alternative actions and goal satisfaction - only if it can somehow be determined whether and to what extent these goals will be realized if particular courses of action are chosen. 19

Thus, the development of an organization objective occurs on a feasibility continuum ranging from problems involving the possibility of implementation to more specific problems of workability and operationality. To the extent that an objective is possible, workable, and operational (i.e., feasible), it will more probably be accepted by other relevant organization members.

Acceptance of objectives

Acceptance of a proposed objective constitutes the second major step in its formulation. Acceptance is necessary for implementation and to the extent that an object-

ive is accepted, the initiating group can assume control over its direction. Here we must introduce the presence of various interest groups, formally or informally constituted, but all with either differing alternative objectives or at least differing suggestions for implementing the proposed objective. We have already stated that an objective's feasibility presents a strong force for its acceptance. Let us now analyse in detail the notion of acceptance and the implications that arise.

The degree of acceptance of a proposed objective can also be placed on a continuum ranging from open conflict against its implementation to full endorsement. Consequently, for each of the various interest groups described above, it is possible to plot their degree of acceptance and thereby assess the chances for successful implementation. If the chances are poor, it may be necessary for the initiating group to modify its objectives so that it will stand a better chance of being accepted. What we are proposing is a continuum of interest group formation ranging from the unlikely yet possible complete conflict of interests to the equally ideal situation of perfect common interest. Points on this scale that we will discuss include: conflict, competition, bargaining, coalition, and merger.

As we indicated earlier, interest groups may be formal or informal. Informal interest groups, organized as a result of in-group communication and other associational

criteria (e.g., educational, voluntary, and professional associations), arise haphazardly and for a variety of reasons. Formal interest groups arise out of the division of labor and the specialization of function.

> ... each member of the top hierarchy represents both an expertise and a problem; this in turn makes him the virtual representative of the problem area in the decisional process. The seriousness of the problem for the decisional process and its recognition determine the status of the problem-solving activity and its head in the organizational hierarchy. The defense of this problem-solving competence and its importance becomes a major drive of the specialized functionaries. [20]

Specialization of function and delegation of authority have the unintended consequence of stimulating conflict by bifurcating interests among formally prescribed organizational subgroups.[21] Depending upon environmental factors and the nature of the various bifurcated interests or subgoals, the intensity of variance may be termed conflict or competition. If extensive conflict prevails, a proposed objective has little chance of successful implementation. Therefore, conflict must be reduced to a point where implementation can occur. Often this involves either a "watering down" of the original proposal and/or a reduction in control over its implementation. Intraorganizational conflict and competition tend "to prevent unilateral or

arbitrary choice of organizational goals".[22] In order for a proposal to be implemented and attain the generality and attention to be called an organization objective, it must sometimes be modified to complement other organizational aims and the goals of various subunits. In addition, control over its direction is shared by other organizational members. The negotiation that this involves brings us to a discussion of bargaining as a means of formulating and implementing objectives.

While conflict and competition often require mediation by a third party, the concept of bargaining as a goal-setting device involves the direct interaction of various interest groups.[23] Each interest group, intent on implementing its own proposals, must seek alliances or make bargains sufficient to induce other groups to comply with and endorse its objectives.

> A policy constitutes the terms offered by some to achieve their objectives, and it will be accepted only when the cost of agreement of those whose approval is needed is less than their cost of disagreement. Policy proposals have no chance of acceptance unless they recommend themselves to some party with sufficient bargaining power to secure their adoption. They make an impact only when they suggest the means for someone's accomplishing his objective who has sufficient bargaining power to secure the adoption of this means. They will be modified to purify them of anything which runs counter to this purpose, and to some extent they will be defiled

> with concessions designed only to induce the necessary others to agree on these terms. 24

Bargains often result in the formation of coalitions of interest groups who jointly have sufficient bargaining power to implement their objectives. In this situation, the chief executive often acts as a political broker manipulating and coordinating bargains.

> On the one hand, he must select a coalition that has relatively low "costs" of maintenance and relatively high returns from the environment. On the other hand, he must so structure the payments made to coalition members as to make the shifts in demands conducive to increasing the difference between total demands and total resources. 25

Merger, one of the final points on the interest group formation continuum, represents a relatively permanent and therefore more ideal, less empirically found type of coalition. Only seldom do the interests and, consequently, objectives of two factions concur sufficiently to justify an indefinite union of interests. This is in fact why the equilibrium (systematic) type of analysis fails in many cases to achieve empirical validity. 26

Thus, acceptance of a proposed objective also ranges along a continuum. At the one extreme, a conflict of interest permits the initiating group to retain each feature of its proposed objective, yet impedes its implementation

because of lack of acceptance. In the middle range, the bargaining situation causes the initiating group to sacrifice some of its features and, consequently, even some control over the direction of the objective, but it does stand a chance at implementation. At the other extreme, a union of interests permits the initiating group to retain all features of its proposed objective, although control over its direction is reduced in the partial transfer of its management to the other (common) interest group. Chances for implementation though are most probable in this case. However, as we stated above, the "common interest" case is empirically unlikely.

It would appear then that the majority of proposed objectives are hashed out, reformulated, and finally accepted as a result of the complex of bargains and coalitions that forms part of the activity of industrial management. To the extent that an objective is feasible and accepted by relevant organization members, it is probable that the initiating group will assume control over its direction and implementation.

Objectives and control

The complex activity we have described as objective formulation has important implications for management control. Unlike some theories of organizational behavior, we do not advocate that objectives are formed as a result

of the joint preference ordering of the group called management. Top management policy is arrived at as a consequence of the relative bargaining power each management interest group or each specialized management function can muster for the particular issue at hand. Depending upon the specific situation, these interest groups can exert more or less control over the problem, its formulation, and its eventual implementation and direction.

We are not implying that bargaining is the sole prerogative of management. The whole continuum of interest group formation and/or acceptance is applicable to every organization member. It is only that as one proceeds up the organizational hierarchy, proposed objectives take on a more comprehensive nature and therefore have wider and fuller implications for the organization as a whole. Consequently, those senior management groups who can get feasible proposals accepted as organizational objectives stand a greater chance of exercising control over the activities that these objectives encompass.

Depending upon the particular problem and the feasibility of the objective proposed to deal with it, interest groups, usually formally derived, form on the basis of their acceptance of the proposal and/or their alternative "solutions" to the problem. The fact that interest groups do propose alternative objectives introduces the notion of subgoals.

> When tasks have been allocated to an organizational unit in terms of a subgoal, other subgoals and other aspects of the larger organization tend to be ignored in the decisions of the subunit. In part, this bias in decision-making can be attributed to shifts in the focus of attention. The definition of the situation that the subunit employs is simplified by omitting some criteria and paying particular attention to others. In particular, we expect the focus of attention to be a function of the differentiation of subgoals and the persistence of subgoals. 27

Emphasis on subgoals or limitedness in the focus of attention can be attributed to several factors: 1) the division of labor and the specialization of function to which we have already referred creates formal positions with specialized tasks and, consequently, differing perspectives as to the activities and priorities with which an organization should be concerned; 2) the formal and specialized training that the specialization of function requires equips the tainees with an orientation unique to their training; 3) the nature of the job that the specialized experts are required to perform demands that unequal attention and energy be paid to certain task areas; 4)during the execution of these specialized functions, experts are continually interacting with colleagues with similar tasks, orientations, and predispositions; and finally, 5) because these experts are the sole representatives of their specialized functions, they are inclined to defend

and promote these functions in order to enhance their position and status within the organization.

Consequently, subgoal preoccupation tends to strengthen and maintain interest group formation and conflict due to individual "reinforcement through selective perception and rationalization", group "reinforcement through the content of in-group communication", and organizational "reinforcement through selective exposure to environmental stimuli".[28] In other words, selective perception, communication, and exposure lead to bifurcation of interests which leads to increased conflict among organizational subunits which in turn causes greater elaboration of subunit ideologies.

The problem of control is multi-faceted. From the initiating group, there is pressure and even inducement for other relevant organizational members to accept its proposed objective. In turn, interest groups form on the basis of this proposal and their own subgoals, and generate pressures ranging from acceptance to rejection. At the same time, it is the task of the chief executives to give weight to all proposed objectives and thus place them in their "proper" organizational perspective.

What we have proposed is that to the extent that the initiator, whether it be an interest group or even the chief executive, presents a feasible objective, it will

more likely be accepted, and thus control over its implementation will accrue to the initiating body. However, to the extent that other interest groups can cause modification of the proposed objective, they also exert control over its implementation and direction. In this way, an organization objective is formed. It remains in force largely because "past bargains become precedents for present situations".[29] Also, if an objective is officially approved, organizational members feel compelled to accept it because they accept the system of authority that approved it.[30]

A cyclic model of the development of an organization objective

It is our purpose in this section to present a model that describes the development of an objective and the problems of control that arise. The processes contained within this moded we believe to be recurring as will be evidenced when we present our data.

1) Search is the process of looking for alternative courses of action, their consequences, and attempting to arrive at a "satisfactory" conclusion.[31] This involves determining the possibility, workability, and operationality of the various alternatives, at the same time ascertaining which interest groups find what alternatives more or less acceptable.

2) Consolidation is the process whereby a proposed objective becomes relatively stabilized and formalized as a result of interest group and subgoal formation. Realignment of interest groups and their subgoals occurs on the basis of the perceived implications of the proposed objective. To the extent that the objective is feasible and accepted by a sufficient combination of interest groups whose inducements to agree are stronger than their costs of disagreement, consolidation will occur.

3) Conflict/Change or Change/Conflict is the process whereby the balance of costs and benefits is disrupted such that conflict occurs and change is implied, or, it is the process where internal or external events cause change in the established relationships sufficient to incur conflict. The overall effect of either of these alternatives is similar. Whether conflict produces change or vice versa, the effect is to produce a return to the search process and a seeking out by the group or groups induced by circumstances to do so a more "satisfactory" proposal, and thereby, a more "satisfactory" set of organizational relationships.

The above cyclic model illustrates the major stages in the development of an organization objective and the relationships that exist among them. At the same time, it also highlights the various problems of control as they occur. For example, in the search process, the quest for

control revolves around developing a feasible and acceptable proposal. In the consolidation process, control is concerned with bargaining power which is "the capacity to effect agreement on one's own terms".[32] In the process of conflict/change or change/conflict, control depends on whether one is interested in maintaining the status quo or whether one is interested in change so that he can more effectively realize his aspirations.

It now remains our task to apply this cyclic model in the analysis of the data. However, as we stated in the introduction, we will first provide a brief description of the research setting and the methods used for investigation.

III. The Setting for the Research

In 1919, four hard pressed steel tube manufacturers formed a defensive alliance in order to reduce unnecessary competition and trading fluctuations. By the beginning of World War II, seven more manufacturing firms had joined this federation. Organized as a holding company with a chairman and board of directors, the central federation body acquired most of these companies as going concerns, complete with their own established methods and organization, their own special expertise and customer contacts. These were left largely undisturbed and the tradition was established of allowing maximum autonomy to operating companies.

Coordination was established by the institution of shared and multiple directorships, various directors being responsible for certain activities of several companies. Control by the Chairman was exercised almost entirely through a vigorous scrutiny of annual trading results. A company showing a satisfactory profit was not interfered with, the concentration being on short term rather than long term results. There was also control of prices and capital investment, although this was not rigidly applied; there appear to have been loopholes. It seems to have been taken for granted that the success of the group could be no more than the collective success of its individual companies.

These conditions generally prevailed until well after the Second World War when several concurring events and conditions caused a number of changes in this vast holding concern.

1) In 1958, the diversified range of resources was grouped into six main product based divisions. Whereas previous to this decision there were informally recognized splits along product lines, it was now established that each of the companies within these newly formed divisions would be responsible to a divisional managing director who in turn reported to the Chairman.

2) During this time (1956-59), research was begun into the feasibility of "getting involved in the use of computers". In 1960, a report was produced which stated that there were very real advantages in the use of a computer in providing integrated production control in the manufacture of steel tubes. Work was started on this project.

3) In 1961, the chairmanship changed hands. The new man was extremely interested in the use of all advance information-generating techniques available. Unlike his predecessor, he was not a proponent of the laissez-faire type of management that had hitherto characterized the corporation. Besides, times and conditions were making this kind of system increasingly unmanageable.

4) In 1962-63, a slight recession, the first since 1938, caused profits to drop sharply, and competition,

both local and foreign, was becoming more keen. In light of this situation, the Chairman instituted a "plan committee" to study the various ways in which the newly formed steel tube division could be organized to protect itself against these changing conditions.

5) This involved discussion along such lines as plant capacity, product range, production process, and the "divisional order book". It was as a result of this specially formed committee that the first explicit statement of divisional objectives and priorities was attempted.

6) Also in 1963, at the insistence of the Chairman and his executive committee, division "functional" executives were appointed to provide coordination between the division and its fourteen constituent companies on the basis of production, marketing, finance, research and development, personnel, and industrial engineering. These functional executives were appointed to provide companies with the expertise required in an increasingly complex and specialized management field, as well as to provide more detailed communication, coordination, and control links between division and companies.

7) Concurrent with many of the previous developments and due to the recommendations of the plan committee, plans to rationalize the companies on a divisional basis were instituted. These were of two kinds. At one extreme,

rationalization was merely a monitoring pressure to ensure that the amount of overlap and competition between the activities of one company and another was kept within reasonable proportions and capital expenditure was not duplicated, while at the other, the production facilities of the entire division were dealt with as a single system of resources from a planning and control point of view.

8) Plans for standardization of production processes were also put forward by companies and division alike. Because of the increase of mostly foreign competition, many of the companies were forced to standardize even though many of them still accept the responsibility and obligations of jobbing-type production upon which they originally established their names.

9) The fact that they are permitted to claim both standardization and specialization in their production facilities is largely a result of the recent increases in mechanization that have occurred within the companies. The former monopolistic conditions that prevailed plus the almost sole concern for short term profits provided little incentive upon which to replace old machinery with modern plant.

From 1958 right up until research was concluded in March, 1966, some quite far-reaching changes have been instituted and experienced in this corporation. It is

necessary to present a fairly wide picture of the situations and events that comprise this organization in order to place the subject of our study with its extensive implications in its proper perspective. The objective to achieve integrated data processing throughout the steel tube division complements and provides a means for achieving several of the other objectives we have discussed. For example, the moves toward greater planning, rationalization, and standardization can be more fully realized with the introduction of a complex computer system. All these moves contribute toward the ultimate objective of achieving a totally integrated information system. Consequently, when we analyse the data, the reader, armed with knowledge of the wider picture, will more accurately be able to assess the reasons for various decisions.

We will now describe the structure and composition of the steel tube division. The division consists of fourteen manufacturing companies organized into six product and process groups, and three service companies located on twenty-one sites, all but six of these sites located within a ten mile radius of divisional headquarters. The other companies are located in a range from a day's travel by train to an hour's drive from this central locale, and consequently, present some rather special communication problems. Another complicating factor is that in some cases more than

one company is represented on the same site.

The manufacturing companies vary in size quite significantly. The distribution in terms of numbers employed is shown in Table I.

Table I

Distribution of Companies by Numbers Employed

Numbers Employed	Number of Firms
less than 500	7
500- 999	1
1000-1499	1
1500-1999	1
2000-2499	2
2500-2999	1
3000-3499	-
3500-4000	1
	14

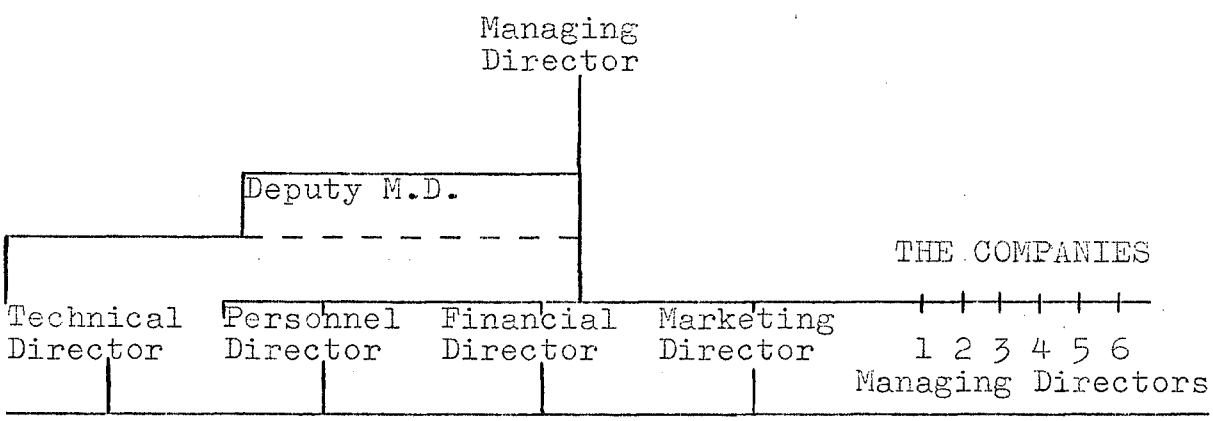
Divisional organization as it looks at present is shown in Figure 1. The chart is based on one prepared by the deputy managing director. Directly responsible to the managing director of the division are the deputy managing director in charge of production and research and development, four "functional" directors, all but one of whom are located at division headquarters, and the managing directors of the six company groups who are all located on the manufacturing sites.

There is a divisional Board. This has been constituted in a variety of ways since its inception in 1958. It now consists of the company managing directors and those

functional directors shown in Figure 1 being directly responsible to the division's managing director. However, this board is not a decision-making body in the sense that it executes the affairs of the division. It is the division managing director who is responsible to the Chairman for the operation of the division. The board provides advice to the managing director and in turn is informed by him as to the wider organizational picture.

Figure 1

Organization Chart of the Steel Tube Division



Also important in providing advice to the managing director to help him run his division are a number of committees, some formally, others less formally constituted. The main committees are:

1) A committee of functional directors usually referred to as the "Monday morning meeting".

2) Capital Expenditure Committee. This committee advises

the managing director on the approval of expenditure. Expenditure of over $75,000 also has to be approved by the Chairman and his Executive Committee.

3) Research and Development Board. This is a high level committee that receives reports from the technical director. An offshoot of this committee is a new products committee.

4) Plan Committee. Of all the committees this is potentially the most far-reaching in its effects for it is concerned with future manufacturing developments, including the rationalization of the division's activities and the distribution of resources among companies. This committee is constituted in various ways depending upon the problem.

5) Price Structure Committee. This was set up quite recently by the managing director in an effort to establish a more rational price structure in the division.

6) Pressure Tube Committee. This was set up in 1966 to coordinate pressure tube business in the division.

7) Computer Application Committee. Also organized in 1966, this committee is responsible for coordinating division and company working parties in computer application projects.

Perhaps the most significant thing about the divisional organization that stands out clearly from even this sketchy description is that it is still very much in the process of development and change. The introduction of a complex

computer unit to achieve integrated data processing represents one of the forcing issues, and the way it is handled will largely determine whether a divisional structure will emerge that is capable of coordinating and controlling the activities of fourteen previously semi-autonomous steel tube manufacturing companies.

IV. Implementation: The Methods of Research

Fieldwork for this research began in October, 1965. A preliminary study identifying the major problem areas had already been concluded.[33] Because we wished to obtain information relating to the computer development, it was necessary to interview all senior managers in each of the major organizational units - the computer unit, the division, and the companies. Consequently, we interviewed all executives at the "director" level in each of the three units, all senior "functional" executives who maintain company-division communication links, and the two senior systems analysts at the computer unit. The breakdown of the total number of people interviewed between October, 1965 and March, 1966 when fieldwork was concluded appears in Table II.

Table II

Number of People Interviewed

	Division	Companies	Computer Unit	Totals
Directors	9	47	1	57
Other Executives	10	31	2	43
Totals	19	78	3	100

The data was collected almost solely through the use

of semi-structured interviewing. Because the problems with which we hoped to deal were not clear at the outset, it was impossible to standardize the interviewing format beyond a minimal degree.

> ... a study is not completely "jelled" at the time the research problem is formulated. During the course of the investigation, a more adequate statement of the problem itself may be developed, new hypotheses may emerge, unforseen relationships may appear. 34

Beyond an interest in managerial control systems in large batch and mass production types of technology, and the ways in which the formulation and implementation of organizational objectives affect manufacturing activities, the researchers were urged to probe as deeply as possible in the time available. Consequently, the interview schedule, more standardized as research developed specific problems, was designed to elicit information on: personal job histories, history and development of company plans, work status and role, product variability, "task" and "element" functions, relationship and amount of contact among the division, companies, and computer unit, the perceived role of the division, management development, and the history and effects of computer application. The interviews themselves took anywhere from two hours to a full working day.

In addition to the interviews, intensive conducted tours were made of all the plants within the division.

Also access to certain company and divisional records and files allowed the researchers to gain a first-hand impression of the diversity that the division is currently attempting to integrate and control. As well as the results contained in this thesis, it is expected that several articles dealing with some of the many interesting problems of this diverse manufacturing operation will soon be published.[35]

Because of the fragmentation of the division both geographically and organizationally, it was necessary to complete the fieldwork in one company before proceeding to the next. This means that all the data are not exactly comparable in point of time, there being a four to five month lag in collection. However, the monthly progress meetings with the managing director of the division helped to eliminate much of this weakness and kept the research workers informed of any major changes taking place within the various companies.

The period of time spent and the number of people interviewed fluctuated a good deal among companies. There were a number of reasons for this. In general, the companies studied first took longest, for the research workers were themselves feeling their way and required a lot of help to understand the complexities of organizing and controlling the manufacture of a deceptively simple product like steel

tube. As they became more experienced and the theoretical problems more concrete, they could make their questions more direct, and the interviewing process speeded up considerably. Companies themselves also varied; is some companies, people's views on organizational problems were more explicit and more sophisticated than in others. There were also differences in social structure which made it easier to cover more ground by informal discussion in some companies than in others; the midday eating arrangement being important in this respect. Finally, and of particular significance to the research, companies varied considerably organizationally; more people fell into the categories covered in the interviewing program in some companies than in others.

It is perhaps opportune to say here that because this study comes near the beginning of a series of studies, we hope that subsequent research designs will test in a more precise fashion the suggestive findings and implications revealed by this investigation. Let us now proceed to an analysis of the data.

V. The Data: Findings of the Research

Historical background of the computer application

In 1956, the director of research and development on the main corporation board suggested to the board "the very considerable potential importance ... of getting involved in the use of computers". He persuaded the board to set up a research project with fairly wide terms of reference: where is a computer useable to best advantage and what organization should be set up to deal with it? For example, should there be one complex central computer or several smaller ones located in different organizational units?

The project team was set up internally and worked from 1956-1959. It was the opinion of the main board that there would be little use in hiring external consultants as there was no one with the necessary experience and knowledge to do the job. Instead qualified systems analysts, programmers, and machine operators were recruited as they were needed and as they became available. The present computer unit director was one of the initial team of four who carried out the original survey.

In 1957, the main board authorized the hiring of an IBM 650 computer for three years solely for research purposes. It was to be used experimentally and did not have to justify itself in terms of revenue. Initially, the

project team visited a diverse selection of manufacturing companies within the corporate structure to ascertain the possible areas of application. The members of the team decided that the steel tube manufacturing companies which were at that time being organized into a divisional structure presented the most promise.

In 1960, the project team presented a report to the main board stating that there were advantages in the use of a computer within the corporation and recommending an initial application in the steel tube division. The report also recommended that due to the complexity of processing required and the sheer volume of work, the right approach would be to install a central computer as large and as powerful as could be afforded and financially justified rather than a series of smaller computers that would perforce be restricted to relatively simple tasks. The report included a recommendation as to the type of machines to purchase (IBM 7070 and 1401). The report was adopted by the board and the companies in the steel tube division were asked to give their full cooperation.

The team began work on the development of computer programs for all the steel tube companies but concentrated its efforts at Company 1 and Company 2. Production control was recognized as the essential foundation of an ultimate integrated system. The basic conception of the original

plan was to integrate fully each company, to computerize the complete manufacturing operations:

a) order raw materials,

b) select raw materials for manufacture,

c) plan work schedules,

d) determine the number of cold draw passes,

e) plan future progress,

f) determine wages in relation to work output,

g) make up the payroll,

h) make out customer invoices at dispatch point, and

i) analyse costs and sales.

Progress, however, was slower than expected partly due to complexity of the operations to be controlled, partly because attempts to base computer programs on existing manual methods proved abortive. The existing methods were found to be inadequate or inconsistent in certain vital respects. No one knew the logic required to make steel tube. Existing manufacturing methods were based on a series of short cuts and rules of thumb - in short, on expedience and experience.

It was only when the first progams were run in 1963 that the full extent of the problems involved in attempting to apply integrated data processing to the production and marketing of steel tube was realized. Computer application was subsequently limited to companies 1 and 2, these being

furthest advanced in the introduction. The process of attempting to amend the first programs began. It was during this period and on the basis of the first programs that the systems analysts at the computer unit claimed that at last they could determine what the controlling factors are in making tube.

In 1965, a team was set up to rewrite the programs. It was claimed that too much information had been left out, and that over five years the programs had become excessively full and very uneconomic to run. This team analysed the computer program in detail and arrived at certain conclusions. On the bases of these conclusions, the computer unit director wrote a report proposing the purchase of an IBM 360/50 "real-time" computer with direct "land-line" links to IBM 360/20 computers located on various manufacturing sites. The main board considered this report and committed itself to new expenditure in 1968.

This ambitious undertaking it was felt required more involvement on the part of senior divisional and company management than had been hitherto forthcoming. In December, 1965, the steel tube division board proposed:

> The formulation of precise systems objectives would be undertaken by the Divisional directors of production, marketing, and finance, who would form and chair working parties consisting of their opposite numbers in the companies. The Divisional finance

> director would coordinate the work of the working parties. This work would be given top priority in full consciousness that it would pre-empt a large part of the time and energies of senior management in both Division and companies.

This statement had become a working reality when research was concluded in March, 1965.

Method of data analysis

The method of data analysis has been to take the above chronology of ten years and attempt to fit it into the cyclic pattern described in the theoretical analysis. In other words, we have lent form to this history by identifying within it the processes of search, consolidation, and conflict/change. What is important to remember in this respect is that when one uses a model to assist in the understanding and explanation of his analysis, he must be extremely careful that the model does not become a vehicle over which he loses control and thereby loses touch with the empirical reality that he is attempting to describe. Far better it is for the analyst to adjust his model to fit the data rather than vice versa. This note of caution is introduced for two reasons.

First, in the cyclic model that we have proposed, the processes of search, consolidation, and conflict/change are merely more dominant at one time than another. In other words, one process does not exist to the mutual

exclusion of the other two; during the process of search, conflict may occur as to which alternative is "best". At the same time, a consolidation of certain interest groups may form in order to promote what they think are tactical objectives. Hence, it is the dominant process with which we are primarily concerned at any one time.

Second, we are not advocating that the presence of one cycle means the exclusion of all others. There is nothing to prohibit the existence of two parallel cycles. For example, it may be that one is concerned with short term objectives, the other with long range prospects. Therefore, the adoption of this cyclic model does not deny either the occurrence of other processes within the dominant process being described nor does it deny that two cycles might take place concurrently.

Also, a case could probably be made for finding cycles within cycles, but on the general descriptive level just concluded, we maintain that there are three major cycles, the third one not being completed at the time research was concluded. We have chosen this method of analysing the data in an attempt to compare similar categories of organizational development and to draw inferences about what they mean. Consequently, all the data are classified according to process and cycle. In this way, we hope to achieve our intention of showing how an organizational objective develops and what ramifications this development has for management control.

During the presentation, we will quote from various interviews to substantiate our claims. Because we have offered the cloak of anonymity to the interviewees, we cannot reveal any confidences of specific individuals. We have handled this first by identifying all quotations by the place in which the respondent works (e.g., division, companies 1,2,3,4,5,6, and the computer unit). Then, in the case of the division and companies, we have attached a symbol to each respondent so that the thread of his argu - ment might be followed throughout. There were too few executives interviewed at the computer unit to adopt this procedure. If the respondents made semi-public statements as some of them did in speeches, articles, and reports, they will be identified as such. Let us now proceed with the analysis.

Development of an organization objective

Cycle 1 - Search

From its beginning in 1956, the introduction of a computer has had the full endorsement of the main board. There are many reasons for this. External factors revolve around the general industrial trend towards more effective use of resources which has been accompanied by the develop- ment of new management tools and techniques. This has resulted in a "need" for increased and more sophisticated measurement and comparison. Internally, the reasons are

just as compelling. The historical trend in this large industrial concern towards more product, process, market, and organizational standardization and rationalization plus the inclinations of the present Chairman to "establish systematic consolidation ... through all advance information-generating techniques available" are additional factors in the main board approval of "getting involved in the use of computers". The main areas of inquiry have centered around what category of problem to computerize, how to apply the computer to these probems, and finally, what kind of equipment would best suit the proposed operations.

It was with this frame of reference that a computer project team consisting of four members was established. It became the job of this team to explore alternative areas for computerization, at the same time devising methods for their implementation. It was also the purpose of the team to win general approval of computer technology and of the specific proposals subsequently contained in its report. Some of the more important alternative applications that the project team considered and the reasons for their acceptance or rejection as explained by the computer unit director are as follows:

1) Computerize accounts. This alternative was considered and rejected because it would not fully utilize complex data processing equipment. Also, the computer unit director

stated that benefits from computerizing accounts are few. "There is very little advantage in the speed-up achieved and few clerks are saved."

2) Computerize stock control. This alternative was rejected as not forming the central problem. As an ancillary project, it would be considered at a later date.

3) Computerize production control ... .

> The real way to make money with a computer is to go into the production control field. The labor displacement is small in this area but using the computer substantially enhances the chances of reducing work in progress, improving delivery records, reducing stock inventory, etc.. One can make a substantial set of savings, but only in return for substantial investment. If one can crack the production control problem - the hardest of all - all the rest follows.
>
> (Computer Unit Director in a speech to the senior management of Company 2.)

a) ... in standard product line plants.

The project team investigated all manufacturing divisions within the corporation. Having settled on production control as the area to concentrate its efforts, it rejected standardized mass production plants because production control problems were not considered acute.

b) ... in custom-built product plants.

> The steel tube division manufactures tubing on a custom-built basis, there

> being no categories of products. Any type of tubing is made within the limits of the installed plant. Every order has to be planned, costed, and loaded as a completely individual thing. ...
>
> There are also in the steel tube division a group of fairly similar companies. We thought that the production control programs devised in the division would not be applicable to just one company, but several, for example, all companies making cold drawn tubing and all using basically the same technology and experience. In other words, all who share the same basic problems.
>
> (Ibid.)

It was on the basis of this search process that in 1960 the project team produced a report. The report discussed the various alternatives, proposed initial application in the steel tube division, indicated the type and organizational setting of the computers required, and stated the overall objective of the computer application in the steel tube division - to provide integrated production control for all of the steel tube manufacturing companies.

Even though it is difficult to collect full and accurate data on events five to eight years passed, this historical description of the introduction to the idea of computers, research into using them, and a report of what specific application would best suit the particular situation and conditions of this corporation does illustrate the concern for feasibility and acceptance of proposed objectives. The initiating interest group, in this case,

the computer team, after gaining approval for its project, set about attempting to develop first a possible and then a workable and operational proposal to present in its report to the main board. Below is an itemized list of the team's progress toward "consolidation".

1) Initial endorsement and approval by the main board, the most influential and powerful body within the corporation, of computers in general and of some kind of application ("getting involved") in particular.

2) The searching out and making itself knowledgeable of the various alternative courses of action so that it could: a) provide the most "satisfactory" application; b) arm itself with reasons as to why alternative courses are not as appropriate; c) establish a priority among alternatives in case the first one is not workable; or, in the event that no application is feasible, d) give up the attempt.

3) Attempts to communicate the idea of integrated data processing and that it is possible to define the logic behind the manufacture of steel tube to organizationally relevant members (i.e., company and divisional managements). The fact that this kind of communication and the ways in which it was communicated was not wholly acceptable to and therefore endorsed by company and divisional managements has important implications which will be evidenced throughout the following processes and cycles.

4) Production of a report specifying in detail the feasibility of computer application - the area and kind of application, the method, the type of equipment appropriate for such a project, and all related to a time schedule.

5) Acceptance of the report by the main board and a "request" by this same board for all divisional and company personnel to cooperate fully with the newly formed central computer unit in its application of integrated production control for the steel tube division.

Cycle 1 - Consolidation

It is at the point of implementation of the above report that the companies become directly invdved in the computer application and the division becomes responsible for its coordination. Immediately, three broad areas of functional responsibility become visible. The computer unit with its task of devising programs to computerize and thus integrate the complete manufacturing operations of each tube company represents a predominantly technical interest; the companies with their obligation to apply these programs to their operations, at the same time giving full consideration to previous commitments present a strong manufacturing (production and marketing) concern; and the division whose job it is to lay the groundwork for a successfully integrated control system and maintain an

adequate profitability for the division as a whole represents a coordinating function.

As we indicated in the theoretical analysis, specialization of function leads to bifurcation of interests and the creation of subgoals. The computer unit, comprised of people with mainly mechanical accounting and operations research backgrounds and training, was involved with the technical problems of the computer application to such an extent that it often neglected the organizational problems that the application most certainly incurred.

The companies, previously on a semi-autonomous organizational footing, were now faced with intervention from two sources. First, the creation of a formal divisional structure in 1958 and, consequently, the creation of a body of divisional executives all seeking information from the companies was resented and even resisted by some company managers.

> Control from the center is getting much too tight. They are wanting mountains of figures. But there is no point in having a mass of figures and doing nothing about them. The load at the top at head office is getting too big; it will topple the organization.
> (Company 5 - A)

> I will resist the rationalization of my company despite the obvious anomalies in the pattern of its organization because if I don't the challenge will disappear from the job for me. It's not a question of status, but one of job satisfaction.
> (Company 1 - A)

Second, the formation of a central computer unit represented a method whereby centralization of control or, in the words of some company executives, "increasing divisional enroachment" could be implemented. Consequently, at this stage of development, specialization of function involves strong company reactions and a move by some company managers to strengthen the previously established tradition of company autonomy.

The division, composed of executives most of whose careers include experience in the tube companies, was perhaps the most ambivalent in its approach. The emotional involvement of divisional executives tends to be with the companies in which they worked in the past. Also they regard their successful experience as company managers as the basis for their present jobs.

> Technically, my relationship with company people is advisory, but because of the successful record of management that lies behind me, I have gained the respect of managers in the division and there is a tinge of the "executive" in practical relationships.
>
> (Division - A)

The company oriented attitudes of divisional management reveal themselves in remarks like the following:

> In the past, a lot of enthusiasm and effort has been generated from leaving companies independent. One doesn't want to destroy company identity lightly.
>
> (Division - B)

Yet this same man also said no more than five minutes later:

> There should not be the slightest compunction in authorizing the actions of a functional director. The companies have no right to be autonomous.
> (Division - B)

Consequently, the division with its specialized function of providing coordination and integrated control of the companies, was at the same time divided in its interests and values. On the one hand, it represented the apex of an ultimate integrated control system, while on the other, its emotional involvement with the companies caused it to act as a service center enabling companies to achieve their individual objectives.

Let us consider in detail the events that took place, the reactions experienced by the various interest groups, and the conditions which finally led to the process of "conflict/change". It was on the basis of their first experimental programs that the computer unit attempted to devise production control for each of the tube companies. The reactions of some company executives recorded in interviews are pertinent to this attempt.

> The decision was made that it would be best to computerize cold drawing operations and specifically production control. Production control was thought to be the core or the key and from this

> everything would follow. It was recognized that this was a complex operation but that if it were mastered, all else would come easily. Unfortunately, the first hurdle has not been overcome.
>
> (Company 1 - B)

> At the beginning, things worked reasonably well. We were asked to provide general rules for making tube. It was only when the computer started feeding back that we found we were in a helluva mess.
>
> (Company 1 - C)

> No one has tackled tube making on a computer before, so to start with it was a very difficult job. ... There is a lack of knowledge of what we are actually doing. There are lots of cases where we don't know how to make tube. We can only work by trial and error. It's very very difficult to simulate "expediency" on a computer.
>
> (Company 1 - D)

Consequently, one of the first realizations that the computer people made was that

> ... no one in the steel tube division knew how to make tube. There were no general rules for making tube, without which it wouldn't be feasible to store in the computer. There would be no use in storing the method related to every single tube. One had got to find the general logic hehind the manufacture of tubing.
>
> (Computer Unit)

It was this first and very serious problem which made all the others loom larger and cause the many repercussions that were to follow throughout the division. The computer people went on to find that not only were there no basic

laws for the manufacture of steel tube but that in each company "there were different opinions and views", and these varied from the cost office to the planning office to the shop floor as to how tubes were made. And furthermore, each company appeared to be saddled with its own peculiar, almost unreconcilable, problems. One computer unit executive stated:

> Everything you touch in this damned steel tube division is unconventional. There is not the same problem in all companies as regards programming and feedback. For example, in Company 1 there are 3,000 customers, 13 of whom account for 80% of the total output. The management there is very anxious that these few customers should always be satisfied and they have no compunction in breaking promises to the remainder to ensure the satisfaction of the few.
>
> Commercially you can't agree with that attitude, but practically, from the point of view of computer application, it is a great problem. You have a problem of selective reporting. If all overdue orders were reported, a lot of them would not account for very much tonnage. Also, we have got to have a means of identifying the most important customers (schedule customers), but in the residue are some customers which are more important than others, and some more important at one period in time.
>
> This is theoretically not the right way to run a business, but it is what happens. For example, while one can calculate theoretically a delivery date for an order, someone will say that he wants it weeks earlier.
>
> (Computer Unit)

As well as the purely technical problems that they confronted, the computer people also met a "very natural resistance to change of any sort" and, particularly, a resistance to "external examination". This they found within company junior and middle management ranks, while in senior management echelons they discovered a relative lack of any involvement. Added to the anxiety, resentment, and resistance on the one hand, and the indifference and non-involvement on the other, the computer analysts became increasingly aware of the mutual lack of knowledge the tube companies and the computer unit shared for each other. One systems analyst made the following comment in an interview:

> To let you know a little of the initial difficulties with which we were faced, here was I with people who didn't know a thing about computers and there they were with a systems analyst who had absolutely no experience in tube making. I was so "green" that when they said that their first operation in cold drawing was "tagging the hollows", I thought they meant putting labels on them. Little did I know that this meant crimping one end so that the tags could grip the hollows as they were drawn through the dies.
>
> (Computer Unit)

The creation of three specialized functional problem areas and the consequent formation of interest groups with individual subgoals all helped to bring about the process of conflict/change that was to follow. The initial problem of not knowing how steel tube is made, plus the fact

that the computer unit's attempt to approximate on the computer the tube manufacturers' rules of thumb failed all relate to questions of feasibility. In this case, the "perceived" feasibility of the computer project differed from its "actual" feasibility. Also, the fact that the computer people only gained acceptance for their project from above, that is, the main board, and did not gain the necessary confidence and endorsement from the companies and various divisional executives relate to questions of acceptance. The initial failure to formulate a feasible and acceptable objective was largely responsible for the conflict and pressures for change that resulted.

Cycle 1 - Conflict/Change

It was in 1963 after the first programs had been run that the various conflicting views were articulated. Company managers were most vocal, especially from Company 1 where the application of production control programs was first begun and most heavily concentrated. Initially, a few managers from each of the affected companies were made responsible by their directors for cooperating with the computer unit in instituting the various production control procedures. The burden lay heavily on these men, and when computerization of technical planning and selection of raw materials was only fifty to seventy percent successful compared with manual methods, this necessitated that these

same men institute manual control to control the mechanical control system. They complained to their superiors who in turn put their case before the various company managing directors.

This cadre of executives, formerly very powerful and still extremely influential, put the case before the division board on which they participate as members but over which they have no direct control. The Chairman had earlier issued an edict to the effect that the managing director of the division in the discharge of his executive responsibilities would be assisted by the division functional directors. "... This does not of itself presuppose any greater centralization of the Division's executive operations in these fields." As well as making the managing director solely responsible for the activities of the division, this memo had the added effect of making some company managing directors feel that the functional directors had been moved a level above them. Consequently, more was at stake than a few hard pressed middle management company executives. The company managing directors put their own individual cases forward as strongly as they could. Any reason became another excuse to renew their wage against decreasing company autonomy.

Therefore, it must be realized that the conflict over computer installation takes place in a much wider context. The computer unit admitted its relative failure but remained

undaunted in its belief that the general logic behind the manufacture of steel tube could and must be discovered. The companies, on the other hand, felt that for the most part they had been taken advantage of. Their criticism can be grouped into four main areas.

1) Authority without responsibility. The greatest single criticism waged against the computer unit by representatives from each of the affected companies was that while they were obliged to give "utmost cooperation", the computer unit was either not willing or not allowed to take responsibility for its actions. One company director commented:

> The application of the computer at Company 1 was bad. They allowed the computer people to take charge. The computer people came in, laid down the techniques, and took the initiative. This is fundamentally wrong. What should happen is that the production man who knows the shop floor should be consulted. What is necessary is that they computerize him and his knowledge.
>
> (Company 4 - A)

The company people felt that whereas they had no alternative but to cooperate, nevertheless they were still judged by the divisional and main boards on their current manufacturing operations. In other words, they were faced with another major variable which could significantly affect their viability but over which they were given

little or no control. They felt that the computer unit should be made responsible in dollar and cents terms so that it might temper some of its more radical and costly ideas.

2) Insufficient consideration and knowledge of company conditions. Closely allied to the above set of criticisms are the companies' claims that the computer unit was not sufficiently cognizant of company conditions, and in many cases did not attempt to remedy the situation. For example, many stated that the approach by the computer unit was rigid and inflexible.

> There have been tremendous changes in attitude over the time. Whereas at the introduction, the computer people stated that the man system of the organization is flexible, therefore, you will do the flexing, they are not now quite so dogmatic. Before, they said that the computer is a relatively simple unit (not run by simple people, mind you) but also relatively rigid; therefore, you will do the accommodating.
>
> (Company 1 - C)

> The computer people are the world's worst salesmen. Their initial approach upset everyone. "If your circumstances do not fit the computer's requirements, you will have to change your circumstances. ..."
>
> (Company 5 - B)

On a more technical plane, many company executives claimed that there are too many variables for manufacturing operations to be computerized. Particularly in Company 5,

which is composed of weld mills, each manager cited reasons as to why it would be difficult, if not impossible given current developments, to introduce integrated data processing. The speed of throughput is too high and the detailed information required for operations is impossible to produce within a given time period. Also, the mass of alternatives, such as cancellations and schedule alterations, that one has to deal with means that amendments cannot be reflected quickly enough. The time factor is critical. Drastic alterations, changes in priorities and delivery sequences take place over such a short period of time that one executive predicted that the computer will only be able to be used for "longer term and bigger problems".

On the commercial side too, marketing managers state that they have to juggle discounts to different customers in order to obtain orders. This they maintain is the only way to get business in a very competitive field, and the computer introduces an inflexibility with which they are not willing and cannot cope. The whole atmosphere at this company can be reflected in the following comment by one of its directors:

> This is what drove the computer man mad when he was here. He wanted to work out neat factory loading figures, but the wide variations in welding speeds from day to day, etc., defeated him to the extent of something like half a

> million feet per week variation around the average. Another problem is that there are so many decisions taken at quite low levels in this operation here, often on an instantaneous basis. It is very difficult to have rational decision making going on at a high level which will be realistically related to what is happening lower down.
>
> (Company 5 - C)

3) Approach poorly planned. From where they were viewing the application, many company executives thought that the approach by the computer people was not sufficiently well planned. Some stated that there was stress laid on the savings that would accrue from computerization when no actual savings were recorded. There was not any provision for people leaving the project, no training program to ensure the continued effort to apply the computer to manufacturing operations. Also, some executives criticized that there were not enough people initially engaged on the project, and those that were were not of sufficiently high calibre.

4) Insufficient liaison. The criticism of the computer application about which both the computer people and company executives could agree was that altogether there was insufficient liaison, a damaging lack of communication caused largely by the specialization of function and the internalization of subgoals. Problems occur when collaboration is required. Other studies, too, report findings that suggest an inverse relationship between the degree to which members

of two groups share norms, values and/or superordinate goals and the ability of the two groups to communicate and cooperate.[36] One of the studies suggests further that "the greater the contrast in values and norms between two groups, the greater the tendency for those groups to reduce their interaction with each other".[37]

In this case, as we have reported, the difference in values revolves around the computer unit's technical objective to introduce a centralized control system and the companies' largely emotional reactions to the loss of individual control and discretion that this entails. However, the companies' reactions are not entirely without substance. The following conclusion made in one of our earlier reports is relevant:

> What tends to happen in the absence of definition is that the people responsible for systems analysis make policy decisions about the various controlling factors almost without being aware of doing so. There is therefore the danger of long-term decisions being made in terms of their appropriateness to system design rather than in relation to more fundamental criteria. Thus real control can shift to the systems designers.[38]

The major reason for the conflict situation that resulted then can be found in the history and growth pattern of this giant holding company. A tradition was established that so long as each company maintained an adequate profit-

ability its internal operations would be left largely undisturbed. This tradition persisted and was strengthened until 1958 when all the companies were grouped into divisions. In the steel tube division, the fourteen constituent companies were further brought together on a product and process basis into six company groups. And in 1960, it was decided to introduce integrated control so that all manufacturing activities could be coordinated from a central headquarters.

We are not here questioning the motives or reasons for such developments. We are merely stating that the notion of autonomy which is a legacy from a previous era and which still forms a major part of company philosophy and ideology is antagonistic towards the idea of both a centralized division and a central computer for the purposes of integrated data processing. To the extent that this ideology persists and is even encouraged, there will remain an organized resistance to such plans. For example, the division in not assuming its coordinating responsibility and becoming actively involved in the project, albeit for quite sincere and altruistic motives, indirectly gave its approval to the resistance that the computer people met and were in part responsible for the degree of failure experienced in the project.

Only belatedly, in the face of open conflict, did the division attempt to assume responsibility and change the

state of affairs by limiting the computer application to companies 1 and 2. The managing director, acting together with his functional directors, felt that the computer unit would more easily arrive at the core of the production control problems if its focus were sufficiently narrowed. This action resulted in a more detailed search process in which the computer unit attempted to ascertain the logic behind tube manufacture and the division attempted to develop an organizational environment more conducive to the introduction of integrated data processing.

Cycle 2 - Search

The computer people began their more detailed search with the principle that until they developed a correct method of technical planning of the methods of manufacture ("pass" and "interpass" operations and work documents), they could not develop an integrated production control program. One computer executive made the following point about manual planning:

> The trouble is, of course, that the human planner works according to "associative" processes when doing his job - planning one operation and then planning the next one approximately the same way.
>
> (Computer Unit)

What the systems analysts had to devise, which was basic to a successful computer application, was a logical system

for tube manufacture. One by-product of this search process was that the questions they asked company production managers enabled these executives to improve their "associative" methods.

Consequently, in an attempt to establish a logical system, each computer project leader was asked to construct a procedure manual which could be referred to by his subordinates and which would form the basis for training company executives in systems analysis. In this way then, the computer teams, always committed to their ultimate objective of developing an integrated control system, proceeded in stages "doing bits at a time and hoping to integrate later".

Almost by default was the division now involved in a second direction of search - the ascertaining of an organizational environment conducive to the introduction of integrated central control. Because of the quite recent creation of a divisional structure together with the tradition of company autonomy already discussed, plus the assurance and confidence of the computer unit in implementing an integrated control system, and the prevailing belief that this introduction was both a rather technical and straightforward matter, the division in a dual attempt to consolidate itself and not interfere with a previous autonomous and profitable corporate structure, did not actively involve itself in the coordination of the computer

implementation. As a result, it was now with a sense of urgency that the division attempted to devise some proposals for a successful implementation. In one of our interviews with the managing director of the division, he stated:

> One feels that the failure has been the insufficient involvement of top management in the computer exercise - both here at divisional headquarters and at the companies. We have been leaving things for too much to the director of the computer unit. He's been conducting a mathematical exercise, and we've been leaving things for him to put them together. We found out too late that top management must be involved for the thing to be a success. It wasn't the computer director's fault; it was the failure of top management to realize that the computer is just as much the responsibility of top management. We didn't realize the implications quickly enough.
>
> (Managing Director of the division)

Before it could develop specific proposals, the division first had to ask of itself in general terms just what it was trying to achieve in the computer application.

> The ultimate objective is to measure companies. ... Something of the pressure behind this effort to devise measures stems from the Chairman's conference recently when he reiterated the need to become more efficient with the plant we've already got.

And again in another interview:

> All of us are worrying at the moment about getting uniform information systems in the companies which will tell us at the center what's going on, so that we can redistribute orders. It will show up the inefficiencies between companies, something I suspect some of the companies are worried about.
>
> (Managing Director of the division)

With the search process of what they were trying to achieve concluded, it then became the task of the division to determine how. Having delegated the problem of determining the feasibility of such a venture to the computer unit, it fell upon the division to ascertain and improve the acceptance for such a project.

The problem of gaining acceptance on the company level proved to be a stumbling block in the first attempt at computer application, and it was just this problem that the division set about to alleviate. A number of suggestions were proposed:

1) In line with the earlier statement made by the Managing Director, the division functional directors proposed that there be more involvement in the project on the part of senior company personnel. As well as the increased time commitment that this would involve, these directors suggested that more responsibility for and control over the implementation should be assumed by the companies. To ensure that this involvement would take place on a regular basis, they further suggested the formation of

company and divisional functional working parties whose prime responsibility would be the implementation of the computer program. These parties would work in close collaboration with the computer unit.

2) To reduce the likelihood of resistance and conflict reoccurring, the functional directors proposed that they should head the working parties and provide liaison between the companies and the computer unit. In this way, there should be more acceptance of the project. One of these functional directors commented:

> Fortunately, I know one or two of these boys [company functional directors]. ... If one can speak <u>their</u> language, it's so much better than, for example, the computer director who is very much of a red rag to a bull to many company people. ... He is a very sound man, but there has to be someone between him and the companies from whom they will "take it". There has to be a "front man", but a man who has got to believe in what he is talking about.
>
> (Division - C)

3) As well as attempting to make the computer people and their project more acceptable to the companies, the division itself was faced with the problem of "selling" its function to these previously quasi-independent manufacturing concerns. The answer that the division came up with attempted to solve both problems. The computer director was commissioned by the division managing director to "lay on two to three day courses ... for all middle

management in the division". Also, it was suggested that both the computer director and some of the divisional directors make day visits to the companies in an attempt to explain their raison d'être and in this way gain the necessary endorsement.

In 1965, after a two year search process, the computer unit announced that at last it had discovered the basic laws of tube manufacture and set about rewriting its complete suite of programs. The division implemented the above proposals by putting them forward at a regular divisional board meeting.

Cycle 2 - Consolidation

The formation of company teams to formulate "precise systems objectives" was generally viewed by company managements as "a good thing". As well as making specific people responsible, it also broke the whole job of computer installation into more manageable tasks. For example, upon receipt of more detailed terms of reference from the company working parties, the computer unit could set up a number of project teams to design the requisite computer programs. A Company 1 executive stated that this more formal liaison "helped to communicate difficulties and ease the strain and tension".

In Company 2, the response was even more enthusiastic. A special department called "computer liaison" was set up

with a manager and one full-time assistant. These two men work in close collaboration with the seven computer people who are specifically concerned with the Company 2 application. As well as this department, there is also a specially created team of three which is responsible for the writing of the second computer program. These three men (material control manager, assistant sales manager, and assistant planning manager) are from the most affected departments.

> This team is considering every minor detail that will go into the program. They have now completed this detailed examination and there are 100 to 200 items still to be resolved. We are now concerned with decisions as to whether we include them in the program but try to modify them, delay the program until they are resolved, or modify our original objectives in light of these difficulties.
>
> In order to make these decisions we must take our difficulties out to the computer unit and get them involved there. We need to get involvement on all levels of management as well as across functions, and between company and computer unit. It is simply imperative that the systems analysts at the computer unit and the managers from all the departments concerned get together and hash these problems out.
>
> (Company 2 - A)

The computer unit, also, reorganized itself so that it could more easily fit into the "functional"

pattern established by the companies. Whereas formerly the unit analysts were organized according to the company on which they were working, they now reorganized themselves according to the type of project on which they were engaged. The computer director stated that this would allow for "more cross-fertilization of ideas and approaches among people doing the same sort of project in different firms".

A number of factors are responsible for what in this presentation may appear to be a rather sudden acceptance of the computer installation which actually occurred gradually over a period of five years. One of the great stumbling blocks in the project was the technical inability to define the parameters of tube manufacture. This dilemma endangered the whole objective of implementing integrated data processing. With the barrier of possibility overcome, however, the systems analysts could then concern themselves with the problems involved in developing workable and operational programs.

The active involvement of the division in the project also promoted greater company acceptance. There are a number of reasons for this. The division executives in their conception of the problem of computer application tended to see it in much the same way as the company managers, that is, as tube manufacturing executives. They therefore attempted to arrange the problem to fit the

existing organizational setting, unlike the systems analysts who had previously attempted to redesign the system to accommodate the problem. The fact that the division used the already existing structural framework to implement the objective greatly enhanced its chance at success. First, it did not upset established role and status relations, and second, it provided the use of an already existing communication structure.

Also contributing to company acceptance was the move by the division to give more control over computer installation to the affected companies. As we indicated in the theoretical section, if an organization objective is in danger of not being implemented, the initiating group must sometimes sacrifice some control over its formulation and direction to other relevant interest groups in order to gain the necessary acceptance. In allocating this control over the computer application to the companies, the division stood to gain the additional bonus of company involvement, and consequently, a commitment to a successful application.

Whereas we have discussed the factors <u>contributing</u> toward the implementation of this organization objective, there are also a number of points that <u>detract</u> from its introduction. When the computer unit first began, it was formed under the auspices of the main board under the

particular direction of the research and development director. However, when the computer project team made its initial report in 1960, it was decided that because its entire operations would take place within the steel tube division, the responsibility for its direction should also lie in the division. Consequently, control over the computer unit was given at that time to one of the joint managing directors. When this man left in 1964 to manage another division, the present managing director allocated responsibility for the coputer unit to the financial director. In the few months preceding the conclusion of our research, direction over the computer unit was again switched, this time to one of the joint managing directors on the main board. The financial director of the steel tube division, however, retained his functional link with the computer director and still assumes responsibility for the computer application within the division.

A number of consequences stem from these developments. First, the continual shunting of responsibility for the computer unit, even though for ostensibly "valid" reasons, indicates either a lack of active involvement in its installation, or a lack of knowledge and experience as to how such a project should be handled, or an unwillingness to accept the responsibility for a project with such pervasive implications, or a combination of all these reasons. One

must here question the motives of the main board. Why did it relinquish control over such an important project that was conceived and born by this same board? Did it fear the criticism that was bound to come from such a contentious issue? Did it want to "wait and see"? Whatever the reasons, this action, or lack of it, resulted in uncertainty, tentativeness, and even anxiety lower down. Consequently, nobody engaged in the positive and active coordinating function that this kind of project requires.

Second, the uncertainty on the company level as to how to handle integrated data processing resulted in a wide variety of organizational patterns designed to accommodate the computer. For example, in Company 1 the responsibility for the computer application is assumed by the chief industrial engineer who reports directly to the company managing director. In Company 2, the responsibility also lies with the chief industrial engineer, but he reports to the financial director; and in Company 4, the only other company actively involved in the application, the financial director has control and he is responsible to his company managing director. These differing company arrangements can provoke reactions by some executives who because of their status and function feel that like other similar company managers who have been given responsibility for the computer, they too should have control over their company

installation. Consequently, it can be seen that the way is open to factional disputes and "power plays" among various interest groups, each intent upon gaining control over its particular company installation.

This leads to point number three. As long as the responsibility for the computer is seen as in doubt, the question remains open on various managerial levels as to who should in fact assume control. For example, on the divisional level, one executive stated:

> Eighty to ninety percent of the computer application is on the production side. Accounts and costing are usually the first to get access to the computer, but in this instance this is not the case. It is therefore illogical, as far as I can see, that accounts should have the responsibility for guiding the application of the computer.
>
> (Division - D)

Whether it is illogical or not is not the point. Rather the point is that if the responsibility for the computer application had been firmly established and allocated, questions as to illogicality and justification would not arise so frequently and from so many quarters. The bargain would have been set and the difficult to uproot precedent established.[39]

On the one hand there are pressures to accept the objective of integrated data processing, while on the other, certain situations and circumstances are decreasing

the chances for acceptance. It seems opportune at this stage to hark back to our original question: What consequences do organization objectives have for managerial control? In this case, if the objective is unprecedented and unprogrammed, and the forces relating to its achievement are not made explicit, then the ways to achieve control are complex and circuitous. To the extent that the initiating group can make its objective feasible (such as determining the parameters of steel tube manufacture) and acceptable (such as giving some control over the computer application to the companies and making itself aware of and eliminating pressures which run counter to the objective), it is more likely that it will implement and maintain control over its direction. It would appear that the division has taken positive, if belated, steps in this direction.

Given the fact that the division <u>is</u> establishing control as a result of a more intimate relationship with its objectives, is there anything to ensure that this control is or will be uniform? A somewhat ambivalent answer is provided by a Company 1 director:

> Knowing when not to do a thing at different levels will take time to stabilize. Controls generated within a company tend to line up with controls generated from the center over time. This will not happen yet in the steel tube division because of the inbalance within the companies. They use dif-

> ferent methods of control, harbor different attitudes. I'm not sure we're all going in the right direction.
>
> (Company 1 - A)

This in turn leads to a further problem that several company managers have posed. Given the situation where central systems are uniform throughout the division, how will the division employ these controls?

> It is possible that the computer could provide an avenue for stronger divisional, that is, executive control if the need arose. However, I would hate to think that this was a prime motive of the division.
>
> (Company 3 - A)

> People don't realize the implications of the computer application. People really fear becoming a lot of "yes men" and not being able to exercise discretion and influence things. They resent the idea of having to carry out instructions. It's the fear associated with the measurement of performance. No one fears bad performance, but it is a fact that few decisions can be taken on one's own criteria. This is the frustrating thing. It's the fact that one has to use <u>their</u> criteria that is the annoying thing.
>
> (Company 5 - C)

Once a gain we confront the problem of divisional involvement versus company autonomy. This is the main basis of interest group and subgoal formation. On the one hand, the division, committed to the objective of integrated control, and the computer unit, committed to implementing

integrated data processing within the steel tube division, together present complementary interests. On the other hand, the companies, fearing that control and discretion over manufacturing activities will be taken out of their hands, present an opposing set of interests. Consequently, if the division is to achieve its objective, it remains the task of the divisional executives to present their objective in such a way that it is more acceptable to the companies. According to the data that we have presented, it would appear that by involving company managers more in the formulation of divisional objectives, the division could possibly succeed in gaining the necessary company acceptance and commitment.

Cycle 2 - Change/Conflict

As we indicated in the theoretical section, conflict does not always precede change; the reverse situation can equally occur,[40] and indeed in Cycle 2, change did precede and was responsible for the conflict that followed. In December, 1965, the divisional board announced that the main board had approved of expenditure in 1968 for new equipment "which offered faster operating speeds and a larger storage capacity than the existing IBM 7070 and 1401 computers together with the additional benefit of real time processing" and that this "was a necessary prerequisite for achieving the objective of integrated data processing

throughout the steel tube division which had been agreed by the board in November, 1963 and re-affirmed in April, 1965".

This decision came as a result of a report written by the computer director and which we will examine more closely in the search process of Cycle 3. The reasons for the above decision are contained in a lecture given by the computer director at a Company 2 Management Conference.

> ... I feel it necessary to give certain reasons for changing the equipment in 1968. The first of these is that we anticipate by 1968 that our present capacity will be fully loaded. The second is that the development of current applications in the various companies which would include Company 2 has shown the need for "real-time" processing; this is only possible with the new installation.
>
> (Computer Unit Director)

1) Storage capacity filled. This first reason for the proposal of new equipment had become quite a bugbear for the the analysts and programmers at the computer unit. Serious inflexibility was being introduced because of the history of development of the programs and because the present machinery was ill equipped to handle the situation.

> Six months ago [October, 1965] we stopped to have a look at what we had done. The reason was that so much had been left out. We had developed the programs over

> five years and had put so many little byways and bits into the programs that that they were becoming excessively fulland very uneconomic to run. They were impossible to develop further. So additional things were very difficult to put in. The programs were very inflexible and method changes were impossible to put into such a big program without affecting much of it.
> (Computer Unit Director)

2) Time delay. The second reason for the purchase of new machinery was a continual source of irritation to management in the companies. Because the computer has many jobs to do, it was impossible to stop what it was doing and insert a different set of programs each time a company wanted to plan an order. Consequently, a 24 hour time delay had to be built into the system so that the computer could accommodate the many requests that it received in a day. The implications that the time delay caused were recorded by one company executive:

> The 24 hour built-in delay is a major problem that manifests itself in peculiar ways. It is more often a problem of simple frustration. Here we are faced with the men, materials, equipment, and time to spare, but are in the dark as to which materials to choose. Quite often we go ahead anyway without waiting for the computer to tell us what to choose, but we always run the risk of picking material that the computer has allocated to some other job, and then there are repercussions all the way along the line.
> (Company 1 - C)

"Real-time" data processing obviates the need for a time delay. Such an equipped computer enables instant access. There are a number of steps involved. The computer a) recognizes the interruption, b) stores its current task, c) feeds in any program required, d) responds to the real-time task, e) resumes its previous task, and all within the space of a very short time (depending upon the time of the required task) and without the intervention of a machine operator.

The reactions to such a proposal and endorsement were mixed. A conflict situation arose which was not resolved by the time research was concluded. Most of the critics prefaced their specific points against purchase of new machinery in 1968 with a reference to the history of the computer application to date:

> I'm amazed about this! I'd have thought many more examples of successful application were needed before hardware was bought. Hardware is not the limiting factor in this project.
> (Company 1 - D)

One divisional executive even questioned the contention that "we have really run out of capacity on the present computer". Another stated that because the main board has committed itself to new expenditure in 1968, this by itself is a source of pressure. If the division is not ready for the changeover in 1968, the fact that it is

committed will present a strong force to "go ahead anyway". The executive who made this comment proposed a possible solution to this dilemma to the division board. If it was discovered in 1968 that the division was not yet ready to undertake the changeover,

> ... the interest on our money for a year or so would more than compensate for the delay in making our investment effective. But how do we get all the chaps in one mind and refine and concentrate the work being done to enable us to make decisions about the control of quality? We're trying to take the computer decisions and let the other decisions follow on behind. A lot of people feel that there is an argument for waiting eight or nine years, but others say that we would never get any further. This is not true because we would by that time have gained a lot more experience in applying the computer to production control systems. Company 2, for example, has made a lot of progress with the application. But there is a lot of impatience around, and several people feel that unless we push ahead with the application people will drag their feet. Unfortunately, my voice is not powerful enough and my views are not popular.
>
> (Division - E)

Several other executives suggested that this corporation like many others that had a desire to "keep up with the Jones's", the purchase and utilization of a computer being an indication of progressive management thinking, first bought a computer and then decided what to do with it. The new purchase they feared was merely an extension of this

kind of attitude. This criticism brings us to the main crux of the problem and the point on which most of the conflict revolves: Does one purchase a computer and then devise a system to fit it, or does one first devise a system and then find a computer that will accommodate it? There are arguments for both alternatives:

> One wants to be clear first about our objectives in relation to the product, profitability, profit planning, and any question of simplification of the order book, and also on the plan for rationalizing the cold drawing side before going into the computer application. The rationalization should come first. I'm horrified at the pressure being applied to force the computer into companies.
>
> (Division - E)

> ... we are not fully utilizing the existing computer. Why not optimize the crude system that we have got now before thinking of this ultimate machine. I have a lot of doubts about the firm going for a better and bigger computer as a solution to our problems. I want to see more use of our present computer and train more people up to what to do. To take our systems now which are very crude and ineffective and build up on the basis of them a very sophisticated system seems to me to be creating a lot of trouble for ourselves in the future.
>
> (Division - F)

However, at the computer unit, they have different ideas:

> You can't divide the machine and the system; the two are so absolutely

> bound up. Whatever machine you use, it has limited facilities, so you design the system within those facilities. The technical limits of the machine dictate the type of system you can put in. When you get a machine with better facilities you can design a better system, always assuming you know enough about the system to improve it.
>
> (Computer Unit)

It is not a question, therefore, of whether or not to buy a real-time computer, but <u>when</u>? The advocates of new purchase in 1968 (and they would most certainly appear to be the stronger group) state that enough has been learned to date in the ten years of computer application, that the computer people have finally determined the parameters of tube manufacture, and that the existing problems will be eliminated by real-time processing. Therefore, a transfer to the new machinery would seem advisable as soon as it can be handled. The proponents of waiting state that the existing system is being taken as it stands and put on the computer. There is no basic questioning of the adequacy of that system. A delay in switching to the new machinery would allow for a "reasonable" search process to take place.

Before we begin an analysis of the search process that actually did take place, it seems appropriate to conclude this section on conflict with a reflection by one of the divisional directors:

> This is one of the big issues for the future, and the way we handle it could make a lot of difference to our effectiveness as a division in the next five years. Are we making a mistake with this "monster"? Although people discuss problems such as this as problems, it is almost impossible to take the emotion out of it. There is a lot of worry and fear surrounding this anthropomorphism.
> (Division - E)

In other words, concern over the technical problems must be balanced with concern for the social repercussions that result from the organizational problems involved in a project with such broad implications.

Cycle 3 - Search

A portion of the search process of Cycle 3 occurred at the same time as the search process of Cycle 2. Whereas the Cycle 2 search was involved with immediate objectives (devising suitable production control programs for companies 1 and 2, at the same time searching for basic laws of tube manufacture), search in Cycle 3 involved itself with overall divisional policy and objectives, and current developments in computer technology. As specific relevant information was learned from search process 2, it was fed into this larger project.

Because the computer director was largely responsible for conducting the entire search process of Cycle 3, it is of benefit to have before us his terms of reference, that

is, within the bounds of the division's objectives and computer technology, a description of that which he is trying to attain.

> Managerial control of any enterprise is exercised by taking decisions based on information supplied by the information system of the enterprise. For example, material is procured when information from actual or anticipated shortage is received, selling prices are fixed, at least partially, in relation to information on production costs, capacity is varied as a result of information on forward demand, labor is controlled on the basis of information of past performance, and so on. The quality of management cannot be better than the quality of the information supplied to it.
>
> The information system in any enterprise is a connected entity, although it is not regarded in this light traditionally. The preparation and presentation of information is the major item of administrative cost in any enterprise. In most enterprises information systems have grown up item by item, usually on a departmental basis and there is often a considerable amount of duplication and frequently information is not presented in the most useful form. ...
>
> An ideal information system will supply to each executive the information necessary to the discharge of his functions. Wherever possible, any information which does not require attention will have been eliminated before presentation. It is not the volume but the quality and scope of the information that is important.
>
> (Computer Unit Director in a report proposing the adoption of a real time data processing system)

Thus, with this frame of reference, the computer dir-

ector and his systems analysts considered the ramifications of division policy and its objective of integrated data processing. On the basis of recommendations made from the Cycle 2 search process and in light of current developments in computer technology, they produced a report which proposed the purchase of equipment which "is now commercially available that enables all the known defects of the present system to be overcome". This report was accepted by the main and divisional boards, and plans got underway to rewrite present computer programs with the objective in mind of eventually transferring to the new machinery. The actual problems involved in transfer were discussed by one computer executive:

> Transfer is not difficult but requires a lot of work and costs a lot of money. ... When we switch to the 360/50 we will not transfer programs as they stand; we will take advantage of the transfer to redesign the logical system used.
>
> (Computer Unit)

A schedule for the real-time data processing applications was also contained within the report. Companies 1 and 2 because of the huge backlog of information would be "integrated" in mid-1968. Company 3, because of the similarity in its production procedures, even though it has had relatively little contact with the computer unit, was slated for a few months later. Companies 4 and 5 and a soon-to-be-

built plant of Company 1 were scheduled for a year later. Company 6 was not mentioned. There was some difficulty envisaged with Company 5 that we have already discussed. Because there is uncertainty in estimating how much footage will come off a weld mill (all estimates being ±25%), this firm will become the subject of a special technical investigation. Otherwise, it was anticipated that transfer and application should take place smoothly and with perhaps only a minor revision of the time schedule.

Let us now make a detailed examination of <u>why</u> this report and its proposals were endorsed. As we have indicated throughout, this will entail an analysis of the feasibility and acceptability of the stated objective of integrated data processing. In this case, it is possible to list seven major reasons why the proposed real-time data processing system for the steel tube division was accepted.

1) Only the characteristics of a real-time computer system make feasible the objective of integrated data processing for fourteen diversely distributed steel tube manufacturing companies. We have already discussed the purely technical advantages of a machine that can accommodate the equivalent of seventeen to twenty of the computer unit's present programs at one time and which can process inquiries immediately and transmit the result almost instantaneously to an external station, irrespective of the task on which it

is at that moment engaged and without any intervention by an operator. We did not, however, discuss the further technical advantage of simulation that this new machinery also offers. As the computer director stated:

> The present information system, so far, offers little guidance to the setting of control parameters which is one of the main managerial functions. In setting such policies the greatest need is to be able to evaluate, within an acceptable degree of certainty, the likely effect of alternative policies and to make a specific choice on the basis of this evaluation. The only effective means of obtaining this information is by simulation. Simulation involves constructing a numerical model under varying conditions and deciding from the results which of the alternative policies is likely to give the best results.
>
> (Computer Unit Director)

2) We have also presented the view that this large firm in purchasing the latest electronic equipment sets itself up as very much of an industrial and business trend setter. In fact, during the period while research was in progress, an industrial columnist wrote a full page report on this firm.[41] The newspaper article discussed the many attributes of the firm which are responsible for making it one of the leaders of the engineering field. Both the present and proposed computers were seen as contributing to this impression. It naturally enough became a talking point in interviews and general discussion. There was a reluctance to read too much

into the article; for example, it was described as "the usual journalistic mixture of truth and half-truth"; but even so, it caused some company executives to view the computer application in a more favorable light. Thus, as well as increasing the general prestige of the firm, it had the added effect of making the project more acceptable to some company executives.

3) Also contributing to the acceptance by the main and division boards was the fact that since 1960 this firm has committed itself to the objective of integrated data processing. If the new machinery is seen as contributing toward this objective, then the pressure of the commitment is a major factor in its acceptance.

4) The actual creation and formation of a specialized organizational unit for the computer gives it significance in policy formulation. As we have already indicated, if there is a lack of definition as there was in this case where the firm was breaking completely new ground, the people responsible for systems analysis can influence policy decisions by the way in which they formulate the problems. It could be argued, for example, that the main board in accepting the proposal at this time of real-time data processing was really accepting the most articulate set of proposals rather than what would be more appropriate for the organization at that time.

5) This leads directly to the next point. The propensity of the computer unit to write reports also provides a partial explanation as to why its recommendations were accepted. The individual or group that recognizes, explains, and even provides a potential solution to a problem "has an important voice in the way in which the problem is formulated and in the extent to which it is communicated to others in the organization".[42]

6) The workability or perceived workability of an objective is also a powerful force towards its acceptance.[43] This point is made very dramatically when one compares the computer unit and its custom of writing reports that spell out specific procedures with the companies and their protestations that "it is impossible to summarize fifteen years of tube making experience on a computer".

7) Finally, if one has the initial endorsement of the principal decision makers of an organization, in this case, the main board, and one's objectives are similar to these individuals, one is far more likely to have his proposals accepted almost as a matter of course than if the reverse situation were true.[44]

As well as contributing to the acceptance of the report by the main and divisional boards, these seven reasons also lead to a consolidation of the proposals contained within the report, and the development of interest groups and subgoals.

Cycle 3 - Consolidation

> Although some benefits will arise directly from the introduction of computer controls in such ways as staff savings, stock reduction, and yield improvement, the chief advantage should be looked for in an improvement in the quality and extent of information available to management. At present there are serious deficiencies to be overcome such as lack of knowledge of product costs and profitability, and a general inadequacy in the information available at Divisional level on which company performance can be assessed and on which future planning, capital expenditure and commercial policies affecting the Division as a whole can be based. To meet the Divisional needs a degree of standardization in the different company information systems will be essential. In addition, the enlarged and improved computer installation will enable simulation studies to be mounted to show the effect on costs and profits of such factors as different production methods, new investment, variations in capacity loading or changes in sales mix.
>
> (a statement by the steel tube division board on computer development)

The above statement by the division could be termed a statement of intent for it embodies all the reasons for the overall objective of integrated data processing, and it was to this end that the division set up functional working parties, arranged for computer courses for all management levels, and sought to establish an involvement never before attempted on a divisional basis. Because research ended before the consolidation process did, we will make only

brief comments about the directions we think this process is likely to lead.

One of the most important areas in the attempt to establish integrated control is the relationship between the companies and the division. One of the computer people in predicting the success of the application stated that

> ... it has to go ahead in the right environment. The Managing Director of the division knows there is a lot of room for improvement ... . He is a far sighted man; he feels the companies should be deeply involved. Involvement was not possible in the first place because they had not got enough experience. But now it is possible.
>
> (Computer Unit)

This statement brings to light a number of questions that have been plaguing the division. What is the "right" environment for the computer application? How is it possible to make companies deeply involved? What kind of experience is necessary for this involvement? Whereas the division has not yet the answers to these questions, at least it is asking the questions.

The division and the image it presents to the companies is extremely crucial, especially in light of the previous era of company autonomy that we have already discussed. However, due to the efforts of the managing director and his functional directors, a workable and acceptable relationship is at last being nurtured. One divisional

director commented:

> The managing director may be individually responsible for the division but it doesn't mean that he acts in an authoritative way; he's not a dictator. It's the difference between a "human relations" approach in which you tell the chaps and keep them in the picture, and a "Human resources" approach in which you assume you are dealing with a group of intelligent human beings who have different experiences and views which it is worth plumbing because they may affect your decision.
> (Division - E)

The fact that the above divisional executive chose these particular words to describe this situation illustrates an interesting phenomenon. Many of the more senior divisional and company executives are relatively sophisticated in management theory. Some of them regularly attend lectures and courses on management and organization. What is interesting is that they are using descriptive social science concepts to defend the particular courses of action that they have chosen. In other words, they are using for justification terms that have been developed to describe the various organizational processes in which they are currently engaged.

What the above executive was saying was that the managing director does not expect nor does he want a unified, completely harmonious divisional structure. He expects, for example, company managing directors to present

their own cases very strongly - this is their job. However, he does want to achieve an environment in which these same senior company executives see that their own individual company interests are represented on a broader plane, that is, in a divisional structure. The changes that are being noticed on the division board which is composed of divisional functional directors and company managing directors are illuminating in this respect. In an interview with one of the divisional directors on the board, he stated:

> It seems to me that the divisional board might be working towards becoming more than an information disseminator in that people are beginning to know each other better, to know more about what's going on, to think of the division more as a division, and of the divisional board as something which is not a forum for defending one's company position (which it used to be apparently). Now people are beginning to feel rather that they are members of the divisional board. Perhaps they still have to sell it to their subordinates in their companies.
> (Division - E)

It would appear that a bargain is in the making. The division in allowing company managing directors involvement on a wider "divisional" spectrum thereby gains a commitment in the establishment of uniform controls throughout the division. As we have stated, this is merely conjecture based on existing data as to how a part of the consolidation process might develop.

An interesting situation in this respect is the development of the computer application in companies 1 and 2. Throughout the data presentation, there have been occasional references to the fact that the application is more successful at Company 2, even though it was begun earlier in Company 1. The major reason for this can be found in the origin of the two companies. Company 1 was one of the original four members of the federated alliance in 1919. From this time forward it has maintained a powerful and influential position (it is by far the largest of the six company groups within the division), including housing the original corporation headquarters. Briefly, it is steeped in the tradition of autonomy that was encouraged for forty years.

Company 2, on the other hand, is a new company conceived by the present divisional management. Born from a merger between two departments of two other companies, its management, most of it from the affected companies, was nevertheless recruited by the division. From its beginning Company 2 has been a steel tube division company. Because of the problems involved in setting up a new company and because it did not have a previously established tradition of autonomy, Company 2 has a more intimate relationship with divisional headquarters than does Company 1. Also, because it does have a closer relationship, it is more

involved in "divisional" projects such as the computer application. Consequently, there is further evidence for the ascertion that if the division can involve the companies in division projects, it can thereby gain a greater commitment and thus greater control over its objective of integrated data processing.

A more definite area for speculation as to how this consolidation process will develop is management training and development. As well as the specific courses on computer installation and operation which in some cases have been extended to three months, the division has also arranged for management courses on how the influence of communications and systems science, and the rapidly expanding developments currently taking place in understanding the processes of thinking, organizing, and problem-solving is affecting and changing the whole practise of management. Also in these courses is an emphasis on "getting people to think of the division rather than the company. It's a start towards making people think beyond the limits of company boundaries." Consequently, it would appear that these two moves - involving senior company personnel on a divisional basis and committing them through divisionally sponsored courses - are helping the division to establish its desired image and at the same time achieve "the objective of integrated data processing throughout the steel tube division".

The cyclic processes

In the preceding sections we have presented the cyclic processes that comprise this particular organization objective. By way of conclusion and in an attempt to depict common elements and explanatory features, we have presented the entire development of this objective in schematic form (see Table III) from "getting involved in the use of computers" (1956) to achieving "integrated data processing throughout the steel tube division" (1965).

In comparing similar processes in each of the cycles, some conclusions are apparent. For example, each of the succeeding search processes becomes more explicit and well defined. The focus of search narrows appreciably as does the time it takes to complete each search process. The energies devoted to ascertaining the feasibility of the objective become more focused. In Cycle 1, the possibility of several kinds of computer application were explored, while in Cycle 3 only the possibility of various detailed aspects of one project were examined. The emphasis of search becomes less concerned with the possibility of the objective and increasingly involved with its workability and operationality. It will be noted that the perceived workability of an objective presents as great a pressure for its acceptance as does actual workability. In Cycle 1, the computer unit's attempt to base programs on existing manual production control systems proved abortive, yet the

Table III

Development of an Organization Objective

Organizational Processes	Cycle 1
SEARCH	1956-59 - research into getting involved in the use of computers.
Feasibility	- ascertaining possible alternative courses of computer application and a report recommending the specific kind, place, method, and time of application.
Acceptance	- acceptance of report by main board. Little attempt to involve other organizational members.
CONSOLIDATION	1960-62 - development of computer programs in various steel tube companies.
Interest group formation	- formation of three broad specialized functional groups - the computer unit, the division, and the companies.
Subgoal formation	- computer unit's concern with technical problems involved in application; division's interest in establishing a coordinated divisional structure; and companies' commitment to previous autonomous manufacturing conditions.
CONFLICT/CHANGE	1963-65 - conflict and pressures for change due to the abortive attempt to base computer programs on existing manual production control systems.
Conflict	- company resistance to divisional integration and computer application.
Change	- decision by division to limit application to companies 1 and 2.

Table III (cont'd.)

Organizational Processes	Cycle 2
SEARCH	1963-65 - attempt by computer unit to find the basic laws of tube manufacture; attempt by division to ascertain environment conducive to integrated data processing.
Feasibility	- ascertaining whether an integrated control system is possible within the division. "Workable" proposals by the computer unit and division to this end.
Acceptance	- attempt by division to involve all company managements in an active role in the computer application by setting up working parties and arranging for special management courses.
CONSOLIDATION	1965-? - cautious compiling of new information for revised programs.
Interest group formation	- formation of company teams to assist in the application; formation of interest groups on the issue of who should assume responsibility for the application.
Subgoal formation	- attempts by division to coordinate subgoals; subgoal formation on the whole issue of control: who is to have it, what kind will it be, and how will it be used?
CHANGE/CONFLICT	1965-? - realization by computer unit that present equipment is becoming overloaded and built-in time delays are hampering objective.
Change	- commitment by main and divisional boards to the purchase of new generation machinery in 1968.
Conflict	- criticism by company and divisional personnel about new plans when only partial success has been shown to date.

Table III (cont'd.)

Organizational Processes	Cycle 3
SEARCH	1965 - research into the problems of attaining integrated data processing and the advisability of obtaining a "real-time" computer.
Feasibility	- ascertaining the "need" and finances for such a project and a report specifying the scope, use, advantages, and schedule of proposed introduction of the new computer.
Acceptance	- attempt by division to involve senior company personnel in "divisional" projects, and initiation of a series of lectures, company visits, and computer courses to gain company commitment.
CONSOLIDATION	1965-? - senior and middle management computer courses and rewriting of programs with the idea of transfer to new machinery.
Interest group formation	- reallignment of interest groups on the basis of new hardware in 1968 and on the division's attempt to achieve more company commitment.
Subgoal formation	- the beginnings of a "positive" company-division relationship by involving companies in "divisional" problems. The differing reactions to the computer application by companies 1 and 2.
CONFLICT/CHANGE	
Conflict	
Change	

main board accepted the proposals contained in the report because it was convinced that these proposals were in fact workable. Succeeding search processes reveal a genuine concern for getting companies to accept the computer project. It was either not known or not thought necessary for companies to be deeply involved for a successful implementation of the objective.

The consolidation processes also reveal some interesting conclusions. In Cycle 1 we note the formation of three specialized functional groups - the computer unit, the division, and the companies. Because of the nature of their specialized tasks and due to their histories of origin, these groups form specialized subgoals. The computer unit concerns itself, almost exclusively, with the technical problems involved in the application. The newly established divisional executives, their sympathies with the companies, nevertheless attempt to establish a divisional structure in which central integrated control is possible. The companies, steeped in a tradition of conducting their own independent operations, present resistance to the notion of central control. As we proceed through the cycles, there is a growing realization of the state of affairs by the division and an attempt by it to bring these subgoals more into line with one another. This involves the bargain of allowing companies more control over the formulation and implementation of the computer project in

return for an increase in commitment and involvement in "divisional" operations.

The processes of conflict and change also merit discussion. There is a tendency to think in some business communities as well as social science circles that conflict is something to be avoided. We hope, however, that this presentation has displayed that conflict is not to be avoided but reckoned with and anticipated. Conflict implies change as does change imply conflict. It is these processes that provoke new development, and in this case, a new search process with a narrower and more precise focus. In the development of this organizational objective, conflict resulted in increased efforts to discover the basic laws of tube manufacture and an involvement that was previously lacking of senior divisional and company managements. It also stimulated the debate that is currently taking place as to the advisability of acquiring new generation equipment in 1968. The process of conflict is two-sided; it acts as both a control over and a stimulator of change.

In the concluding section, we will concentrate on the more general issues that we have raised throughout the data presentation. Specifically, we will produce generalizations in propositional form on the notion of an organiz ation objective as it affects managerial control.

VI. Conclusions: Implications for Further Research

Organization objectives

In the preceding study, we have analysed the factors significantly affecting the development of this organization objective. Some of these factors have detracted from its achievement while others have contributed toward a successful implementation. In this section, we will describe both sets of factors and then attempt to relate them to the notion of managerial control.

One of the major factors detracting from the achievement of the objective in its early years, and from which several other factors follow, was the relative lack of direction and involvement on the part of the senior management responsible for its introduction. Whether the fault lies with the division or the main board is really a side issue. What is important is that a lack of firm leadership over the project resulted in uncertainty and tentativeness throughout all affected parts of the organization. We have already discussed the various manifestations. The computer unit, intent on achieving the technical application, and faced with this lack of direction, took the initiative. Unfortunately, the computer unit executives were unfamiliar and in some cases unaware of the organizational problems involved. Consequently, due to the uncertainty caused by a reluctance to assume responsibility and the computer unit's

initial approach to the companies, a great deal of resistance was mustered against the project. Added to this situation was the computer unit's technical inability to define the parameters of tube manufacture.

Throughout the presentation, we have commented on the companies previously established tradition of autonomy. This comprises another major reason detracting from the achievement of this organization objective. As long as company autonomy is allowed to be seen as a possible alternative to an integrated division, resistance will flourish and the objective will be endangered.

In creating a number of specialized functions to achieve a given organization objective, a classic situation arises. This is known as subgoal formation and sometimes detracts from the implementing of that same objective. In our study, we note the formation of three broad functional groups - the computer unit, the division, and the companies. As we have already outlined, these groups because of their specialized knowledge and training, their in-group communication, and the specialized nature of their tasks, tend to view the objective in different, sometimes conflicting, ways. For example, the divisional objective to introduce integrated data processing is hampered by the computer unit's overbearing concern with the technical application, the companies' interest in maintaining their own independent manufacturing operations, and the division's emotional

attachment to the views of the companies. As well as producing different views, subgoal formation also tends to reduce the amount of contact among various organizational subgroups. Consequently, the liaison and communication necessary for a project of this nature is also endangered by this phenomenon.

Finally, during the development of this objective, there were a number of changes in senior management and in overall policy. This had the effect of introducing more uncertainty and complicating an objective already fraught with complex issues. All these factors had the cumulative effect of slowing down the implementation of integrated data processing. Particularly in the formative years when the issues were not so concrete and well known, these factors together impeded a successful conclusion.

The fact that this objective <u>is</u> developing toward its desired end implies that there is also a set of factors that is contributing toward its implementation. An external factor can be found in the general industrial trend toward the adoption of impersonal control mechanisms.[45] The computer represents a means whereby an impersonal control system can be established. Consequently, there is a strong pressure to implement those objectives seen as contributing toward the advancement of industry and that are industrially fashionable.

From its inception, this project has had the continued endorsement of the main board. It was one of the directors of this board who first conceived the idea, and now, with the computer unit again under the direct control of one of the joint managing directors of the firm, it has gained improved status in the eyes of many executives concerned with the application.

We have already discussed the computer unit's propensity for report writing. As we also mentioned, the workability of an objective, whether perceived or actual, presents a strong pressure for acceptance. The fact that the computer unit specifies in detail the methods and priorities of its plans and relates them to a time schedule is a great contributing factor toward the development of the objective.

The belated activities of the division also significantly affect the development of the objective. In its attempt to stretch company managers' horizons to include divisional matters, it is breaking down the parochial company boundaries reinforced by forty years of independent operation. Control over the formaulation of divisional policy, increased participation on the division board, and divisionally sponsored and influenced management courses are the methods whereby the division is attempting to gain more company commitment to the computer project.

All of the factors contributing toward the implementa-

tion of this objective as well as some of those detracting from it relate to questions of feasibility and acceptance. Thus we may conclude that to the extent an organization objective is feasible and accepted, it is more likely that it will be implemented. There are other factors such as previously established traditions, rapid organizational change, and a lack of involvement by senior management that we also deem to be significant. However, it is suggested that if this objective had been more feasible (e.g., the parameters of tube manufacture being known at the outset) and more accepted (e.g., the companies being involved earlier in the formulation and direction of the project), these other problems, if indeed they would have been problems, would not so significantly have affected the outcome.

Managerial control

Given the objective to establish an integrated control system within the steel tube division, one conclusion is obvious. A tighter system of control implies a more precise statement of objectives, for we have already stated that control is, by definition, related to some standard or objective. The precision with which objectives and plans have been made within the steel tube division has been characteristically loose. For example, one divisional director commented:

> We've never been ones for defining things too precisely in this firm. Things happen by implication and usage.
> (Division - B)

Thus, along with its objective to establish integrated control, the division has also attempted to describe in detailed terms exactly what it is doing and what it is trying to achieve. For example, the managing director of the division recently asked all his functional directors to produce terms of reference. Also, divisional plans for rationalization and standardization call for a more precise statement of objectives.

It is our conclusion, given the very slow start of the objective to achieve integrated data processing within the steel tube division, that had the division concerned itself first with a definition of objectives and then with the attempt to introduce control rather than focusing on both these problems concurrently, it might now be in a stronger controlling position. One must first ascertain his objectives before he can attain control, and the more tightly he wishes to control, the more precise must be his objectives.

If the division does establish a centrally unified control system as appears likely, several points follow. First, as one company director indicated, an emphasis on planned objectives reduces the probability of risk because of the detailed search process that takes place. However,

it also has a restrictive effect on business enterprise.

> Now any scheme has to run the gamut of committees and boards. This eliminates the risk factor. Mind you, we will probably continue for evermore making a nice steady profit, but we will never do anything startling. People who make and lose a lot of money are those who take development risks, and we are no longer set up in a way to take advantage of opportunities.
>
> (Company 4 - A)

The whole process of management changes as a result of the changing nature of control. The replacement of personal hierarchical control with an impersonal mechanistic control system has broad ramifications.

Second, the introduction of centralized integrated control still leaves open the question in a division with such diversified manufacturing operations of what to measure. A current worry expressed by some company executives is that the division will concentrate on things first because they are measurable and not necessarily because they are good indicators of company performance, especially when compared with other companies. Such concentration tends to distort the total picture. The division is currently experimenting with the measure of comparing companies' relative ability to meet their budgets. However, realistic budgets presuppose a precise and explicit statement of objectives, something that the companies are only now attempting to formulate. Conse-

quently, we again find attempts to impose relatively strict control failing because objectives are vague and often only implicit.

Third, the application of centrally administered mechanistic control poses a conflict in two managerial ideologies. The steel tube division provides an interesting illustration of a problem currently facing a large number of industrial firms. An attempt is being made to pursue two courses simultaneously, to promulgate two ideologies which are not really compatible. Current management development procedure emphasizes the importance of individuals and the professional nature of management with all the emotional undertones of the word "profession". On the other hand, what is happening in practice - rationalization of every kind, establishment of control systems, and the computer application - puts much less emphasis on individual management performance and more on the system in which management functions. Yet traditional management ideology is still propounded in management training and development schemes.

This conflict in ideologies is at the base of the present company-division difficulties. On the one hand, is the division attempting to establish an integrated mechanistic control system, while on the other, are the companies holding on tenaciously to their individual, personal, hierarchically

organized operations that they have established over the years. The fact that the divisional executives have for the most part the bulk of their experience in the companies explains their reluctance "to treat company identity lightly".

With the difficulties that the division is experiencing in attempting to establish unified control, it is no wonder that it has looked to the companies for increased commitment.

> In a situation charged with conflict, the process of discretion will be subjected to close scrutiny, and the quality of administrative decision will tend to be infused with a high degree of self-consciousness. The scrutiny of the opposition and self-consciousness of the leadership will alike center upon the question of commitment. What attributes and what symbols are commanding the loyalties of the staff? What precedents are being established? What alliances are being made? Such issues will be uppermost in the minds of leading individuals during periods when the evolution of the character of an organization is not settled. 46

If the division can achieve more company commitment to the computer application in exchange for more company involvement and direction over divisional policy, it is probable that the division will achieve its objective of integrated data processing within the steel tube division.

What is now being discovered, however, is that in the determination of what the real controlling factors are, the

computer application does more than simply simulate the work of manual planners. It provides the basis for a radically different integrated system of control. Because the machine has to programmed, it forces decisions to be made consciously both about long term objectives and short term standards of performance. Moreover, when organized from a central point, it alters the pattern of information flow. In future, for example, instead of approaching the companies for much of the detailed information required for planning, divisional personnel will simply have to commission the writing of a computer program. The dangerous misconception in the case of the steel tube division, as in many other manufacturing concerns, was to see the computer as a management tool mechanizing mental activity rather than as an intrinsic part of a total system of control.

FOOTNOTES

VII. Footnotes

1. For an outline of this approach, see Joan Woodward, Industrial Organization: Theory and Practice (London: Oxford University Press, 1965).

2. Loc. cit.

3. Ibid., pp. 180-1.

4. Joan Woodward, "Technology, management control and organizational behaviour" (forthcoming), p. 3.

5. Joan Woodward, Unpublished confidential report #1 (London: Imperial College of Science and Technology, 1965).

6. Joan Woodward, P.G. Combey, & R.A. Hedley, Unpublished confidential report #2 (London: Imperial College of Science and Technology, May, 1966).

7. Ibid., p. 18.

8. See, J.G. March, "The business firm as a political coalition", Journal of Politics, 24, 1962, pp. 662-78; N.E. Long, "The administrative organization as a political system", in S. Mailick & E.H. VanNess (eds.), Concepts and Issues in Administrative Behavior (Englewood Cliffs, N.J.: Prentice-Hall, 1962), pp. 110-21; and, R.M. Cyert & J.G. March, A Behavioral Theory of the Firm, (Englewood Cliffs, N.J.: Prentice-Hall, 1963), esp. pp. 26-43.

9. See fn. 8.

10. H.A. Simon, Administrative Behavior (New York: Free Press, 1957), p. 5.

11. Neil Chamberlain, A General Theory of Economic Process (New York: Harper, 1955), p. 359.

12. Cyert & March, op. cit., pp. 27-8.

13. See H.A. Simon, "Birth of an organization: The Economic Cooperation Administration", Public Administrative Review, 13, 1953, p. 236.

14. Ibid., pp. 230-1.

15. J.G. March & H.A. Simon, Organizations (New York: Wiley, 1958), p. 42.

16. See A. Etzioni, Modern Organizations (Englewood Cliffs: Prentice-Hall, 1964), pp. 8-10.

17. See James D. Thompson & F.L. Bates, "Technology, organization, and administration", Administrative Science Quarterly, 2, 1957, pp. 325-43.

18. Ibid., p. 329.

19. March & Simon, op. cit., p. 155.

20. Long, op. cit., p. 114.

21. March & Simon, op. cit., pp. 40-4 and 121-9.

22. James D. Thompson & W.J. MacEwen, "Organizational goals and environment: goal-setting as an interaction process", American Sociological Review, 23, 1958, p. 26.

23. See ibid., pp. 25-7.

24. Chamberlain, op. cit., pp. 363-4.

25. March, op. cit., pp. 673-4.

26. See ibid., p. 672.

27. March & Simon, op. cit., p. 152.

28. Ibid., pp. 152-3. For a social psychological explanation of interest group and subgoal formation, see Hans L. Zetterberg, "Compliant actions", Acta Sociologica, 2, 1957, pp. 179-201, where he states:

> The more an actor's actions conform to the uniform prescriptions in his action system, the more favored his self-attitudes tend to become. (p. 195)

29. Cyert & March, op. cit., pp. 33-4.

30. See Simon, "Birth of an organization ...", p. 236.

31. See R.M. Cyert, H.A. Simon, & D.B. Trow, "Observation of a business decision", in A.H. Rubenstein & C.J.

Haberstroh (eds.), Some Theories of Organization (Homewood, Ill.: Dorsey Press, 1960), pp. 458-9; William R. Dill, "Administrative decision-making", in S. Mailick & E.H. VanNess (eds.), Concepts and Issues in Administrative Behavior (Englewood Cliffs, N.J.: Prentice-Hall, 1962), p. 34; March & Simon, op. cit., pp. 139-40; and, J. Feldman & H.E. Kanter, "Organizational decision making", in J.G. March (ed.), Handbook of Organizations, (Chicago: Rand McNally, 1965), pp. 620-3.

32. Chamberlain, op. cit., p. 358.

33. See Woodward, Unpublished confidential report #1.

34. Claire Selltiz et al., Research Methods in Social Relations (New York: Holt, Rinehart and Winston, 1959), p. 447. See also, A.H. Rubenstein & C.J. Haberstroh, "Research techniques", in Some Theories of Organization (Homewood, Ill.: Dorsey Press, 1960), pp. 479-80.

35. See Joan Woodward et al., (forthcoming).

36. See H. Ronken & P. Lawrence, Administering Changes (Boston: Harvard Business School, 1952); M. Sherif, "Superordinate goals in the reduction of intergroup conflict", American Journal of Sociology, 63, 1958, pp. 349-56; J. Seiler, "Toward a theory of organization congruent with primary group concepts", Behavioral Science, 8, 1963, pp. 190-8; and, J. Seiler, "Diagnosing interdepartmental conflict", Harvard Business Review, 41, Sept.-Oct., 1963, pp. 121-32.

37. J. Seiler, "Toward a theory of organization ...", p. 196.

38. Woodward et al., Unpublished confidential report #2, pp. 60-1.

39. Cyert & March, op. cit., pp. 33-4.

40. See W. Moore, Social Change (Englewood Cliffs, N.J.: Prentice-Hall, 1963), pp. 10-11.

41. Because we do not wish to identify this firm, it is impossible to provide the reference to this newspaper article.

42. Dill, op. cit., p. 38.

43. See Simon, "Birth of an organization ...", pp. 230-1.

44. Loc. cit.

45. See for example, P.M. Blau & W. Richard Scott, Formal Organizations (London: Routledge and Kegan Paul, 1963), esp. pp. 163-93; and, M. Janowitz, "Changing patterns of organizational authority", Administrative Science Quarterly, 3, 1959, pp. 473-93.

46. P. Selznick, "Ideology in organization", in A.H. Rubenstein & C.J. Haberstroh (eds.), Some Theories of Organization (Homewood, Ill.: Dorsey Press, 1960), p. 78.

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