IMPLICATIONS OF ORGANIZATIONAL CORRELATES OF TECHNOLOGY FOR SUPERVISORY BEHAVIOR

by

FREDERICK HERBERT HOSTETTER
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Department of Commerce and Business Administration

The University of British Columbia,
Vancouver 8, Canada.

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ABSTRACT

This study deals with the indirect effects of industrial technology upon the behavior of first-line supervisors. Homans' paradigm of the constituents of social behavior, and Woodward's observations regarding organizational correlates of technology provide the rationale for the enunciation of specific hypotheses pertaining to the nature of supervisory activities, interactions and sentiments associated with each of three categories of industrial technology.

The validity of the specific hypotheses is tested thru a secondary analysis of data reported in a number of observational studies of organizational behavior.

The perennial "man in the middle" concept of the first-line supervisor is rejected. It is not a valid ideal-type concept that is representative of supervisory behavior in all forms of contemporary production organizations.

It appears that the dominant mode of technology within a production organization or work unit affects organization structure and processes. The latter phenomena seem to be important factors shaping supervisory role demands, characteristics of work environment, and, hence, supervisory behavior. Thus, the study suggests the utility of three ideal-type constructs of supervisory behavior; one for each of the three categories of technology.

Unit-and small-batch-production technology

Role demands include an important technical element. Administrative activities include personally attending to personnel matters, production reports and specifications, and coordinating and monitoring work flow through the unit. Interactions with fellow supervisors along the work flow are minimally required. Interactions with both subordinates and staff specialists are typically task-oriented, face-to-face and devoid of conflict. Interactions with superiors may be mediated by the reports of staff specialists if the latter are found in the organization. Sentiments toward subordinates, superiors and staff specialists tend to be neutral to friendly in tone and fairly constant over time.

Mass-production-assembly-line technology

The supervisor typically neither possesses, nor is required to possess, a significant body of technical knowledge or set of technical skills. Administrative activities are directed toward coordinating and monitoring work flow through the unit, and, in general, achieving the collaboration of others. These activities are effected by verbal interactions, mainly with non-workers such as staff specialists. The requirement for interactions with fellow supervisors along the work flow ranges from being minimally required to inherent in the productive process. Interactions with staff specialists are face-to-face, task-oriented, and typically hostile. Interactions with superiors tend to be task-oriented, hostile and heavily mediated by the reports of staff specialists. Supervisory interactions with subordinates tend to be face-to-face, frequently hostile, and primarily task-oriented. The sentiments of supervisors toward subordinates, and particularly superiors, are characteristically those of defense and hostility; they are unstable over time. Sentiments toward staff specialists tend to be neutral to hostile and generally stable over time.

Continuous-process technology

Role demands of the supervisor include an important technical element; technical advice is both sought from and given to subordinates and staff specialists. As the degree of automaticity of production control increases, the need for coordination of work flow within and between units decreases; similarly for the requirement for exclusively task-oriented interactions with other organization actors. Administrative activities include inspection and control functions designed to assure the safety of both personnel and the process and equipment. Interactions with subordinates and staff specialists tend to allow for the mutual evaluation of technical issues. As the degree of automaticity of production control increases, such interactions tend to be characterized by the exchange of advice and information. Sentiments are generally neutral to friendly and slightly unstable over time.

V.V. Murray, Supervisor

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF CHARTS

INTRODUCTION

Statement of intent and scope

This study is an attempt to develop and test a series of specific hypotheses regarding the following dimensions of first-line supervisory behavior: (1) the nature and frequencies of first-line supervisory activities (2) supervisory interaction patterns and frequencies, and (3) the nature of supervisory sentiments toward those organizational actors with whom interactions occur.

The phrase "supervisory activities" denotes any overt behavior directed toward the accomplishment of supervisory tasks. Thus, acts of reading, writing, observing, speaking and listening are included under the title of "activities."

"Interactions" refer to a sub-class of activities in which the speaking, listening and non-verbal communication activities of either the supervisor or another organization actor exercise immediate influences upon the behavior or perceptions of another actor. The nature of interactions will be spoken of as being characterized by a quality or tone associated with the "sentiments" engendered by an interaction. The term "horizontal interactions" shall be used to denote interactions between the first-line supervisor and either (1) fellow supervisors along the work flow, or (2) staff specialists, e.g., maintenance, quality control, production planning and scheduling, methods officers, etc.

As used in this study "sentiments" refer to the feelings of an actor in response to a particular aspect of his environment. Such feelings beome "sentiments" if they endure over a period of time, for example, a few days, or weeks, or longer.

To be more specific, the objective of this study is to proceed by a quasi-deductive method to formulate and test a series of specific hypotheses regarding the above-noted dimensions of supervisory behavior under three categories of industrial production technology.

The phrase "industrial production technology" is used to denote the complex of physical objects, technical operations, men-machine systems, and the level and type of mechanization associated with the manufacture or production of a product, series of related product, or a service.

Following Joan Woodward's study[1] three discernible categories of industrial production technology are utilized in the analysis. Category I denotes "unit and small-batch production technology." Category II refers to the technology associated with "large-batch mass-production, or assembly-line" production. Category III refers to "continuous-process technology."

Overall methodology and organization of the study

The study commences with an attempt to set the research in its historical perspective. To this end, the observations of a sample of both the earliest and contemporary students of organizations and the implications of technology for social behavior are examined briefly. The historical survey of Chapter I concludes with reference to the research of Joan Woodward, which provides a logical bridge to the remaining chapters of the study.[2]

In Chapter II the observation made by Woodward, which serves as the starting point of this study, is noted. In addition, the conceptual scheme underlying the analysis is explained. Chapter II concludes with a statement of the general hypothesis of the study, plus an explanation of the analytical framework used for ordering the enunciation of the specific hypotheses and their subsequent testing.

Chapter III serves to develop the specific hypotheses regarding the dimensions of supervisory behavior for each of the three categories of production technology. Woodward's observations regarding the organization structural correlates of a given category of technology are presented and interpreted. The specific hypotheses pertaining to the dimensions of supervisory behavior for that category of production technology are then developed.

Chapters IV, V and VI each contain two case studies which provide descriptions of first-line supervisory behavior under production technology Categories I, II and III respectively.

In Chapter VII the data of the three preceding chapters and the appendices to the study are analyzed. The purpose of the analysis is to test the validity of the specific hypotheses enunciated in Chapter III.

Chapter VIII includes: (1) a summary of the analysis carried out in Chapter VII (2) a statement of the conclusions emerging from the study (3) an enumeration of future research problems suggested by this investigation, and (4) a discussion of the implications of the analysis for organization theory.

FOOTNOTES ON INTRODUCTION

[1]Joan Woodward, Industrial Organization: Theory and Practice, (London: Oxford University Press, 1965).

[2]Ibid.

CHAPTER I

CORRELATES OF TECHNOLOGY: AN HISTORICAL PERSPECTIVE

Introduction

The contents of this chapter comprise a survey of some of the highlights from the literature pertaining to technology, the division of labor, organization theory, and the social effects of technology. By sketching the more fundamental relationships among these elements, and by pointing out the limitations of contemporary organization theory, the stage is set for the subsequent analysis. The chapter serves to illustrate the continuity between the analysis contained in this study and the research and speculation which precedes it.

Historical perspective

From the earliest beginnings of the Western intellectual tradition scholars have studied the nature and significance of the division of labor in society.[1,2] Although as early as the time of Aristotle several scholars recognized the importance of society's division of labor[3] and, hence, technology, it was not until the end of the eighteenth century that an extensive social cognizance was taken of the phenomenon.[4]

In the writings of Adam Smith one notes what is probably the first serious attempt to enunciate a theory of the principle of the division of labor.[5] But it was Comte who first saw beyond the purely economic nature of the technologically based division of labor.[6]

The special interests, predilections and values of several scholars since Adam Smith have led to research endeavors all apparently stemming, at least partially and indirectly if not directly, from a common concern for identifying the nature and consequences of the technologically conditioned division of labor. The objectives of these scholars seem to have been directed toward delineating the dominant social, organizational and behavioral implications of the division of labor under industrial production technologies. The immediate purpose here is to sketch the main boundaries of these broad avenues of inquiry in order to establish the background to the subsequent analysis.

The works of Karl Marx provide a useful, if arbitrary, beginning for the survey. In the earliest writings by Karl Marx one finds a number of concepts and themes which appear to run throughout his entire works. For example, in his German Ideology Marx observes that persons who are "productively active" enter into "definite political and social relationships."[7] He goes on to explain that as persons are "effective," as they "produce materially" and are "active under definite material limits," the social structure of society evolves continuously and independently of the will of individuals.[8] The same concepts find expression in his later works, for example in Capital. Here Marx notes that

> 'The general conclusion I arrived at--and once reached, it served as the guiding thread in my studies --can be briefly formulated as follows: In the social production of their means of existence, men enter into definite, necessary relations which are independent of their will, productive relationships which correspond to a definite stage of development of their material productive forces. The aggregate of these productive relationships constitutes the economic structure of society . . . to which definite forms of social consciousness correspond. The mode of production of the material means of existence conditions the whole process of social, political and intellectual life.'[9]

The foregoing broad and inclusive concepts integrating the writings of Marx find expression in a number of lower level observations which are particularly relevant to our analysis. To illustrate, Meissner remarks that the elder Marx focused his study upon the interrelationships between technical innovation, production organization and task segmentation.[10] To paraphrase Marx himself, under the earliest forms of manufacture, production was hardly distinguishable from that of the handicraft trades.[11] Nevertheless Marx suggests that there were significant differences between these two stages of technology. Under "manufacture" a portion of the means of production (e.g. raw materials and warehouses) are consumed in common by all workers.[12] Also, the processes of manufacture create a unique "social force" due to the fact that "many hands take part simultaneously in one and the same undivided operation."[13] Furthermore, at the "great industry" stage of manufacture other basically social transformations occur. Under this latter stage of technology the worker becomes a "mere appendage" to machines producing other machines in work organizations largely independent of worker capabilities.[14]

Other lower level observations made by Marx pertaining to the impact of technology on organization are germane. He suggests that the factory division of labor does not primarily yield a distribution of workmen into groups. Rather, "it is primarily a distribution of the workmen among specialized machines."[15] Cooperation among workers is, therefore, "only simple." Marx notes that the organized groups peculiar to the factory (as distinct from "manufacture") consist of the "head workman and his few assistants."[16] In the factory the fundamental division of labor is between machine operators and the "mere attendants" of the operators.[17] In addition to these two groups of actors which Marx considers to be peculiar to factory technology and organization, there is a "numerically unimportant" class of workmen, some of them "scientifically educated," others "brought up to a trade," whose occupation it is to repair and maintain the machinery.[18] It is clear that Marx is describing the phenomenon of what organization theorists call "line-staff" arrangements. Their origins appear to lie in the organizational forms, or structure, associated with early factory technology.

A study of the most advanced production technology and industrial organization of his time led Marx to posit that factory technology and organization leads to the "separation of the intellectual powers of production from the manual labor. . . ."[19] It appears that the separation of intellectual powers of production from manual labor, plus the "technical subordination" of the machine operator and the elaborate system of "barrack discipline," provide the basis for industrial patterns of supervision. For, as Marx notes, the final consequence of these processes is the division of "work-people into operatives and overlookers. . . ."[20]

Thus it is apparent that Marx's studies of the technologically conditioned division of labor in society embrace several areas of inquiry. In particular, he develops concepts relating production technology to worker behavior, the organization of industrial enterprises, and broad social issues such as alienation from work. Emile Durkheim appears to have continued the study of the implications of the division of labor along some of the avenues delineated by Marx.

A careful study of Durkheim's The Division of Labor in Society[21] yields a few observations relevant to this survey. Their primary value is to illustrate the historical continuity in the search for understanding regarding the implications of technology and the division of labor. Like Marx, Durkheim sees in the division of labor the "necessary" conditions for the development of societies.[22] It is the source of civilization.[23] It is through the division of labor, notes Durkheim, that individuals are linked together.[24] Just as the division of labor makes a society coherent, so too it determines the "constitutive traits" of its structure.[25] In its non-anomic state the division of labor determines "functions," and "ways of definite action."[26] Although the broad lines of continuity between the works of Marx and Durkheim are amply illustrated in the preceding remarks, the relationship between industrial production technologies and forms of the division of labor in industrial organizations are not as well developed by Durkheim as by Marx.

If broad lines of historical continuity connect the studies of Marx and Durkheim, the connections between the enquiries of Max Weber and Karl Marx are even more apparent. The use of language, the wide historical sweep, the sense of the differential effects of production technologies upon the division of labor so typical of Marx, all find expression in Weber's work.

It is evident that Weber recognizes the pervasiveness of the division and organization of "human services" in the interest of production.[27] In particular, Weber distinguishes between two classes of services for economic purposes: "managerial services" and services "oriented to the instructions of a managerial agency."[28] Weber suggests, that varying technical modes of production determine the patterns of "occupational differentiation."[29] He argues that

> The use of mechanized sources of power and machinery is characteristic of modern industry. From a technical point of view, the latter presupposes specialization of function . . . and also a peculiar uniformity and calculability of performance, both in quality and quantity.[30]

That is, Weber associates machine technology with distinctive organizational correlates in the form of requirements for the planning and control of production.

That Weber is cognizant of the organizational correlates of production technology is suggested by the preceding discussion. His cognizance may be made more explicit by noting the technical factors which Weber regards as partially responsible for the expropriation of the individual worker from the means of production. In developing his argument Weber points to the following "purely technical" factors: (1) the fact that sometimes production technology requires the services of numerous workers either simultaneously or successively; (2) the fact that sources of productive power may only be rationally exploited by using them simultaneously for basically similar operations under unified control; (3) the fact that frequently a technically rational organization of production processes is possible only by combining complementary processes under continuous and common supervision; (4) the fact that coordinated processes of labor can only be exploited rationally on a large scale which, in turn requires special training for the management of such processes of labor; (5) the fact that, if production technology and raw materials are under unified supervisory control, labor may be subjected to a "stringent discipline" thereby controlling both the pace, quantity, standarization and quality of production.[31]

Subsequent chapters shall develop and test in considerable detail many of the ideas contained in the foregoing paragraph.

This brief sketch of the highlights of the literature pertaining to technology, the division of labor and their social, organizational and behavioral correlates would be incomplete without an examination of the contributions of Thorstein Veblen. Joan Woodward states that Veblen first postulated the link between technology and social structure.[32] The foregoing discussion of the writings of Marx, Durkheim and Weber indicates that Woodward's statement is incorrect. A more valid interpretation consists of acknowledging the continuity apparent in the works of Marx, Durkheim, Weber and Thorstein Veblen.

This continuity of perspective is amply revealed in Veblen's observation that ". . . the machine process conditions the growth and scope of industry, and . . . its discipline inculcates habits of thought suitable to the industrial technology. . . ."[33] Veblen observes that

> The discipline of the machine process enforces a standardization of conduct and knowledge in terms of quantitative precision, and inculcates a habit of apprehending and explaining facts in terms of material cause and effect. . . . Its metaphysics is materialism and its point of view is that of causal sequence.[34]

In addition to comprehending the foregoing broad socio-cultural implications of a pervasive machine technology, Veblen points to its effects upon managerial behavior. He speaks of the "gravest urgency" associated with keeping comprehensive machine processes operating efficiently.[35] He suggests that the urgency of effective "immediate supervision of the various industrial processes" is due to the pervasiveness of the machine technology.[36] Veblen contends that the largest effects of the discipline of mechanical operations are to be sought among those required to "comprehend and guide" the processes.[37] Presumably the first-line supervisor would be included in this category. That is, first-line supervisory behavior would appear to be in part dependent upon the demands of technology.

The presumption made in the preceding paragraph, as well as the observations of Marx and Weber noted above, appears to have been discounted by most of the more recent students of organization theory. With the exception of a handful of very recent studies, one finds at best casual, isolated, indirect and fragmentary acknowledgments of the effects of a single mode of production technology upon the first-line supervisor's role demands and behavior. A more dominant and central area of inquiry during the past three decades has dealt with the implications of production technology upon the behavior of workers in large mass production and assembly line technologies. The Hawthorne studies, for example, delineated areas of investigation which served to generate countless empirical and theoretical studies designed to shed some light upon the social problems of an industrial civilization. It appears as though a concern for delineating the implications of the new and dominant division of labor under assembly line technology was either implicit, or infrequently explicit, in most empirical studies and theoretical statements subsequent to the Hawthorne studies.

During the past three decades a tendency has developed among students of organization and organizational behavior to ignore possible variable effects on organizational structure and the behavior of actors of differing modes of production technologies. Certainly there are exceptions to this generalization as this study will reveal. On the whole, however, it seems as though the fruitful perspectives and observations of Marx, Weber and Veblen have been discounted due to either (1) a preoccupation with the implications for organizational structure and behavior associated with the division of labor peculiar to assembly line or other particular technologies, or (2) a general insensitivity toward the comparative organizational and behavioral correlates of varieties of production technology. Thus, for example, classical management theory "was developed in a technical setting but independent of technology. . . ."[38,39] In their high-level statements classical management theorists were prone to generalize on the basis of their technologically narrow experience, plus the expedients found to be effective in practice[40] within a given technological setting. More recent attempts[41] to supplement the theory of "formal" organization with the findings of empirical studies of the behavior of organizational actors also fail to deal adequately with the implications of production technologies. For example, in the behavioral models of March and Simon technology is either not included as a variable, or, if included, the possibilities of variable types of technology and their implications for other elements of the model are not developed in detail.[42]

An additional illustration of the rather common tendency to discount the differential effects of varying modes of production technology on organization structure, processes and the behavior of organizational actors is found in the literature of "human relations." As Robert Blauner observes[43]

> The crucial variables to be studied and manipulated [by students of "human relations"] are . . . the general social climate of the enterprise and the quality of interpersonal contact among employees and between employees and their supervisors--rather than the worker's relation to technology and the division of labor.

In addition to Blauner's analysis of production technology and worker alienation, two recent studies also appear to have grasped anew the perspectives of Marx, Weber and Veblen. Both of these studies give explicit cognizance to the apparent variable effects of differing modes of industrial production technology. Although sharing this common basis, the studies move in quite different directions. On the one hand Woodward focuses primarily upon the overall organizational correlates of major classes of production technology.[44] Meissner on the other hand presents an analysis of the major dimensions of technologically required and permitted behavior of rank and file operatives as a function of basic types of production technology.[45]

The research objectives of this study have been prompted by the observations of Woodward and Meissner, the perspectives of Marx, Weber and Veblen, and the general deficiency of the current state of organization theory in dealing with modes of industrial production technology as a basic variable. Focusing upon an organizational level intermediate between that of Woodward and Meissner the following questions are posed for analysis: What are the effects of current modes of industrial production technology upon the behavior of first-line supervisors? How might such effects be explained?

FOOTNOTES ON CHAPTER II

[1]Emile Durkheim, The Division of Labour in Society, trans. George Simpson (New York: The Free Press, 1964), p. 39.

[2]See for example the commentary of Xenophon (circa 370 B.C.) in Friedrick Klemm, A History of Western Technology, trans. Dorothea Waley Singer (London: George Allen and Unwin, 1959), p. 29.

[3]Durkheim, p. 39.

[4]*Ibid.*

[5]*Ibid.*

[6]*Ibid.*, p. 62.

[7]E. Fromm, Marx's Concept of Man (New York: Ungar, 1961), p. 197.

[8]*Ibid.*

[9]*Ibid.*, p. 219.

[10]Martin Meissner, "Behavioral Adaptations to Industrial Technology," unpublished PhD dissertation, University of Oregon, copyright 1963 by author.

[11]Karl Marx, Capital: Critical Analysis of Capitalist Production (New York: Humboldt), p. 192.

[12]*Ibid.*, pp. 192-193.

[13]*Ibid.*, p. 194.

[14]Meissner, p. 10.

[15]Marx, p. 258.

[16]*Ibid.*

[17]*Ibid.*

[18]*Ibid.*

[19]*Ibid.*, p. 260.

[20]Ibid.

[21]Durkheim, op. cit.

[22]Ibid., p. 50.

[23]Ibid.

[24]Ibid., p. 61.

[25]Ibid., pp. 192-193.

[26]Ibid., pp. 365-366.

[27]Max Weber, The Theory of Social and Economic Organization, trans. A.M. Henderson and Talcott Parsons, ed. Talcott Parsons (New York: The Free Press, 1964), p. 218.

[28]Ibid., p. 219.

[29]Ibid.

[30]Ibid., p. 228.

[31]Ibid., pp. 246-247.

[32]Joan Woodward, Industrial Organization: Theory and Practise (London: Oxford University Press, 1965), p. 50.

[33]Thorstein Veblen, The Theory of Business Enterprise c 1904 (New York: August M. Kelly, Bookseller, 1965), p. 66.

[34]Ibid., pp. 66-67.

[35]Ibid., p. 18.

[36]Ibid.

[37]Ibid., pp. 312-313.

[38]Woodward, p. 36

[39]See for example the discussion of the theory of "formal" organization in Joseph A. Litterer, Organizations: Structure and Behavior (New York: Wiley, 1963).

[40]Woodward, loc. cit.

[41]For example, James G. March and Herbert A. Simon, Organizations (New York and London: Wiley, 1958).

[42]March and Simon, *op. cit*. See for example, the models of organizational member behavior found at pp. 66, 69, 71, 117, 120, 128 and 154.

[43]Robert Blauner, *Alienation and Freedom: The Factory Worker and His Industry* (Chicago and London: University of Chicago Press, 1964), p. viii.

[44]Woodward, *op. cit*.

[45]Meissner, *op. cit*.

CHAPTER II

RESEARCH PROBLEM AND DESIGN

Conceptual scheme

Although at a very broad level the research reported in this study has been guided by the perspectives of Marx, Weber and Veblen, an observation by Joan Woodward constitutes the most immediate starting point.[1] Her studies of the implications of production technology for organizational structure and processes lead her to the observation that

> Technology, because it influences the roles defined by the formal organization, must therefore influence industrial behaviour, for how a person reacts depends as much on the demands of his role and the circumstances in which he finds himself, as on his personality.[2]

On the basis of the foregoing observation, plus George Homans'[3] model of group social behavior, a conceptual scheme was developed which is designed to provide a rationale for the generation of specific hypotheses regarding the dimensions of supervisory behavior under a given category of production technology. Figure I below is a schematic portrayal of the conceptual scheme utilized in the research.

Figure I is meant to convey that the conceptual scheme treats the nature and behavioral demands of a given category of production technology as an "independent variable." Supervisory activities, interaction patterns and frequencies, sentiments, are regarded

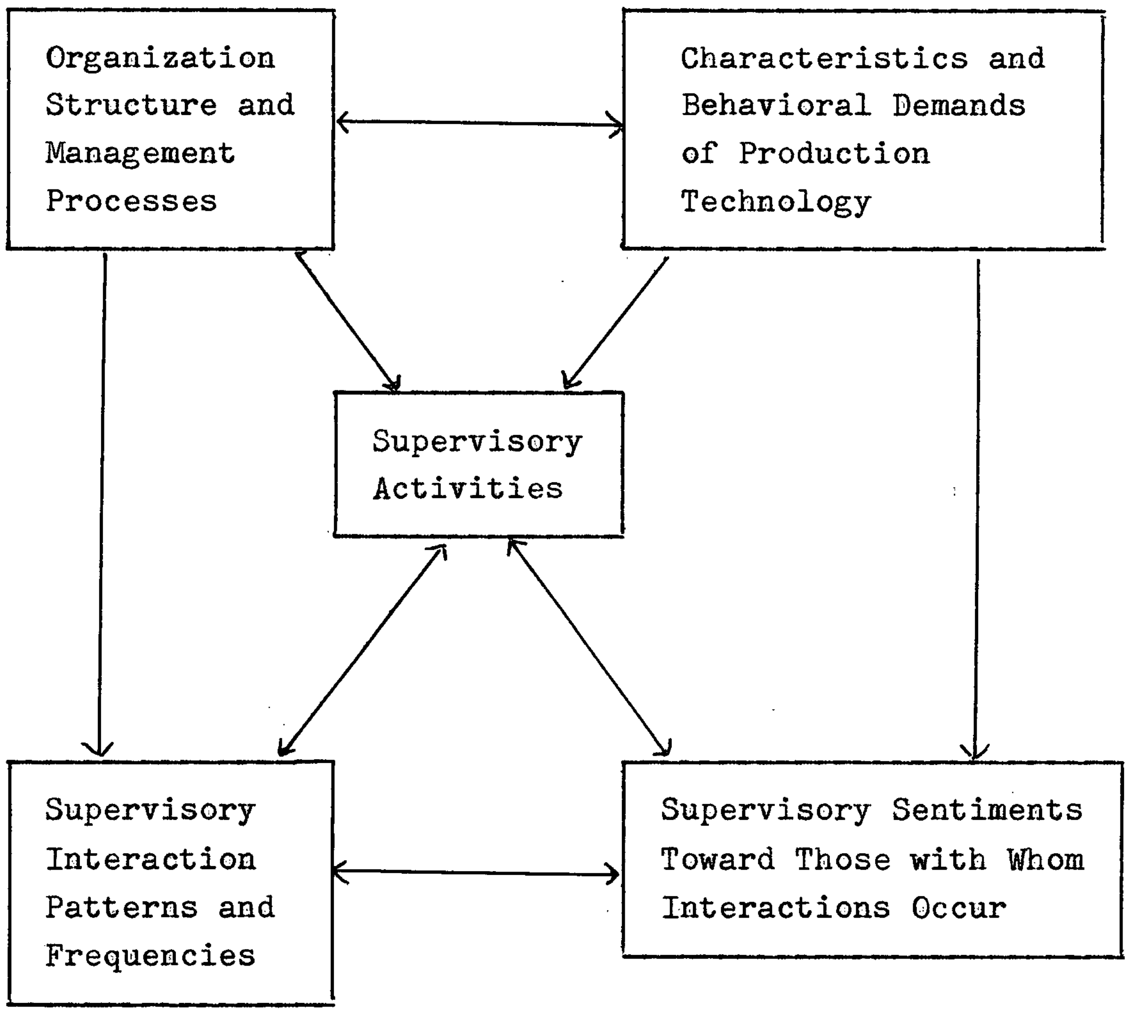


FIGURE I

CONCEPTUAL SCHEME UTILIZED IN THE STUDY

as "dependent variables." The "intervening variable" postulated to account for observed relationships between the independent and dependent variables comprises the structural or organizational correlates of a given category of production technology observed by Woodward.

Research problem

The central problem for organization theory which serves as the immediate focus of the research is indicated in the following general hypothesis. The hypothesis gives verbal expression to the conceptual scheme of Figure I above.

General hypothesis

Given a characteristically dominant mode of production technology within an enterprise or work unit, a number of unique organizational or structural correlates will appear, the function of the latter being to facilitate the accomplishment of the enterprise's multi-faceted goals. As a consequence of the enterprise's technologically influenced structural features, there will emerge a characteristic set of first-line supervisory activities. The latter will shape a pattern of supervisory interaction and a set of sentiments toward those with whom such interactions occur.

Research design

In order to test the validity of the foregoing general hypothesis, the following research design is utilized in Chapter III. For a given category of production technology the observations made by Woodward regarding the structural correlates of that category of technology are summarized in chart form. On the basis of these data, the conceptual scheme of Figure I, and reasonable, logical inferences drawn from the data, a series of specific hypotheses is developed regarding the dimensions of supervisory behavior under that category of production technology. In Chapter VII each of the two case studies of Chapters IV, V and VI is analyzed with a view to: (1) classifying the case in terms of a category of technology (2) testing the validity of the specific hypotheses for that category of technology, and (3) reformulating the specific hypotheses as may be required in the light of the analysis. Steps (2) and (3) are repeated in the analysis of the additional empirical data located in the appendices.

The development and testing of the specific hypotheses are organized and coded according to the analytical framework depicted in Chart I below.

CHART I

FRAMEWORK FOR CLASSIFYING HYPOTHESES AND ORDERING OBSERVATIONS BASED ON EMPIRICAL DATA

Category of Technology	Activities		Interactions						Sentiments toward		
			Nature			Frequency					
	Nature of Activities	Frequency of Activities	Subordinates	Superiors	Horizontal	Subordinates	Superiors	Horizontal	Subordinates	Superiors	Horizontal
I Unit and Small Batch	I-A-1	I-A-2	I-B-1-a	I-B-1-b	I-B-1-c	I-B-2-a	I-B-2-b	I-B-2-c	I-C-1	I-C-2	I-C-3
II Large-Batch, Mass Production, and Assembly-Line	II-A-1	II-A-2	II-B-1-a	II-B-1-b	II-B-1-c	II-B-2-a	II-B-2-b	II-B-2-c	II-C-1	II-C-2	II-C-3
III Continuous Process	III-A-1	III-A-2	III-B-1-a	III-B-1-b	III-B-1-c	III-B-2-a	III-B-2-b	III-B-2-c	III-C-1	III-C-2	III-C-3

FOOTNOTES ON CHAPTER II

[1]Joan Woodward, Industrial Organization: Theory and Practice (London: Oxford University Press, 1965).

[2]Ibid., p. 79.

[3]George Homans, The Human Group (London: Routledge and Kegan Paul, 1951).

CHAPTER III

FORMULATION OF SPECIFIC HYPOTHESES

Introduction

This chapter presents specific hypotheses regarding the dimensions of supervisory behavior under each of the three categories of industrial production technology. The code designations following the statement of specific hypotheses are those found in Chart I. Each of the three categories of technology is considered separately. Some general observations and inferences based upon Woodward's data precede the formulation of the specific hypotheses for a given category of technology. The purpose of the latter observations and inferences is to provide the rationale for the formulation of the specific hypotheses.

Category I technology

General observations and inferences

Probably the most fundamental correlate of Category I production technology is the "organic" nature of the management processes typically found in the more successful enterprises operating under this technology. Therefore we infer that associated with this class of production technology are the following features: (1) the contributive nature of special knowledge and experience to the common task of the

CHART II

STRUCTURAL CORRELATES OF CATEGORY I TECHNOLOGY

Category I Production Technology: unit and small batch
definition: units produced to customer requirements; fabrication of large units in stages

Structural Correlate of Technology	Characteristic
1. Complexity of technology	Simplest of three categories (p.42)
2. Median number of levels of management	3 (p.52)
3. Median chief executive span of control	4 (p.52)
4. Median first-line supervisors' span of control	14-27 (p.61)
5. Existence of "small primary work groups"	Yes (p.60)
6. Ratio of supervisory to non-supervisory personnel	1:23 (p.55)
7. Ratio of direct to indirect workers	1:9 (pp.59-60)
8. Middle management span of control	relatively large (p.53)
9. Length of management communication line	relatively short (p.53)
10. Practice of management by committee	relatively rare (p.53)
11. Technical qualifications of management and supervisors	less than in Category III technology (pp.57-58)
12. Required technical competence of supervisors	relatively very high (pp.57-58,64)
13. Source of technical competence of supervisors	experience plus trade training
14. Relative proportion of skilled to unskilled workers	highest of the 3 categories of technology (pp.61-62)

CHART II--continued

Structural Correlate of Technology	Characteristic
15. Focus of skilled workers' activities	direct labor or production of units (p.61)
16. Ability of direct labor to influence the quantity and quality of production	relatively very great (p.61)
17. Existence of formal production control systems	frequently too difficult to attempt (pp.42,66)
18. Existence of staff specialists	none or few
19. Sense of urgency of production	low (p.158)
20. Type of communications regarding production	mainly verbal (p.66)
21. Production schedules based on	firm orders only (p. 129)
22. Planning and time perspective of top and lower management	short-term (p.129)
23. Perceived security of employment for direct workers	fairly high (p.129)
24. Interdependence of task function among marketing (M), Production (P) and development (D)	high (pp.129-131, 134)
25. Quality of interdepartmental relations	good (pp.130-133, 135)
26. Order of manufacturing cycle	M-->D-->P (p.128)
27. Frequency of organization problems	low (p.135)
28. Typed management of more successful firms	"organic"[1] (p.64)

Source: Joan Woodward, Industrial Organization: Theory and Practice (London: Oxford University Press, 1965).

enterprise; (2) individual tasks set by the total situation of the enterprise; (3) adjustment and continual redefinition of individual tasks through interactions with others; (4) ad hoc location of control authority and communication based upon expertise; (5) lateral rather than vertical communications predominating; and (6) communication of advice and information rather than instructions and decisions.[2]

If realized in practice within an enterprise characterized by Category I technology, the "organic" nature of the management process suggests that the first-line supervisor is allowed a fairly wide area of discretion over the performance of his tasks and his interactions with others.

Using a slightly more operational phraseology, it is inferred that, as a consequence of the organic nature of management processes, enterprise organization under Category I technology is typically characterized by:

1. Fairly flexible detailed production guidelines coming to the first-line supervisor from line superiors and the few staff specialists who may exist in the organization.
2. The initiation of task-oriented interactions (i.e., interactions concerned with production schedules, methods, sequence, quantity and quality) to the first-line supervisor by skilled direct workers, and to the latter by the former.
3. Extensive "feedback" to the first-line supervisor from

skilled direct production workers regarding task-oriented interactions originally initiated either directly by the supervisor, or indirectly by staff specialists in the form of production schedules, job specifications, etc.

4. Minimal reliance by all levels of management and staff specialists upon the official records and other information generated in the production planning and control activities. (This inference follows from both the organic nature of the management processes and the frequently relatively great difficulty of establishing reliable, comprehensive and formal production controls. See Chart II above.)
5. A high degree of voluntary and informal interdependence among first-line supervisors and: staff specialists, senior line supervisors, and direct production workers.
6. A low sense of urgency of production experienced by all individuals, especially skilled direct workers and their first-line supervisors.

In Chart II are noted a number of structural correlates of Category I technology which may have significance for the development of the specific hypotheses regarding the dimensions of supervisory behavior in this class of production technology. For example, one notes a relatively shallow management organization structure (3 levels on the average). In addition, there tends to be a relatively small supervisory span of control (small relative especially to Category II technology). Furthermore, enterprises under Category I production technology tend to be characterized by the existence of small primary work-groups of skilled employees able to influence to a considerable degree the quantity and quality of production. The relative absence of elaborate staff groups engaged in comprehensive and continuous production planning and control activities, suggests that the first-line supervisor is able to exert considerable influence over the quantity and quality of production, especially since his technical competence is relatively great and apparently is given scope to be exercised (organic management processes). Finally, the relatively shallow management organization structure; the relatively small first-line supervisory span of control; and the broad characteristics of organic management processes outlined above--all of these features of the enterprise under Category I technology suggest that frequent and relatively non technologically required interactions with others are one important aspect of supervisory activities.

Specific hypotheses

Supervisory activities (tasks) (I-A-1)

As a consequence of the above technologically induced features of the first-line supervisor's work environment, it is hypothesized that the following are characteristics of supervisory activities under Category I technology:

1. Application of technical knowledge and exercise of technical skill
   a. Based upon his analysis of production orders and their attendant specifications, the first-line supervisor personally makes a relatively broad range of technical decisions, or gives technical advice regarding
      (i) choice of work tools, methods and sequence
      (ii) content of individual workers' tasks
      (iii) pace of work and the quality of production (primarily when unforeseen difficulties arise).
   b. The supervisor becomes personally involved in contributing his technical knowledge and experience to the direct production activities of his subordinates (primarily when unforeseen problems or excessive workloads arise).
2. In the absence of extensive, continuous, and highly rationalized staff production planning and control activities, the supervisor personally executes a range of administrative activities[3] including:
   a. Issuing written or verbal reports regarding attendance, production achieved or in process, pay, etc.
   b. Allocating subordinates to jobs, job orders, or particular tasks within a given job.
   c. Scheduling and monitoring work flow through his unit.
   d. Coordinating the work-flow between successive work units.

e. Negotiating with fellow supervisors along the work-flow for access to scarce production resources (materials, labor, facilities, services, etc.).

3. Because of, and as part of his performance of the foregoing activities, the first-line supervisor in Category I production technology performs activities the nature of which consists of face-to-face (verbal) interactions with subordinates, line superiors, staff specialists (if found in the enterprise) and fellow supervisors along the work-flow.

Frequency of performance of activities (I-A-2)

The specific hypotheses regarding the elements of supervisory activities clearly are mutually interdependent. It is thus difficult to separate the elements from one another and predict their relative frequencies. The exercise of intuition is, therefore, required.

It is hypothesized that the supervisor will be engaged relatively frequently in activities requiring the application of his technical knowledge and skill. Within enterprises under Category I technology the frequency of performance of technical activities will be about equal to that of other classes of activities. Looking ahead, the hypothesis is that, in comparison with Category II technology, the first-line supervisor will apply his technical knowledge and skill, and carry out "administrative activities" more frequently in Category I technology. The distribution of activity frequencies in enterprises under Categories I and III technology will be about equal, with the exception of administrative activities, which, it is hypothesized, will be of relatively minor importance under Category III technology.

Nature of interactions

The following specific hypotheses follow from: (1) the preceding attempt to operationalize the implications of organic management processes, and (2) the foregoing specific hypotheses regarding the nature and frequency of supervisory activities.

With subordinates (I-B-1-a). Interactions will be face-to-face and concerned with production methods, pace, quality, schedules, special problems associated with the nature of the work at hand, and specific, non-routine jobs or tasks to be performed by individuals or small groups (i.e., "task-oriented" interactions).

Because of the organic nature of management processes, combined with the low sense of urgency about production, such interactions will tend to be relaxed; that is, devoid of conflicts over authority and responsibility. They will tend to allow reciprocal feedback and evaluation by the parties. The technical expertise of both parties will allow the interactions to be based upon the communication of advice and information rather than explicit instructions and directions.

With superiors (I-B-1-b). It is hypothesized that the nature of interactions between the first-line supervisor and his line superiors will be identical to that of the interactions between the supervisor and his subordinates.

Horizontal interactions (I-B-1-c). In addition to the interaction characteristics described under "interactions with subordinates," horizontal interactions involving the first-line supervisor will involve negotiation with fellow supervisors over access to scarce production resources (e.g., materials, equipment, labor). Also, such interactions will involve activities designed to effect the required coordination of work-flow between successive work stations.

Frequency of interactions

At best, only very general hypotheses are possible. The relatively small span of first-line supervisory control, the shallow management organization, the presence of small primary work groups, and the minimal reliance by management upon the formal reporting systems of staff specialists--all of which are associated with Category I technology, have been noted. In addition, some of the more significant dimensions of organic management processes have been indicated. These observations, plus the hypotheses concerning the nature and frequency of supervisory activities, suggest the following hypotheses.

<u>Frequency of interactions with subordinates (I-B-2-a)</u>. The full potential (under organic management processes) for very frequent interactions between the supervisor and his subordinates will tend not to be realized. The extensive technical and administrative duties of the supervisor, plus the technical expertise of direct workers, will tend to limit interactions between the parties. On the whole, then, a moderate rate of interactions between the supervisor and individual subordinates may be anticipated; a rate greater than that found in Category II technology, but probably less than in Category III technology.

<u>With superiors (I-B-2-b)</u>. The first-line supervisor's administrative activities, plus the organic nature of management processes, will tend to create opportunities for frequent interactions between the supervisor and his line superiors. The hypothesis is that the frequency of such interactions will be at least as great as that between the first-line supervisor and his subordinates as a group. Also it is hypothesized that the frequency of supervisor-line superior interactions will be greater in Category I than in Category II production technology. The frequency will approximate that found in Category III technologies.

<u>Frequency of horizontal interactions (I-B-2-c)</u>. The relative absence of staff specialists engaged in production planning and control activities; the requirements for coordination along the work flow; and the scope given to the

exercise of the supervisor's technical knowledge and skill--suggest that the frequency of interactions between the first-line supervisor and fellow line-supervisors will be fairly high, while the frequency of interactions with staff specialists (where they appear in the management organization) will tend to be low. These hypothesized frequencies are relative both to those for other classes of interactions within Category I technology and relative to the corresponding interactions in enterprises under Category II technology. A similar distribution of horizontal interaction frequencies in technology Categories I and III is hypothesized, where, as will be demonstrated, the nature of organic management processes, the scope of application given to supervisory technical skills, etc., are observed in about the same proportions.

Utilizing the conceptual scheme (Figure I) relating activities, interactions and sentiments; and, given the foregoing analyses and hypotheses, the following dimensions of first-line supervisory behavior under Category I technology are predicted.

Supervisory sentiments

Toward subordinates (I-C-1). These sentiments will tend to be neutral to friendly. They will tend to be constant or stable over time.

Toward superiors (I-C-2). As in the preceding paragraph.

Between parties in horizontal interactions (I-C-3). As in the preceding two paragraphs.

Category II technology

In this section the specific hypotheses pertaining to the dimensions of first-line supervisory behavior in enterprises under Category II technology are developed. The basic approach is the same as that employed in the previous section.

General observations and inferences

From the point of view of the general hypothesis of the study, perhaps the most important correlate of Category II technology is the "mechanistic" nature of the management process with the more successful enterprises employing this type of production technology. It is inferred that, associated with Category II technology one finds: (1) a rigid breakdown into functional specialisms, precise definitions of duties, responsibilities and power, and (2) a well-developed managerial hierarchy through which information filters up and decisions and instructions flow down to the first-line supervisor. If realized in practice, this inference suggests that the supervisor is allowed a very limited area of discretion over the performance of his activities and his interactions with others.

To use a somewhat more operational phraseology concerning the significance of mechanistic management, it is

CHART III

STRUCTURAL CORRELATES OF CATEGORY II TECHNOLOGY

Category II Technology: large batch mass production-and-assembly-line technology
Specification: production in large batches; large batches on assembly lines; mass production

Structural Correlates	Characteristic
1. Complexity of technology	Average, relative to Categories I & III (p.42)
2. Median number of levels of management	4 (p.52)
3. Median chief executive span of control	7 (p.53)
4. Median first-line supervisors' span of control	30-44 (p.61)
5. Existence of "small primary work groups"	No (p.60)
6. Ratio of supervisory to non-supervisory personnel	1:16 (p.55)
7, Ratio of direct to indirect workers	1:4 (pp.59-60)
8. Middle management span of control	relatively large (p. 53)
9. Length of management communication line	relatively long (p. 52)
10. Practice of management by committee	relatively rare (p.53)
11. Technical qualifications of management and supervisors	less than in Category III technology (pp.57-58)
12. Required technical competence of supervisors	very low relative to other categories of technology (pp.57-58)
13. Source of technical competence of first-line supervisors	not stated but probably on-the-job training

CHART III--continued

Structural Correlates	Characteristic
14. Relative proportion of skilled to unskilled workers	lowest of three categories of technology (pp.61-62)
15. Focus of skilled workers' activities	indirect labor, e.g., staff work (pp.62-63)
16. Ability of direct labor to influence quantity & quality of production	relative low (pp.62-63)
17. Existence of formal production control systems	yes; highly developed with built-in sanction for failure to meet narrow specified objectives (p.66)
18. Existence of staff specialists	numerous and comprehensive, frequently in conflict with first-line supervisors (pp. 64-66)
19. Sense of urgency of production	relatively great (pp.135-136)
20. Type of communication regarding production	mainly written (p.66)
21. Production schedules based on	forecasts and orders (p.136)
22. Planning and time perspective of management	medium for senior management, short for first-line supervisors (pp.135-136)
23. Perceived security of employment for direct workers	fairly low (p.136)

CHART III--continued

Structural Correlates	Characteristic
24. Interdependence of task functions among marketing (M), production (P) and development (D)	very high (p.137)
25. Order of manufacturing cycle	D-->P-->M (p.128)
26. Interdepartmental relations	not good (pp.137, 145)
27. Frequency of organizational problems	high (pp. 137, 139, 145)
28. Type of management of more successful firms	"mechanistic"[2] (p.64)

Source: Joan Woodward, Industrial Organization: Theory and Practice (London: Oxford University Press, 1965).

inferred that Category II technology is typically characterized by the following structural features of organization:

1. Directives and decisions filtering down to the first-line supervisor from his superiors and laterally from staff specialists.
2. Reliance by all levels of line management and associated staff specialists upon the records generated by the formal, well-developed production control systems. (The goal in view is to achieve effective monitoring of the first-line supervisor's behavior, as well as that of his subordinates, as demonstrated by the production quantity and quality achieved.)
3. A high sense of urgency regarding production being experienced by all persons, particularly the supervisor.
4. A high degree of functional interdependence among first-line supervisors and staff specialists on the one hand, and first-line supervisors related to each other along the work-flow on the other.

As a consequence of the foregoing technologically delimited organization structural correlates, a characteristic set of first-line supervisory activities tends to develop. The observations summarized above in Chart III do not provide any direct insights into the nature of supervisory activities in enterprises utilizing forms of Category II technology. However, certain inferences based upon the preceding observations may be justified. If valid, they will prove helpful in operationalizing further the general hypothesis of the study.

It is noted from Chart III above that the first-line supervisor has a median span of control in the order of 30-44. In addition, it appears that small primary work groups probably are rare in this type of technology. Furthermore, required technical competence among line supervisors is very limited relative to that found in either of Category I or III production technology. Finally, because work methods, pace, and volume and quality standards all tend to be highly rationalized and controlled by higher-level line management, or non-line supervisors, the ability of either direct workers or the first-line supervisor ultimately to adversely influence production quantity and quality is relatively limited.

Specific Hypotheses

Supervisory activities (tasks) (II-A-1)

Given the foregoing technologically induced features of the first-line supervisor's work environment, it is hypothesized that the nature of supervisory activities (tasks) under Category II technology consists, for the most part, of verbal and non-verbal interactions with subordinates, line superiors, staff specialists, and fellow supervisors in the work-flow. (The primary object of such interactions is to effect the directives transmitted to the supervisor by line superiors and staff specialists.)

It is hypothesized that neither the technical nor "administrative activities" specified in the discussion of Category I technology will be significant elements of first-line supervisory behavior in Category II technology.

Frequency of performance of activities (tasks) (II-A-2)

If one accepts the specific hypothesis that the nature of first-line supervisory activities under Category II technology consists mainly of interactions with others, then it follows that the frequency with which these activities are performed (their relative importance) reduces to the frequency of interations with others. See below for the specific hypotheses regarding interactions.

Nature of interactions

With subordinates (II-B-1-a). The discussion in the section dealing with the implications of mechanistic management suggests the following specific hypothesis. Interactions between the supervisor and his subordinates, a dominant feature of the first-line supervisor's activities, will tend to be hostile, threatening and aggressive in nature.

Also, it is hypothesized that interactions between the supervisor and his subordinates will consist mainly of face-to-face communications. The content of such interactions will be concerned primarily with problems of work pace, methods and production quantity and quality. That is, the interactions will primarily be "task-oriented."

With superiors (II-B-1-b). Once again, because of the mechanistic type of management, the sense of urgency of production, the high frequency of "crises," etc., it is hypothesized that interactions between the supervisor and his line superiors will tend to be tense, hostile and task-oriented in nature. Interactions will find their bases in both verbal and written communications.

Horizontal interactions (with staff specialists and fellow supervisors along the work flow) (II-B-1-c). For the reasons outlined in the two preceding paragraphs it is predicted that this class of interactions will be largely task-oriented, verbal as well as non-verbal, and frequently tense, that is, involve conflicts over authority and responsibility.

Frequency of interactions

With subordinates (II-B-2-a). Only the most general hypotheses are possible given the quality, for our purposes, of Woodward's data. Given the absence of small primary work groups, the mechanistic nature of management, the high sense of production urgency, etc., it is hypothesized that the frequency of interactions between the first-line supervisor and his subordinates as a group will be relatively very high. The frequency of interactions with individual subordinates will, however, tend on the average to be low (relative to the frequency of interactions with line superiors, or staff specialists, or fellow supervisors along the work flow).

With superiors (II-B-2-b). For the reasons outlined in the previous paragraph, it is hypothesized that interactions between the first-line supervisor and his line superiors will be relatively fairly low, especially those initiated by the supervisor himself.

Horizontal interactions (II-B-2-c). By the same token, a relatively very high frequency of horizontal interactions is predicted, especially for interactions with staff specialists.

Supervisory sentiments

Toward subordinates (II-C-1). In the absence of more complete descriptive data regarding the nature of supervisory activities under Category II technology, it has been hypothesized that such activities will consist primarily of interactions with others. In addition, a relatively high frequency of tense, task-oriented interactions between the supervisor and his subordinates has been hypothesized. On the basis of these hypotheses it is predicted that sentiments felt by the supervisor toward his subordinates will tend to range from neutral to suspicious to aggressive depending upon circumstances. Furthermore, because of the high sense of urgency of production and short time perspectives of lower supervisory levels, these sentiments will tend to be unstable or variable, ranging from neutral to hostile.

Superiors (II-C-2). By the same token, sentiments of the first-line supervisor toward his superiors will tend to be characteristically those of defense and hostility. They will tend to be variable depending upon the demands of momentary circumstances.

Parties to horizontal interactions (staff specialists, fellow supervisors along the work-flow (II-C-3). Similarly, sentiments of the first-line supervisor toward staff specialists and fellow supervisors along the work flow will tend to be neutral to hostile in tone. Given the relatively high frequency of interactions between the parties, the sentiments of the first-line supervisor will tend to be rather unchanging, at least in the short-term.

Category III technology

In this section the specific hypotheses pertaining to the dimensions of first-line supervisory behavior under continuous-process technology will be developed. The approach to hypotheses formulation will be the same as that employed in the two previous sections of the chapter.

General observations and inferences

Given the general hypothesis of this study, probably the most fundamental correlate of continuous-process technology is the organic nature of management processes typically found in the more successful enterprises employing this type of technology. Proceeding from this generalization it is inferred that, the following organizational characteristics are associated with continuous-process technology: (1) the

CHART IV

STRUCTURAL CORRELATES OF CATEGORY III TECHNOLOGY

Category III Production Technology: continuous-process technology
Definition: intermittent production of chemicals in multi-purpose plants; continuous flow production of cases, liquids and crystalline substances

Structural Correlate	Characteristic
1. Complexity of technology	very great relative to Categories I and II (p.42)
2. Median number of levels of management	6 (p.52)
3. Median chief executive span of control	10 (p.53)
4. Median first-line supervisors' span of control	11-18 (p.61)
5. Existence of "small primary work groups"	Yes (p.60)
6. Ratio of supervisory to non-supervisory personnel	1:5-9 (p.55)
7. Ratio of direct to indirect workers	1:1 (pp.59-60)
8. Middle management span of control	relatively small (p.53)
9. Length of management communication line	relatively long (p.53)
10. Practice of management by committee	common (p.53)
11. Technical qualifications of management and supervisors	high relative especially to Category II technology (pp.57-58)
12. Source of technical competence of supervisors	extensive formal or academic training (pp.57-58)
13. Required technical competence of supervisors	relatively high (pp.57, 65, 149)
14. Relative proportion of skilled to unskilled workers	midway between that found in Categories I & II technology (pp.61-62)
15. Focus of skilled workers' activities	both direct and indirect labor (pp.61-63)

CHART IV--continued

Structural Correlate	Characteristic
16. Ability of direct labor to influence the quantity and quality of production	Potentially very high (pp.62-63)
17 Existence of formal production control systems	built-in; virtually automatic; not a source of conflict between staff and line (pp.66, 152)
18. Existence of staff specialists	few & not easily distinguishable from line supervisors; no ideological conflict with line supervisors (p.65)
19. Sense of urgency of production	low (p.65)
20. Type of communications regarding production	mainly verbal (p.66)
21. Production schedules based on	long-range orders (p.66)
22. Planning and time perspective of top management	very long range (p.152)
23. Perceived security of employment for direct workers	very high (pp.149, 152)
24. Interdependence of task functions among marketing (M), production (P) and development (D)	minimal (p.153)
25. Order of manufacturing cycle	D-->M-->P (p.128)
26. Interdepartmental relations	fairly good (pp.147,150,152)
27. Frequency of organizational problems	low (p.153)
28. Type of management of more successful firms	"organic"[3] (p.64)

Source: Joan Woodward, Industrial Organization: Theory and Practice (London: Oxford University Press, 1965).

contributive nature of special knowledge and experience to the common task of the enterprise; (2) individual tasks set by the total situation of the enterprise; (3) adjustment and continual redefinition of individual tasks through interactions with others; (4) ad hoc location of control authority based upon expertise; (5) lateral rather than vertical communications predominating; and (6) communication of advice and information rather than instructions and decisions.[4]

As was recognized in the forumlation of specific hypotheses for Category I technology, if organic management processes are realized in practice under continuous-process technology, then the first-line supervisor is allowed a fairly wide area of discretion over the performance of activities and his interactions with others.

To employ a more operational phraseology, it is inferred that, as a consequence of the degree of organic management processes realized in continuous-process technology, enterprise organization tends to be characterized by:

1. Fairly flexible, detailed production guidelines coming to the first-line supervisor from line superiors and possibly from the few staff specialists (see Chart III above) which may be found in the organization.
2. Two-way initiation of task-oriented interaction involving the direct (skilled) production workers and their supervisor.
3. Extensive "feedback" to the first-line supervisor from

skilled direct production workers regarding task-oriented interactions initiated either directly by the supervisor, or indirectly by staff specialists.

4. As a consequence of (a) the complexity of technology (Chart III) and (b) the ease and frequently virtual automaticity of formal porduction control systems (see Chart III)--a heavy reliance by all levels of management and staff specialists upon the records and other information generated in the production planning and control activities. However, as a consequence of (b) above, plus organic management processes and items 1, 2, and 3 above, minimal conflict arising about production matters.
5. A high degree of voluntary and informal interdependence among, on the one hand first-line supervisors, and, on the other hand staff specialists, senior line supervisors and direct production workers.
6. Generally a low sense of urgency of production experienced by all individuals, especially skilled direct workers and their first-line supervisors. When on occasion production crises arise, interpersonal relations between workers and supervisors will not deteriorate greatly, given the existence of organic management processes.

Chart III specifies a group of structural correlates of continuous-process technology which may have significance for the development of the specific hypotheses. For example, note the fact of a small span of first-line supervisory control. (It is the smallest of the three categories of technology.) The supervisor directs a small (primary) group of skilled direct production workers who are able to exercise considerable influence over production, particularly the quality of production. The scarcity of staff specialists, or their lack of distinction from other management personnel, the tendency for production control to be virtually built into the productive system, and the high degree of technical competence of supervisors, imply the latter's potential ability to exercise considerable influence over production quantity and quality. The presence of small primary groups of skilled workers, the low frequency of organizational problems, the largely verbal nature of communications, and the broad characteristics of organic processes of management, suggest that the supervisor enters into frequent and casual interactions with subordinates. From the practice of management by committee and the long line of management communications, we infer that interactions with superiors will be frequent and rather formal in nature.

Specific Hypotheses

Supervisory activities (III-A-1)

As a consequence of the foregoing observed and inferred characteristics of the first-line supervisor's work environment, the following characteristics of supervisory activities under Category III technology are hypothesized.

1. Application of technical knowledge and the exercise of technical skill.

   In response to fairly long-range production schedules the first-line supervisor makes a fairly narrow range of complex technical decisions, or gives technical advice to his subordinates, regarding the technical specifications of the product to be produced. Advises subordinates regarding technical adjustments required in the process. If and when crises occur, he seeks the technical advice of staff specialists and/or communicates technical instructions to his subordinates.

2. Given the relative absence of staff specialists, the organic nature of management processes, and the automatic nature of production controls and reporting, the first-line supervisor performs none of the administrative duties defined in Chapter III. At most he reviews periodic production reports as a means of monitoring the performance of his subordinates and the processes they control.

3. Because of, and integral to the performance of his technical activities, the supervisor engages in face-to-face interactions primarily with subordinates.

<u>Frequency of performance of activities (III-A-2)</u>

The low sense of urgency of production; the relatively long time and planning perspective of management; the ease of production control; the existence of small primary work-groups responsible to the first-line supervisor--these characteristics of the supervisor's work environment suggest that activities consisting of interactions with others will occur most frequently. The performance of technical activities under continuous process technology will occur somewhat less frequently.

Nature of interactions

The specific hypotheses under this section follow from the preceding hypotheses.

With subordinates (III-B-1-a). Interactions will be face-to-face, verbal and somewhat informal, that is, not mainly task-oriented. Because of the characteristics of organic management processes, both described and hypothesized above, plus the generally low sense of urgency of production and the absence of conflict with staff specialists, interactions between the first-line supervisor and his subordinates will tend to be relaxed; that is, devoid of conflict over authority and responsibility. With the possible exception of crisis situations, the technical expertise of both parties will allow the interactions to be based upon the communication of advice and information rather than explicit instructions and directions.

With superiors (III-B-1-b). It is hypothesized that, because of: (1) the relatively long chain of management communication (2) the practice of management by committee (3) the long time and planning perspective of management, and

(4) the high degree of complexity of the technology, interactions between the first-line supervisor and his line superiors will tend to be face-to-face, task-oriented, and generally relaxed; that is, devoid of conflicts over authority and responsibility. The technical expertise of both first-line supervisors and their superiors will permit the interactions to be based upon the communication of advice and information as well as instructions and directions.

Horizontal interactions (with fellow first-line supervisors and staff specialists) (III-B-1-c). The relatively highly complex nature of fully integrated continuous-process technology suggests the probability that first-line supervisors will enter into interactions with fellow supervisors, either along the work-flow or in the maintenance sections of the enterprise. These interactions will tend to be task-oriented, and, given the nature of organic management processes, largely devoid of conflict over authority and responsibility.

The ease and virtually automatic nature of production control, plus the long time and planning perspective of management, suggest that interactions between the first-line supervisor and staff specialists will be of very limited importance, except possibly in periods of crisis in the production process. To the extent to which this class of interactions occurs, it will be characterized by being devoid of conflict over authority and responsibility. Mutual communication of advice and information will be a characteristic feature of this class of interactions.

Frequency of interactions

The foregoing analyses and hypotheses suggest the following specific hypotheses regarding interaction frequencies.

With subordinates (III-B-2-a). Interactions between the first-line supervisor and his subordinates will be more frequent than for either of the other two classes of interactions. In comparison with interaction frequencies in either of Category I or Category II technology, the frequency of interactions between supervisors and direct production workers will be the greatest in Category III technology.

With superiors (III-B-2-b). The frequency of interactions between first-line supervisors and their line superiors will be less than the frequency of interactions with subordinates or parties to horizontal interactions. The frequency of supervisor-superior interactions will be greater in Category III than in Category II technology, but slightly less than that found in Category I technology.

Horizontal interactions (III-B-2-c). The frequency of this class of interactions will be mid-way between the frequencies noted in the two preceding sections. In comparison to Category II technology, the frequency of horizontal interactions is hypothesized to be less in Category III production technology. The relative frequency of horizontal interactions will be approximately the same in Categories I and III technology, with a possibly greater frequency in continuous-process types of technology, where the complexity of the technology is considerably greater.

Supervisory sentiments

Toward subordinates (III-C-1). Toward superiors (III-C-2). Toward parties in horizontal interactions (III-C-3). As in enterprises under Category I technology, sentiments of supervisors toward subordinates, superiors and parties to horizontal interactions will tend to be neutral to friendly in tone. However, in contrast to Category I technology, these sentiments will exhibit a certain amount of instability over time due to the major significance attached to production crises in continuous-process technology.

FOOTNOTES ON CHAPTER III

[1]Joan Woodward, Industrial Organization: Theory and Practice (London: Oxford University Press, 1965), p. 23. Woodward defines "organic" management systems as being "more adaptable": jobs lose much of their formal definition, and communications up and down the hierarchy are more in the nature of consultation than the passing up of information and the receiving of orders." In the subsequent analysis we utilize a slightly more operational concept of "organic" management processes.

[2]Tom Burns and G.M. Stalker, The Management of Innovation (London: Tavistock Publications, 1961), pp. 121-122.

[3]The foregoing criteria shall constitute the definition of "administrative activities."

[4]Woodward, op. cit., p. 23. "'Mechanistic' systems are characterized by rigid break down into functional specialisms, precise definition of duties, responsibilities and power, and a well developed command hierarchy through which information filters up and decisions and instructions flow down." In the subsequent analysis we utilize a somewhat more operational concept of "mechanistic" management processes.

[5]Woodward, loc. cit. See footnote 1 of Chapter III for a definition of the concept of "organic" management processes.

CHAPTER IV

CASE STUDIES: CATEGORY I TECHNOLOGY

Introduction

Chapter IV is the first of three consecutive chapters devoted entirely to the presentation of empirical data in the form of case studies. The chapter consists of two case studies used to demonstrate examples of the nature of first-line supervisory role demands and environmental characteristics under Category I technology. The cases have been edited in order to present only those data pertinent to this analysis.

The sources of the case studies will be cited initially in conventional footnote form. Thereafter, within a given case, only page references will be used to indicate those portions of the studies utilized in the research.

CASE NO. 1

"A Dyeing and Cleaning Plant"[1]

Background

1. This is a short account of the foremen's place in a firm of dyers and cleaners. The firm is a small one, employing in all about 400 people, of whom 250 are in the works. The remaining 150 work in shops belonging to the company, at which goods are received from customers for cleaning and dyeing. In this study we are concerned only with the works, with its 250 employees and their supervisors.

Factory Organization

2. Figure II below portrays the management organization of the enterprise described in Case No. 1.

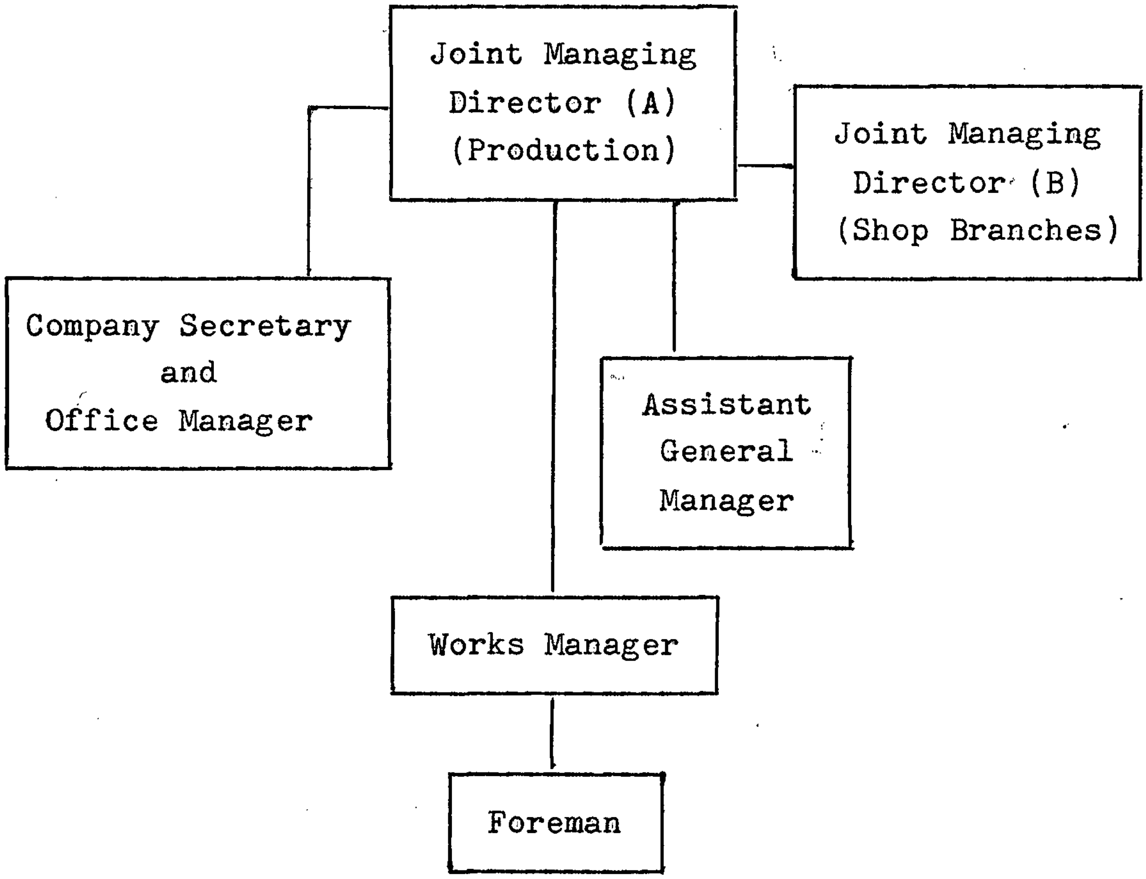


FIGURE II

MANAGEMENT ORGANIZATION
(adapted from source: pp. 73-74)

The Assistant General Manager "has recently come on the scene. He is responsible to the Production Director and the Works Manager is responsible to him although at present,

as a newcomer, he is acting rather as a special assistant to the Production Director than as controller of production."
In other words, the factory will ultimately have four levels of management authority instead of its present three.

> The Managing Director for Production has had a great deal of experience in the factory, in different management positions, over the years, and has always been interested in the methods and processes and in ways of improving them. . . . the Works Manager, the foremen and the other supervisors have all been with the company or the industry for many years.

The Technology and the Foremen's Work

3. The procedure for the major part of the company's business, cleaning, can be simply described. Goods are collected from the shop branches by van at night, and on arrival at the works are sorted into categories for cleaning. Those which it is impracticable to dry-clean usually go direct from the sorting point to the Wet-cleaning Department, though others are sent for wet-cleaning after having already been through the Dry-cleaning Department. After being dried they pass to the Finishing Department for spotting and pressing and are then inspected and dispatched. The articles to be dry-cleaned go straight to the Dry-cleaning Department, and then, in the same way, to the Finishing, Inspection, and Dispatch sections.

<u>Dry-cleaning department</u>

4. The Dry-cleaning Department has cleaning machines, hydro-extractors and tumblers for drying. The work consists almost entirely of putting the clothes, etc., into the cleaning machines and then transferring them to the others in turn. As the goods have previously been sorted according to material and colour, the work is entirely manual and requires no skill or particular knowledge on the part of the workers.
5. There are two shifts working in this department, each consisting of four men under a charge-hand. The latter, who is responsible for the work of the department, is also in charge of the sorter, who, however, requires little attention apart from being kept informed about what kind of work is required next. The department is a busy one, for thousands of articles pass through in a day and the charge-hand works on the job with the other

men for a considerable amount of the shift. He does, however, spend some of his time organizing the work so that the washing machines do not stand idle and he is responsible for such things as maintaining the level of cleaning spirit. He is also likely to find himself involved in minor machine repairs and maintenance. He spends little or no time actually supervising the work.

6. This work does not demand a great deal of skill on the part of the supervisor and therefore there is no foreman in charge. At the same time it does need a good deal of practical experience, particularly of the machines used. The charge-hand on the day shift, in this instance, has been with the company for sixteen years and his experience covers nearly all the different kinds of work done in the factory. He has been in the Dry-cleaning Department for nearly ten years, as charge-hand for the last five. He is paid on the same basis as the ordinary operators in his department, i.e. according to the amount of work handled in a week, with a flat rate addition of fivepence an hour.[6]

<u>Wet-cleaning department</u>

7. The Wet-cleaning Department deals with two categories of work: that which cannot be dry-cleaned because of its nature, and that which does not respond to dry-cleaning, and is therefore sent on for wet-cleaning. Articles arrive in the department, mostly from the sorters, with coloured labels on them indicating the degrees of priority they should receive. They are sorted into categories according to the treatment to be given.

8. The actual cleaning is done either by hand or by machine, and in some cases by a combination of the two. There is a considerable variety of possible treatment in the way of rinses and drying methods. The workers number eight with an additional two men in a small section devoted to carpet cleaning. The equipment consists of washing machines, hydro-extractors, tumblers and other apparatus for drying. In this department, the system of wage-payment depends again on the amount of output and is essentially a group bonus plan.

9. There is a foreman in charge and his job is principally one of organizing the production flow in the department, not only to keep the work going but also to make sure that the correct treatment is given to the different categories of goods involved. He sorts the articles himself. All this means that he must be able to recognize different fabric types and know the effects of different kinds of treatment upon them. He needs to be able to estimate the likelihood of success in wet-cleaning a particular garment, and weigh this up against

the probability of its being utterly spoiled if the process fails. He must have in mind such things as chances of coats shrinking, or skirts dropping, or colours running. He must remember that rayon loses half its strength when wet, and must be careful to spot that a garment has padding in it and so cannot go into the machines. The present foreman has been in his position for the last twenty years, having worked previously in the Wet-cleaning Department of another firm.7

The dyehouse

10. For a number of reasons, only a very small amount of dyeing is undertaken these days, and the Dyehouse employs only three workers, with a foreman in charge. The latter's job is mainly a technical one; he examines goods sent for dyeing and decides on the appropriate treatment. He also has to advise on the likelihood of successful dyeing of goods that are sent from the shops in doubtful cases for his opinion. All this requires a considerable knowledge of fabrics and fibres and particularly of the effects on them of boiling. The foreman's position is, from the technical point of view, a very responsible one; present-day fabrics with their mixtures of natural and synthetic fibres are difficult to dye successfully and the risk of failure is often high. The foreman of the Dyehouse gained his knowledge of the trade at another company, and came to his present position as an already experienced man during the Second World War.

Finishing department

LL. After goods have been cleaned they are sent to the Finishing Department where they are prepared for dispatch to the shops. The two principal operations in the department are spotting and pressing. Spotting involves examining garments and removing any small marks left on them after they have been through cleaning processes. There is one group of people engaged on this work. After the spotting the garments are distributed by a service operator among the Pressing Section, which consists of a number of small groups, each concentrating on a different type of finishing process. The pressers and spotters are under the charge of the Finishing Department foreman, who also controls two smaller sections, cleaning household goods and hats, which are regarded as part of the Finishing Department.

12. It is this foreman who came to act as a kind of unofficial co-ordinator of the work of the factory. He has been with the firm for a great many years, coming to it when he was eighteen. He has been charge-hand in the Dry-cleaning Department, foreman of the Spotting Section,

and subsequently of the Pressing Section in addition. He has added to his great amount of practical experience by studying the technology of cleaning and dyeing at a local institute. When the previous Works Manager left more than two years ago it fell to him to co-ordinate the work, first of his department and of those sections most closely related to it, and subsequently of all the production departments. His position as Works Manager has now been formally recognized, though he continues still in his role of foreman of the Finishing Department.[8]

Silk spotting

13. In this section there are a forelady and four girls. They do the spotting of all silk or imitation silk garments and all white garments. The forelady spends a good deal of her time checking over and sorting goods as they arrive in trolleys, putting aside any that require recleaning, or which have been dry-cleaned and require wet-cleaning. She supervises the work of her girls and when time permits checks what they have done.

14. The forelady has been with the company since the mid-'thirties, having worked previously at another firm as a spotter. She became forelady 'longer ago than I could remember' and has had a vast amount of experience which allows her to advise when additional treatment, other than simple spotting, is necessary for garments that have been cleaned. Her role as checker and adviser is, in fact, a more important side of her work than her supervisory function.

Repairs department

15. This department undertakes alterations and repairs at the request of customers. There is a forelady with a fairly large work-force, including some part-timers, who is left very much on her own to run the section. Apart from advising on repairs and supervising and checking work, she keeps records of work done for costing purposes, and of the work of different operators for wage purposes. It is skilled work in this department and one of the forelady's responsibilities is for the training of new workers, who are for the most part inexperienced when they come. The workers range in age from girls not long out of school to an old lady over seventy. The forelady started with the company twenty years ago as a shop assistant, becoming a shop manageress and later supervisor over several shop-branches before transferring to her present job in 1940. She is, in fact, one of the few people on the production side who has had experience in the shops and is therefore in a position to appreciate some of the difficulties of dealing with customers face-to-face.

Inspection department

16. The Inspection Department, which employs women and is under the control of a Chief Inspector, is regarded as one of the most important departments in the works. All articles come here for examination and those which do not meet the required standard are returned for further processing. The department has a direct influence on operators in other parts of the factory, as work which does not pass inspection is returned to the people responsible, who must re-do it. The Chief Inspector spends some of her time in feeding work to the inspectors and seeing that they maintain a reasonable rate of inspection, and some of it in checking their work. She also sees to the sorting and removal of garments to the point of dispatch. She is herself an ex-inspector.9

Investigation department

17. The Investigation Department deals with queries and complaints from the shops and from customers about articles overdue, missing or damaged. Its work involves searching for garments which have gone astray in the factory or which may have been dispatched to the wrong branch in error, writing letters of explanation or apology, arranging for claim forms to be completed and compensation settled, and dealing with queries on the telephone. The staff of three is under the control of a lady who has had experience both in this factory and with another firm. Her relations with the production sections are informal and friendly; co-operation in finding missing articles is readily given by the factory people, who regard her department as one that is simply doing another necessary job.

The Demands of Supervision

Except in the Finishing Department the number of workers under the control of any supervisor in this factory is relatively small. The importance of a supervisor's job, however, should not be assessed solely in terms of the number of workers he is in charge of or the amount of work done in his department. The type of work done must also be taken into account. Here, for instance, though it handles a comparatively small number of articles, the Wet-cleaning Department gives a great deal of individual attention to them. Treatments must be varied according to the types of fabrics and colours and the foreman spends a great deal of time deciding and advising on individual treatments. The Dry-cleaning Department, however, does work which is much more repetitive, with little modification of the standard process necessary or possible. In this department it has not been found necessary to have a foreman and there is a working charge-hand in control of each shift.[10]

18. Except in the Dry-cleaning Department, there are two important requirements for the supervisor in this factory: organizing ability and an expert knowledge of the work done in his department. In the first place he must be able to administer his department so as to keep the flow of work running smoothly with all machines and workers employed to the best advantage. This does not involve a lot of 'paper work' or any long-term planning but it does require the ability to think ahead on a short-term basis, to adapt to the different requirements of each day. In the second place he must be the technical expert and adviser for his department. The wet-cleaning foreman, for instance, must be able to say whether a particular article is likely to wet-clean successfully; the forelady in charge of silk spotting must be able to decide whether a garment which is still stained when it comes to her department should be reprocessed. This kind of expertness requires a great deal of first-hand experience with the work.

19. There are, of course, other functions for the supervisors to perform. They are responsible for the training of new employees coming into their departments. They are responsible also for the engagement of staff for their departments, though in this case all applicants are seen first and screened by the Finishing Department foreman, now Works Manager, and only the most likely ones sent on to be seen and accepted or rejected by the foremen. Finally they are responsible for the work and discipline of those in their departments. This last function does not figure prominently, as it is the sort of factory where the workers know what their jobs are and get on with them without close supervision. A system of payment by results plays its part in this and indeed emphasizes the importance of the supervisor as an administrator. For the system to run smoothly the supply of work to operators needs to be continuous and the supervisor must organize things so that this is the case. As we have seen, the Inspection Department controls standards of quality; individual workers have to re-do work which is not up to standard, and their bonus earnings are adversely affected when garments are returned to them.

20. The question of selection and training of supervisors calls for little comment. With the small numbers involved the occasion for replacing a supervisor arises very rarely. There is no formal scheme of training for supervisors; emphasis is placed rather on picking the right people for the work on the assumption that they can then be relied upon to develop the necessary supervisory skills in their own way. The question of tech-

nical training for supervisors does not arise, as newly-appointed supervisors are invariably highly experienced in the work they are to control.[11]

Attitudes of the Supervisors

While the foremen in this factory spend a considerable part of their time helping 'on the job,' they do have certain signs of status which distinguish them from the ordinary operators. They are given an extra week's holiday, they have sickness pay benefits and they do not clock on and off. As far as their pay is concerned, the position is that the supervisors are on a flat rate, which varies from one individual to another but which places all of them, as a rule, above the earnings of those they are in charge of. It must be noted that the work of the factory is to some extent seasonal, so the few occasions on which a good worker's pay exceeds his supervisor's wage are more than offset by the weeks of the 'off' season. There is no pension, but a gratuity on retirement is payable to supervisors at the discretion of the directors.

21. The supervisors are satisfied with their position. They are largely independent, and free to run their departments as they think fit. They do not need to have much contact with managers as there are no problems of planning, or raw material, to be discussed with them, and the supervisor is the technical expert in his field and makes technical decisions for himself. The organization is an informal one; supervisors are not separated from top management by long lines of control, and they and the managers have worked together long enough to know each other extremely well. The supervisors' jobs have not changed very much over the years, and so their considerable experience remains relevant today. Any problems that do arise they can discuss with the Works Manager, whom they accepted as co-ordinator before he was formally appointed to his present position.

22. Relations between supervisors and their workers have already been touched upon. They are, for the most part, very easy and friendly, with the supervisor having always in the back of his or her mind that it will be a tricky job to find suitable replacements for any workers who are allowed to leave where this could be prevented. For the most part relations between supervisors are also good. In a small, stable group like this, whose members have known each other for many years, good-will and tact overcome the minor difficulties that arise at times in relations between them.

23. In fact, while a certain amount of co-operation between the factory departments is necessary, the work of

one does not affect that of another to any great extent. Very much more does the work of all departments affect the company's shops, and vice versa. There are many ways in which the shops can help the factory: by closely inspecting all articles received and noting tears, etc., by clearly labelling all such things as belts that are likely to become separated from garments, and so on. For their part, the factory people can help or hinder considerably the work of the shops. At present, neither seems to be sufficiently aware of the difficulties of the other; the factory people do not have to reason with angry customers face-to-face and the shop people do not know of the technical difficulties associated with some of the treatments they recommend to customers. This company is not, of course, the only one to have this particular problem; to some extent it is inevitable in an organization of this kind, with its separate system of control for factory and shops.[12]

Conclusion

24. This is a study of the supervisors of a small firm of cleaners and dyers. In this case the supervisors are in charge of varying numbers of operators and of different kinds of work. By and large, they run their own shops: they are their own technical experts, they do not have to consult with others about plans, or raw materials. Their technical responsibilities are heavy, and their position requires a great deal of practical experience of the work they control.

25. The main importance of supervisors in this kind of firm is that they are directly responsible, to a very great extent, for the firm's reputation with its customers. Products which are not up to standard cannot be 'scrapped', and so the need for technical competence and years of practical experience on the part of the supervisors is of particular importance in this industry.[13]

CASE NO. 2

"An Electrical Engineering Works"[14]

Background and Technology

1. This is an account of the place occupied by the foremen in a company about 600 strong engaged in the manufacture of electrical equipment.[15]

2. Type of production in early years [fifty years ago] set the pattern for what was to follow. Thus between 1915 and 1919 the company was engaged entirely on contract work for other organizations, working to individual orders for relatively small quantities, and this type of work has continued to be a major part of production.[16]

3. Following the post-war slump of 1949, "a gradual expansion occurred . . . and the total amount of work in hand became greater than in any other peace-time period."[17]

4. The company has always manufactured electrical equipment such as generators, switchgear and small-sized electric motors. . . . There is also a certain amount of sub-contract machining. Because the company is engaged in a very competitive field and among its rivals is a number of much larger mass-producing concerns, it has tended to specialize in the production of motors of a slightly non-standard type. Since many of the orders are for small numbers only, production consists to some extent in small lots of orders of different types. There are also long-term orders, so that total production consists partly of long-term contract work and partly of orders for small numbers of special designs and types.[18]

5. Figure III below portrays the management organization of the enterprise discussed in this case.

The Management Organization

<u>The managing director</u>

6. Of the two working directors, only the Managing Director directly concerns this study. He is closely in touch with production and employees through the Works and Personnel Managers. . . . [He] has controlled the company from the days when it employed 175 or so workers . . . until today when it has 600-odd employees. It is only natural to expect that after nearly twenty years a managing director will have impressed his own philosophy of management on a company, especially when, as in this case, it has grown and prospered under his direction. Leaving aside matters of company policy and technical development for which he has had responsibility, and considering only his views on management, it may be said that this Managing Director has always believed that a company has a

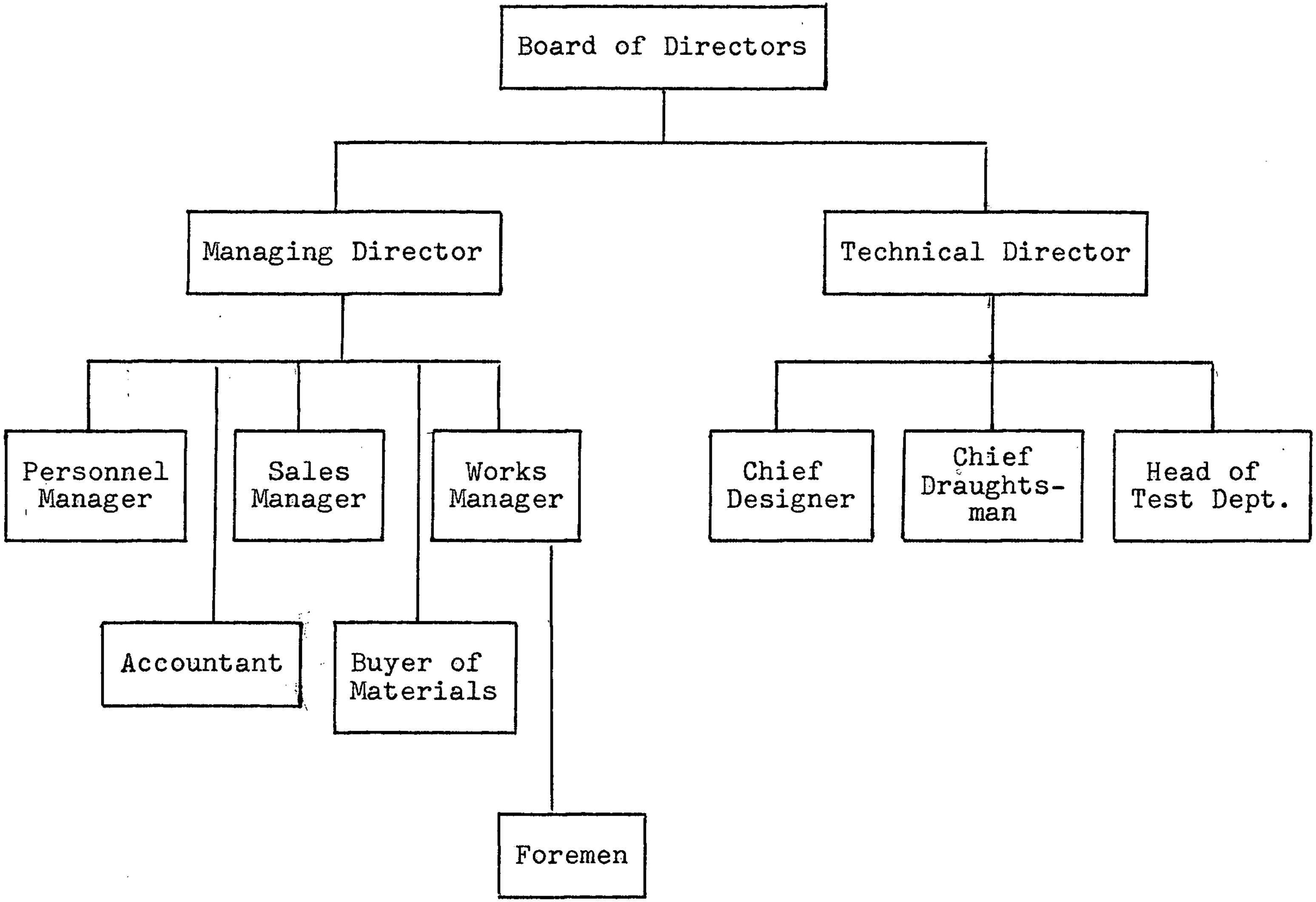


FIGURE III

THE MANAGEMENT ORGANIZATION
(adapted from source: p. 19)

definite social responsibility towards its workers. He has always aimed to encourage a family feeling in the firm, to make everyone feel that they are thought of as individuals with an interest in the company and its affairs, and not simply as labour which can be hired or fired to suit the convenience of the moment and with no consideration of the effect this may have on their lives.

7. Two effects of this manner of thinking may be instanced. In line with the desire to treat all workers as responsible individuals, there is a determination first to have as few rules and regulations as possible, and secondly, to allow anyone access to top management. Each employee of the company knows that he can have an interview with the Managing Director, if he wishes to see him.

8. The Managing Director is in close tough with the works side of the business not only through his contact with the Works and Personnel Managers, but also by means of his daily walk around the works and his chairmanship of the Works Advisory Committee [the labour-management works council]. Perhaps he is more closely concerned with the detail of what is going on than would be the case with other men in his position; . . . . . His intense interest in the work of the company and in its people has continued as the company has grown.[19]

The works and personnel managers

9. Responsible to the Managing Director for production is the Works Manager. He and his assistant are both professional engineers who have been with the company in their present capacities since just before the war, and so have lived through the major period of company growth. At the risk of over-simplifying the picture, it can be said that the Works Manager himself is principally concerned with the technical side of the production work, leaving factory administration largely to the Assistant Works Manager. Thus the Works Manager will be most often found in one of the shops, talking over and suggesting solutions to a difficulty caused by some technical problem. The Assistant Works Manager, on the other hand, is concerned with production control and progress, plant and building maintenance and so on.

10. The Personnel Manager is responsible to the Managing Director for engaging and dismissing staff, fixing rates of pay, arranging merit increases, and dealing with any personal difficulties that may be brought to him. He also plays a major part in the organization of sports and social activities within the company,

and in addition has responsibility, jointly with the Accountant, for packing and transport and the main factory stores. He . . . joined the firm as a youth just before the war and [has] been given a full engineering training. . . .[20]

The Workers and the Factory Atmosphere

11. Something should be said of the general atmosphere in the factory. . . . the general atmosphere is an extremely happy one. A number of possible reasons for this can be suggested: first the same team of managers and most of the foremen have lived through the expansion years together, and so the policy has had time to take root and grow as the firm has grown; secondly relations between management and union representatives--both informally and at Joint Consultation meetings in which each department is represented by its shop steward--are on the whole friendly; thirdly, there is the deliberate informality of the organization, and the recognition of each employee as an individual of importance in his own right.

12. The company [has] a solid core of workers who have been with it for over fifteen years or more, but with the expansion of recent years these represent a smaller proportion of the whole than they did. Most of them are skilled men, and the present aim is to enlarge the core, for, like all firms, this one wishes to feel that it can depend on a few workers, particularly skilled men, through any change. However, it is being found extremely difficult to get suitable skilled men for the production shops and any addition to the production strength can only be made by the recruitment of semi-skilled or untrained personnel. . . . this affects the foreman's job and makes it more difficult than in former years.

13. There is a shortage of skilled workers in the area, ... For the skilled labour that is available there is acute competition between the various firms. . . . . Relations between management and workers are such that there are no hard feelings when good workers leave and they are usually re-engaged if they wish to return, as they quite often do. . . . . Despite the difficult labour position in the district, however, the turnover in this firm is no more than the average for the industry.

14. We come now to the eleven foremen and the jobs they perform, their attitudes to their work, to their colleagues and their managers, and how they fit into the framework of management in this company.[21]

The Foreman's Background

15. Most of them have been with the company for at least fifteen years, having previously served apprenticeships in either mechanical or electrical engineering. The case-history of one of them, Mr. X, is fairly typical of the group.

16. Mr. X is now forty-seven years old, and has lived most of his life within a few miles of his present job. When he left school at the age of fourteen he went to work in a firm of electrical engineers, and obtained an apprenticeship. He served his time, and then continued to work for the firm in his trade. . . ., Mr. X obtained employment with his present company in 1937, working in a trade closely similar to his own. It was at about this time that the company's expansion began and that the present management team took over. Then came the war-time increase in numbers, with the necessity of increasing the number of departments and in consequence the number of foremen. In 1940 Mr. X was appointed as a foreman, and he has held his position ever since.

17. It will be seen that Mr. X is a man who has been all his working life involved with the kind of work which he is now supervising, having served an apprenticeship and worked for a period as a craftsman. He has had no further education since he left school except for the technical part of his apprenticeship, nor did he have any training for his work as a foreman. He was appointed because he was a good workman who, it was felt, would be able to stand up to the responsibility involved in a supervisory position and who showed signs of possessing the leadership qualities required.[22]

The Foreman's Work

18. The foreman's work can be considered as consisting of technical, administrative and supervisory duties. . . . . .

Technical duties

19. In this, as in other firms, the technical side of the foreman's work has changed considerably over the years. In earlier days the foreman of this company was told what work was to be done in his shop and he then had to work out the best way of doing it. He had to consider work methods from the points of view of quality of work, and economy of material and time. It was usually up to him to decide the order in which jobs and operations had to be done. Today, much of this is done for him by specialist departments. The Progress

Department lays down the sequence of the operations on a particular job and says when they are to be done. The Planning Department prescribes the methods to be used. But however cut and dried this sounds in theory, it does not mean that in practice the foreman has little technical responsibility today. He is still the man on the spot, the man of practical experience, and the fact that the Planning Department decides on methods does not relieve him of the necessity to consider their decisions very carefully, to criticize them when necessary and take steps to see that jobs are done in the most economical ways. He will, in fact, very often be consulted on any matter out of the ordinary before the Planning Department decides on the methods. His experience and knowledge also play a part in establishing piece rates for jobs--matters in dispute will be thrashed out by the fixers, the planners and the foreman.

20. The growth of specialist departments has meant that there has been a redistribution of skill and a change in the complexity of the work of the production departments. Previously the skilled workers were all engaged on production work, under the control of the various shop foremen. Today many of them are in the Planning Department, the Tool-room, and Inspection sections, and their work makes it possible for the actual production work to be satisfactorily done by less skilled people. For the foreman's part, this means that he is now supervising many more semi-skilled and unskilled workers on simpler jobs. He has less planning to do but he has to do more training of new adult workers, as the work still requires a certain amount of skill and experience and care, and new workers are mostly inexperienced when they come to it.[23]

Administrative duties

21. In the old days, but within the experience of most of the foremen, every department received a works order for every separate job, giving details of the particular job to be done and the number required. The foreman was in complete control from the moment he received the works order; he decided who should do the job, which machines should be used, how much material would be needed and when it should be fetched from the stores. Owing to the increasing complexity of the work, however, and the need for management to be kept more exactly informed of the production position throughout the company, a few years ago the Progress Department was reorganized and a new system of control installed. The Progress Department is responsible for following every job through from beginning to end; it makes sure that the right amount and

type of material is available to make the specified number of components, and that every department carries out its work as far as possible to schedule, so that there is a steady flow of work throughout all shops. Instead of just the simple works order, the foreman is now sent, together with the works order, separate requisition orders for every different type of material that will be required for the job, all of which he has to check and sign in order to obtain the material needed. This involves him in handling more paper than previously, even though much of this paper work is fairly routine. . . .

22. On the administrative side the foreman is also responsible for keeping certain records and making regular returns. These concern such things as the work done in his shop, and daily absentees. There are also occasional reports and lists to be compiled concerning, for example, holiday arrangements. (The company operates a system of staggered holidays.) Progress reports on certain workers are also required at intervals, as are reports on the apprentices in his shop.

23. It can be seen therefore that the amount of clerical work required of the foreman can be substantial and is always considerable, and certainly a great deal more than had to be done in the old days. One reason is the bigger number of workers that the foreman has to deal with. As we have seen, the reorganization of the Progress Department has also led to an increase in paper-work for the foreman. Another department whose importance has increased is the Personnel Department, and this too has involved extra work in some directions for the foreman, although relieving him of some burdens in others. It is essential for these specialist departments, if they are to fulfil their functions properly, to be in possession of up-to-date information about the situation in the works, whether concerning production or personnel matters; as they have increased in importance, so has the amount of clerical or administrative work done by the foreman increased.[24]

<u>Supervisory duties</u>

24. By 'supervisory' we mean that aspect of the foreman's work concerned with the handling of the workpeople under his control. The most obvious responsibility here is for maintaining discipline, in its widest sense; that is of endeavouring to ensure that workers arrive regularly and punctually and work steadily and carefully during their proper hours of work. If the purpose has not changed in this company, it is recognized that the methods have, because of the altered situation of both the workers and the foreman. The worker's position is vastly different nowadays from what it was before the war; then

workers knew that they could be easily replaced, whereas now this is not the case. Not only can the worker afford to risk being sacked, he can afford to leave of his own accord safe in the knowledge that other employers will be glad to engage him.

25. The change in the circumstances of the worker has changed the position of the foreman. The latter can no longer think in terms of his workpeople wishing to stay at all costs; . . . . the 'sack' is not the extreme penalty it used to be. Another factor which has changed the situation from the foreman's point of view is the increased importance of the Personnel Department. Before the war the foreman hired and fired the workers in his shop. Now the hiring is done by the Personnel Department, with the foreman having the right to turn down anyone he thinks not likely to be satisfactory, but not having the power to dismiss, except after consultation with the Personnel Manager. . . . There are two other penalties which can be inflicted: suspension, a power which is never used in the company nowadays, and varying the pay rate, which can only be done after consultation with the Works Manager.

26. As far as the maintenance of discipline goes, then, the position is very different from before the war. As there is no penalty which the foreman can impose without first getting permission, and as this is only encouraged in serious cases, it is evident that he needs to use leadership of a different type. Much more trouble has to be taken over newcomers and, as we have seen, more training of adult workers is necessary. Late-comers and absentees have to be 'reasoned with', and not threatened.

27 The foreman also has certain responsibilities for the training of apprentices. Every boy goes into the various shops, learning something of the work that is done in each, and the foreman must either give instruction himself or see that an experienced man is put in charge of the boys. It is up to the foreman to arrange matters so that apprentices spending about six months in his shop have the opportunity of getting all-round practical experience of the processes that are carried on there. He must be in close enough touch with their work, even if he is not supervising it personally, to be able to send reports on the progress they are making and the promise they show to the Personnel Manager, who relies on this information for planning their future training.[25]

Selection and Training of Foremen

28. Vacancies for foremen's positions do not arise very frequently. When they do, the policy is to promote from within if possible but there is no hard and fast rule about this; if there appears to be no suitable man then the company is quite prepared to bring someone in from outside. . . .

Applicants from inside the company are almost invariably experienced tradesmen who have been acting as charge-hands or setters. . . .

29. This selection method ensures that so far as possible the prospective foreman will have had adequate training and experience in the technical side of the job he is to supervise. Up to the present it has not been felt necessary to arrange training in the administrative or supervisory aspects of the foreman's job.

The Attitudes of the Foremen

It is now time to consider the feelings of the foremen about their work and its circumstances. While they do not all feel quite the same way about their jobs, they have a surprising amount in common when they come to talk about their work.[26]

Attitudes to status

30. 'I think sometimes the foremen feel that a lot of their status has been taken away from them', was a remark made by one foreman and echoed by others in different words. And what do the foremen mean by this word 'status'? What they mean can be understood from 'the differential between foreman and worker nowadays is altogether too small' and, in a convenient summary, 'less responsibility, less privileges, less contact with managers and a lower quality work-force'.

31. This is not to say that this company's foremen are discontented; on the contrary they agree that the atmosphere in the firm is a happy one. Nevertheless we have seen that a period of change and growth has come about, and as the job of the foreman has gradually changed, so, it appears to him, has the status, the importance of his job in the eyes of management.

. . . . On the whole, as in many other firms today, the foreman is justified in thinking that he is less valuable to the firm than he used to be, at least in terms of his pay.

32. Other privileges enjoyed by the foremen are the same as for all the company's staff as opposed to hourly-paid workers, and include sickness pay for up

to a month and afterwards at the company's discretion, and no clocking on and off. The foreman's hours are the same as for hourly-paid workers. . . .

. . . . The foreman's job carries considerable responsibility, but also . . . it is of rather a different kind from earlier days. The words of one of the foremen are revealing: 'Before the war the foreman ran his own shop.' The implication is that nowadays he does not, and so he feels that his job is a less responsible one. Before the war he made his own estimates, promised job completion times, engaged and dismissed his own staff, while nowadays these functions have been taken from him by Planning Progress and Personnel Departments, and to this extent he is no longer in such direct control. On the other hand, the introduction of functional specialists and more elaborate control systems means really not that the foreman's responsibility is less, but that it is different. His role demands, far more than it used to, the ability and willingness to co-operate with others. He must be prepared and able to make out returns accurately and punctually for the Personnel Department, or to discuss methods of work with the Planning Department. We have already seen, moreover, that the foreman has to spend more time in training new adult workers than he once did.

33. There are one or two other things which the foremen think adversely affect their status. They feel, e.g. that it is made rather too easy for their workers to go direct to members of higher management with their problems. In fact, people like the Managing Director and the Personnel Manager, though they are fairly often approached by workers about such things as educational and welfare matters, are conscious of the need to uphold the foreman's authority and they rarely deal with matters which come into the foreman's province. But the foreman, who is concerned about his status and perhaps too liable to suspect people of reducing it, is inclined to fear that his workers go to others to discuss matters that are his concern.

. . . . The relations between foremen and shop stewards are generally very good and the foremen sometimes even ask the shop stewards to raise matters they want discussed at the meetings [of the Works Advisory Council]. Nevertheless, though it is only a small point to to the foreman, they do tend to regard the situation [of their limited participation in council meetings] as another sign of declining status.[27]

Relations with managers

34. It might almost be said that the lack of attention which they give to the clerical side of their work is

the most serious shortcoming of the company's foremen. . . . the growth of the company has led to more paper-work for the foremen, paper-work on which the specialist departments such as Planning, Progress and Personnel depend for their knowledge about the day-to-day situation. Without this information they cannot carry out their functions properly.

. . .: why are these duties not dealt with more effectively and why is their importance not recognized? . . . .

35. The answer . . . is . . .; the foreman's paper work is not done more effectively because he is not made to do it effectively. . . . the foreman does appreciate the importance of the specialist departments, but does not recognize how important he is to them. While he appreciates the need to give information to another foreman, he does not realize just how much these other departments are dependent on him for information. This could be put another way by saying that he is inclined to think a specialist department has taken over part of his job entirely, and that that part of the job can now be left to it.

36. Though considerable trouble is usually taken to explain the introduction of new systems to the foremen, it should be remembered that foremen receive no training for their job other than the technical training and experience they obtain as operators. It is not surprising, then, that they should not realize completely just where their responsibility ends and someone else's begins. . . . It appears that some formal instruction in the administrative side of his work would be valuable to the new foreman, to give him information about the work of functional departments and the relation between their responsibilities and his.

37. It was said earlier that the foremen are not forced to do all the things that they are theoretically responsible for. It seems that this is due partly to the fact that some managers prefer to do things themselves rather than insist that the proper people do them. The Personnel Manager, for instance, will go to production departments and get for himself information which foremen have delayed sending to him. The Works Manager will sort out for a foreman administrative problems which have resulted in a delay in production. On the whole, this situation is more or less accepted by everyone; over the years it has become known that there are certain things that certain foremen aren't expected to do. At the same time, there are some unfortunate results. Some managers are overworked through doing others' work for them. Again, foremen are not always obliged to do things they could reasonably be expected to do and so they do not

get practice and experience in solving their own problems.

38. This leads us to a consideration of the relations between higher managers and foremen. It can be said at once that they are extremely good and friendly at a personal level. The Managing Director's largely successful attempt to maintain a happy working atmosphere is appreciated and applauded. The managers are seen as very hard-working and competent individuals. It does not excape the attention of the foremen, however, that the managers are devoting a good deal of time to doing other people's work. This is generally regarded as being bad both for the company and for departments. If the Works Manager is occupied in dealing with specific departmental difficulties, for instance, he has not enough time to do his own work, nor is he available to the rest of the factory. (This is what was meant by the comment 'less manager contact'.) . . ., the foremen feel that higher management does not always take a sufficiently strong line.

39. Any description of the relations between people at different levels in an organization, in order that it may be clear, is bound to be over-simplified. The foreman's view in the present case, in very simple terms, is: (a) his authority is lessened and his responsibilities fewer, due to the growth of specialist departments who now do part of what was his job, and due to the fact that communications between management and workers can by-pass him; (b) the managers are inclined to do too much of the work that should be done by the foreman, instead of concentrating on their own work and ensuring that everyone else does the same.

. . . . Top management does not regard them [the foremen] as of lower status or importance, though it may not have done everything possible to make it clear to the foremen that while their role has changed and some tasks have been taken away, other aspects of their work are more important than ever. . . . [28]

Conclusion

40. This study has been mainly concerned with the foreman's role, and particularly how it has altered, in a growing organization. We have seen how an increase in numbers, the need for more training of adult workers, and the growing importance of specialist departments have all contributed to the change in the foreman's job. Also that he himself sees in the changes a lowering of his status and responsibilities. It is suggested that the foreman's responsibilities are in fact no less important than they were. . . .[29]

FOOTNOTES ON CHAPTER IV

[1] The Place of the Foreman in Management. Seven case studies undertaken by the National Institute of Industrial Psychology (London: Staples Press, 1957), pp. 73-82.

[2] p. 73.

[3] pp. 73-74.

[4] p. 74.

[5] p. 74.

[6] pp. 74-75.

[7] pp. 75-76.

[8] pp. 76-77

[9] pp. 77-78

[10] pp. 78-79.

[11] pp. 79-80.

[12] pp. 81-82.

[13] p. 82.

[14] The Place of the Foreman in Management. Seven case Studies undertaken by the National Institute of Industrial Psychology (London: Staples Press, 1957), pp. 17-33.

[15] p. 17.

[16] p. 17.

[17] pp. 17-18.

[18] p. 18.

[19] pp. 19-20.

[20] pp. 20-21.

[21] pp. 21-22.

[22]pp. 22-23.

[23]pp. 23-24.

[24]pp. 24-25.

[25]pp. 26-27.

[26]pp. 27-28.

[27]pp. 28-30.

[28]pp. 30-32.

[29]p. 32.

CHAPTER V

CASE STUDIES: CATEGORY II TECHNOLOGY

Introduction

Chapter V comprises two case studies utilized in this study to demonstrate examples of the nature of supervisory role demands and environmental characteristics within enterprises employing Category II technology. The studies have been edited so that only those data are included which are pertinent to the analysis that follows in Chapter VII.

Case No. 3[1]

Background and Description of Plant Technology

1. This particular semi-independent plant specialized in a type of custom-made unit forming a component part of many types of electrical equipment.[2]
2. To meet competition, it was becoming essential to make more complex units and also to reduce their size. Top plant management not only gave [a recently enlarged] group of engineers smaller and more complex units to design, but, breaking the plant precedent of specializing in custom-made products, also decided to mass-produce some of these units . . . [also] the plant was in the throes of a major expansion. From early spring 1951 to mid-winter 1952, ten months later, the number of employees more than doubled.[3]
3. The special mass-production (assembly line) section was

> . . . located in one room and supervised by one foreman. . . . [The section] was to perform all operations in quick succession. Thus, the foreman in charge not only

had all the headaches accompanying rapid expansion, but he also faced in miniature, problems met in all three manufacturing departments, plus the customary problems which accompany repetitive assembly line operations.4

4. As one company observer phrased it: 'This organization puts responsibility on the immediate supervisor . . . higher-ups [are] not held responsbile.' . . . department heads . . . now all found themselves over-involved in their own departments and left to go-it-alone.5

Organization of Assembly-line Section

5. The forty workers in the assembly line section were divided into four groups under the supervision of a single foreman. Group 1 consisted of 6 girls winding coils, including their group leader. Group 2 comprised one group leader and eleven coil assembly-line girls. In Group 3 eighteen case assemblers (1 group leader, twelve assembly line girls assembling parts and finished coils, 4 older girls preparing covers for cases, and 1 repair girl) were employed. Group 4 was made up of 4 men performing various finishing operations. They had no group leader and so reported directly to the section foreman.[6]

6. In addition, there were in the room three test girls or inspectors, supervised by a test foreman who visited them at intervals during the day.

In this study, we will be directly concerned only with groups 2 and 3, the two assembly-line groups, consisting at the start of about 30 girls. Each of these two groups was under the semi-supervision of a different group leader, who at the same time was a member of the union. These two group leaders, both women, in turn reported to the section foreman [Teddy, the focus of our attention].7

Overall Organization. Further Notes on Technology

7. Within the plant full-time time study and methods improvement officers were utilized. Also, a rigid system of

inventory control was employed.

8. Members of the time study and work methods department analyzed the work operations in great detail, subdividing the total assembling operations into a number of highly repetitive jobs by assigning to each girl only a very few particular operations to perform on each unit, such as inserting a coil in a case, turning a screw, or soldering a connection. Each girl was assigned no more than four or five operations to perform on each unit--all four or five to be completed in a little over 1 1/2 minutes. . . .[8]

9. As the [assembly-line] section was placed in the Assembly Department, the section foreman reported to the Assembly Department head, who reported to the chief of all production. In turn the latter worked directly under the plant manager.[9]

10. Figure IV below is a schematic portrayal of the organizational position of managerial and supervisory personnel in the plant as a whole.

Supervisory Behavior and Problems of Supervision

A major component of any work environment with which a supervisor must cope is the attitudes toward work of subordinates and superiors. Evidence pertaining to such attitudes and their implications for supervisory behavior are summarized in the next three paragraphs.

11. Another irksome trait of the [assembly-line] job [in addition to the 20 sec., 5-step assembly operation] was the pacing imposed by a moving assembly line or by the speed of adjacent workers. . . . many of the girls paid little attention to the belt, but passed items to one another since they were rubbing elbows anyway. As the employees' rhythm demands and temperments differed, many characteristically preferred different speeds and rhythms of work flow.

To keep the work on an assembly line flowing smoothly, every position has to be filled, and everyone working in rhythm. . . . Sometimes, however, Teddy [the foreman] did not even have enough of these girls to replace absentees, so he would have to phone . . . to get a replacement immediately transferred . . . for the day. At other

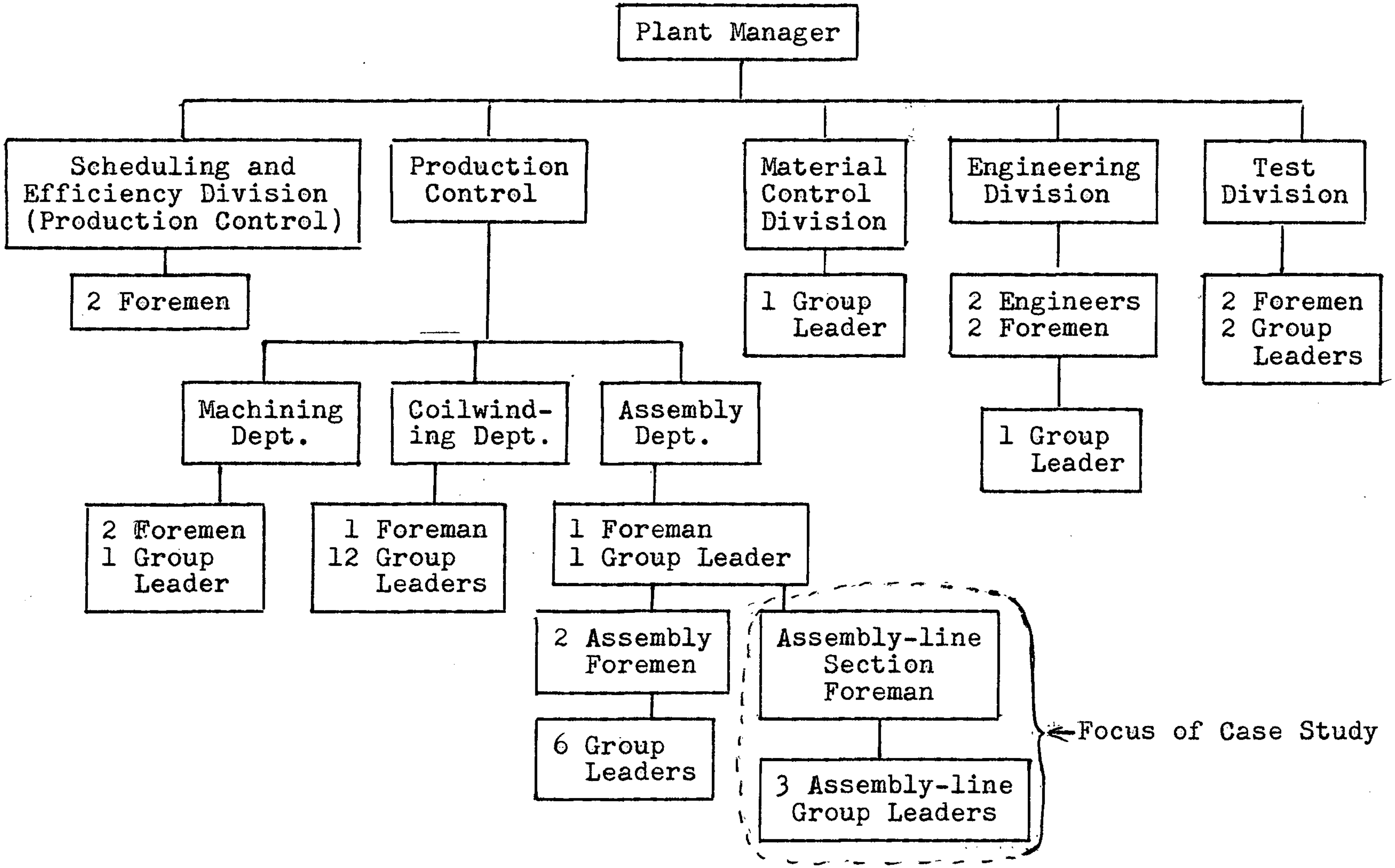


FIGURE IV

ORGANIZATION CHART. CASE NO. 3
(adapted from source: p. 21)

times . . . he might seriously need an extra girl to keep those on the line supplied, or to attend to odd jobs and repairs. [Such emergencies occurred perhaps 2-3 times per week.][10]

12. However successful Teddy had been in ending the girls' strong negative sentiments toward their direct supervisors [group leaders], he made little progress in ending the discontent of the girls toward their job demands. During Teddy's regime, according to the ample interview evidence, the girls reacted strongly against the boring repetitive nature of their jobs.[11]

13. Members of management made a practice of dropping in the room [because it was a 'pet' project] . . . to see what was going on. . . . Occasionally, even the plant manager himself would drop around. From these sources and miscellaneous management gossip channels, the impression built up that the case assemblers and their group leader were entirely too happy a lot. There was too much talking and laughing and not enough attention to work. Katy, the group leader, was considered far too friendly and easy going with the girls.[12]

Relations with Superiors and Subordinates

14. On occasions [the foreman], had looked for a little backing and some help or advice in running the department, but had been unable to approach anyone for extended discussion. As the plant was going through an almost unprecedented expansion, everyone was busy and had little time to spare. He dared approach . . . his department head, only on special occasions such as when he needed help or when he wanted the girls to work overtime, and even then they did not talk long.[13]

. . . in defense of the girls [the foreman] said that they were scared management would jump the quota if they increased their output adding skeptically 'I don't know myself if they [management] would do that'. He was obviously cautious about telling [the girls] to make less noise and it was difficult for him to check up on them all the time to see how long they stayed [in the ladies' room].[14]

Supervisory Tasks and Sentiments

15. [The foreman's] worries about his department were reflected during an interview. . . . At this time he referred to the fact that on his former job, they did not do repetitive work[Category I technology: custom-made units], as they only made a few units of each type. Having [now] the same product to do day after day and week after week bothered him a good deal, for

> he did not have the enjoyment and challenge of figuring out new problems and of working with his hands.[15]

He felt insecure about his position.[16]

16. Relations with Staff Specialists and Management

The following paragraph suggests something of the flavor of the challenges to effective interpersonal relations in situations involving technological change.

> In the process of introducing the soldering machine as well as the new product, no member in management made much of an effort either to win over their [the foreman's and group leaders'] cooperation or to guide them. The department head was so pressed by new problems continually arising in his overexpanded department that he left many of his subordinates to fend as best they could for themselves. The efficiency men were frustrated by the technical difficulties, so they paid little attention to the [assembly] room supervisors whose technical experience was even less than their own.[17]

To the foreman ". . . management represented a kind of inexorable, unfriendly, and mysterious force."[18]

17. The following three paragraphs similarly are suggestive of the flavor of challenges to effective interpersonal relations, this time with subordinates, in situations involving technological change.

> With a job suddenly thrust at them which they sensed could not work, with a department head too busy to offer more than token help, and with efficiency men more or less taking over the room, the supervisors . . . did not know where they stood. Without [the supervisors'] presence, however, the girls would probably have given up long before. [The foreman and section heads] conscientiously spent much time calming and soothing the ruffled dispositions of the girls, but when any trouble flared up between the efficiency experts and the girls, [the foreman and group leaders] were inclined to be on the side lines, to look the other way, and let the

experts show how expert they were. Sometimes, however, to protect the girls, they would have to step in. . . . In short, there was anything but harmony . . . among workers, efficiency men, and room supervisors.[19]

18. One of the more irksome demands of any job is to be interrupted to do an old job over again. Persons working on an assembly line have work rhythms which include subtle alternations of work and rest, or moments of conversation, or exchanging pleasantries with moments of silence. Among overworked persons, these subtle rhythms are seriously interrupted and, instead a dull exasperating rhythm of little else but work, work, work is imposed with only a minimum of alternating moments of rest, jokes, or talk of any kind. The matter is made worse if the overwork is caused by a backflow of rejects. With no other assembly-line experience, [the foreman], the defender of the group against the ravages of management and time study and methods men, perhaps by this one maneuver of dumping rejects onto an already confused line, unknowingly added the final straw that broke the will of the girls to produce.[20]

A Further Note on Relations Between Foremen and Management

19. [Although, after a period of time,] the technical problems had been solved, . . . still the girls had trouble assembling the units. As a last resort, management . . . removed the new product from this group of girls, giving it over instead to an entirely different group in an adjacent room. Thus, two weeks after the introduction of the new product, the time study and methods men set about transferring the problem product and all its associated parts, jigs, and the like out of the room.[21]

. . . the day after the removal of the problem product, [the Foreman] was summarily told by management to dismiss the entire group in fifteen minutes until further notice. He was taken aback by this pronouncement, but, as it turned out, the girls were relieved. . . . As a result of this occurrence, the test department set about more carefully testing washers, and, no doubt, other incoming supplies [which had been causing most of the problems on the assembly line].[22]

Management's Monitoring of Performance

20. Management kept informed about the assembly-line section indirectly by the usual means of written records and verbal accounts of intermediaries. Their main reliance, as is the custom in work organizations, was on using written records to keep them regularly informed regarding the work performance of the group. The most

frequent and widely used record information was the daily efficiency reports. In addition, plant management received monthly profit and loss statements, output reject, and absence records. [All of which are subject to inaccuracies and misuse.]

As middle and upper management were ultimately responsible for the performance of numerous groups throughout the entire plant, they could not possibly monitor directly the performance of all groups. Their judgements then became through necessity dependent on the information they received secondhand and of these the ones most relied on were the above-mentioned daily efficiency reports.[23]

The Foreman and Management Norms

21. . . . management through their time study and methods men had established a work pace and work methods which the assemblers were expected to follow. . . . As regards the room supervisors, they were expected by management to 'keep the girls working' by any or all appropriate means of which perhaps the most widely accepted norm was a firm disciplinarian manner.

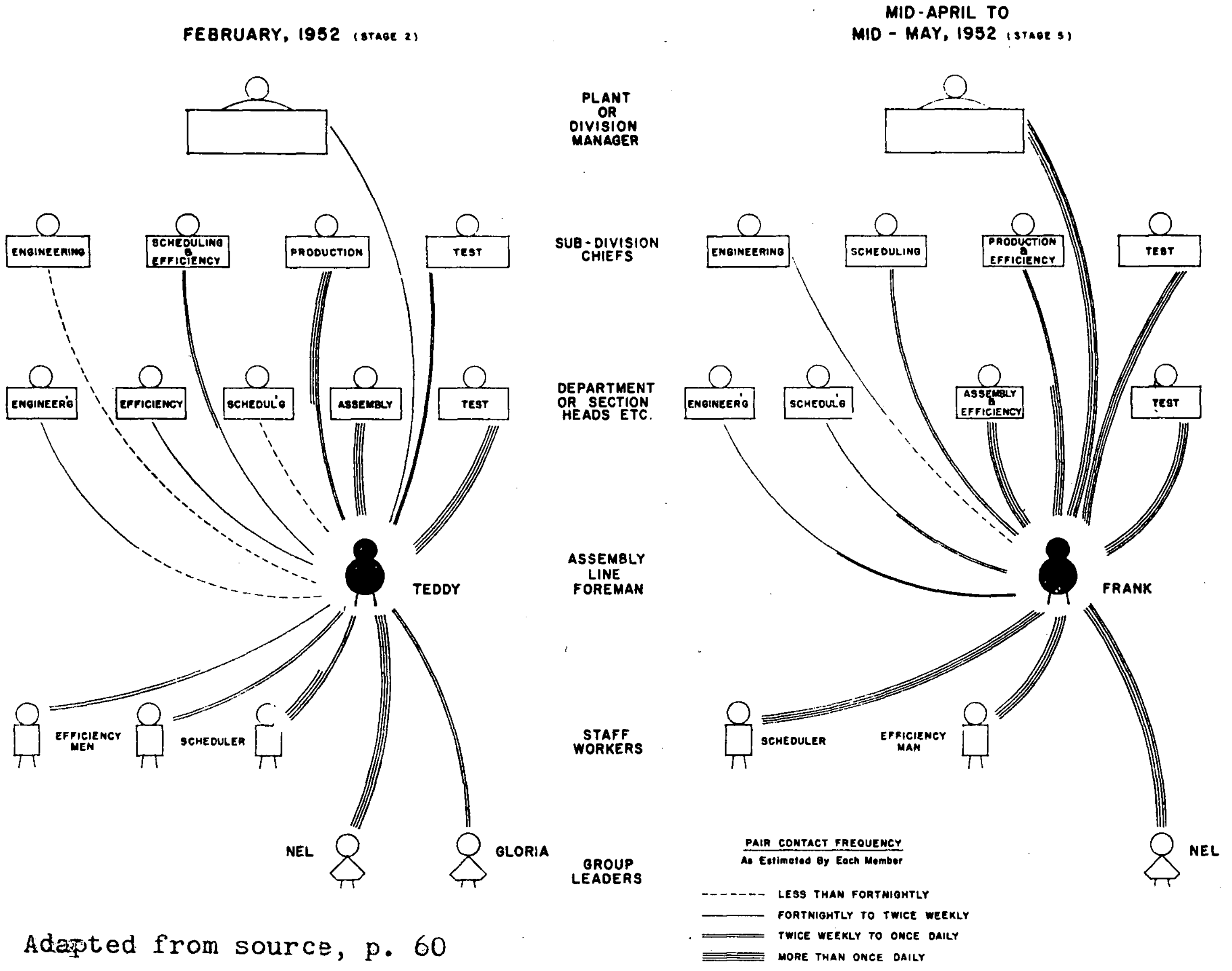
[There is] good evidence to support the point of view that judgements held by some members of management about [the assembly room foreman] being a poor supervisor were primarily based on an emotional reaction to him as a person rather than on an objective appraisal of him or the performance of his group.[24]

[The foreman] finding himself in the middle between the anti-time study views of his former intimate worker and union associates and the pro-time-study views of his new upper management bosses, avoided the ambivalence . . . by stressing the non-controversial need for co-operation. . . .[25]

The following charts and table provide a quantitative supplement to the preceding materials.

CHART V

FOREMAN CONTACT FREQUENCIES

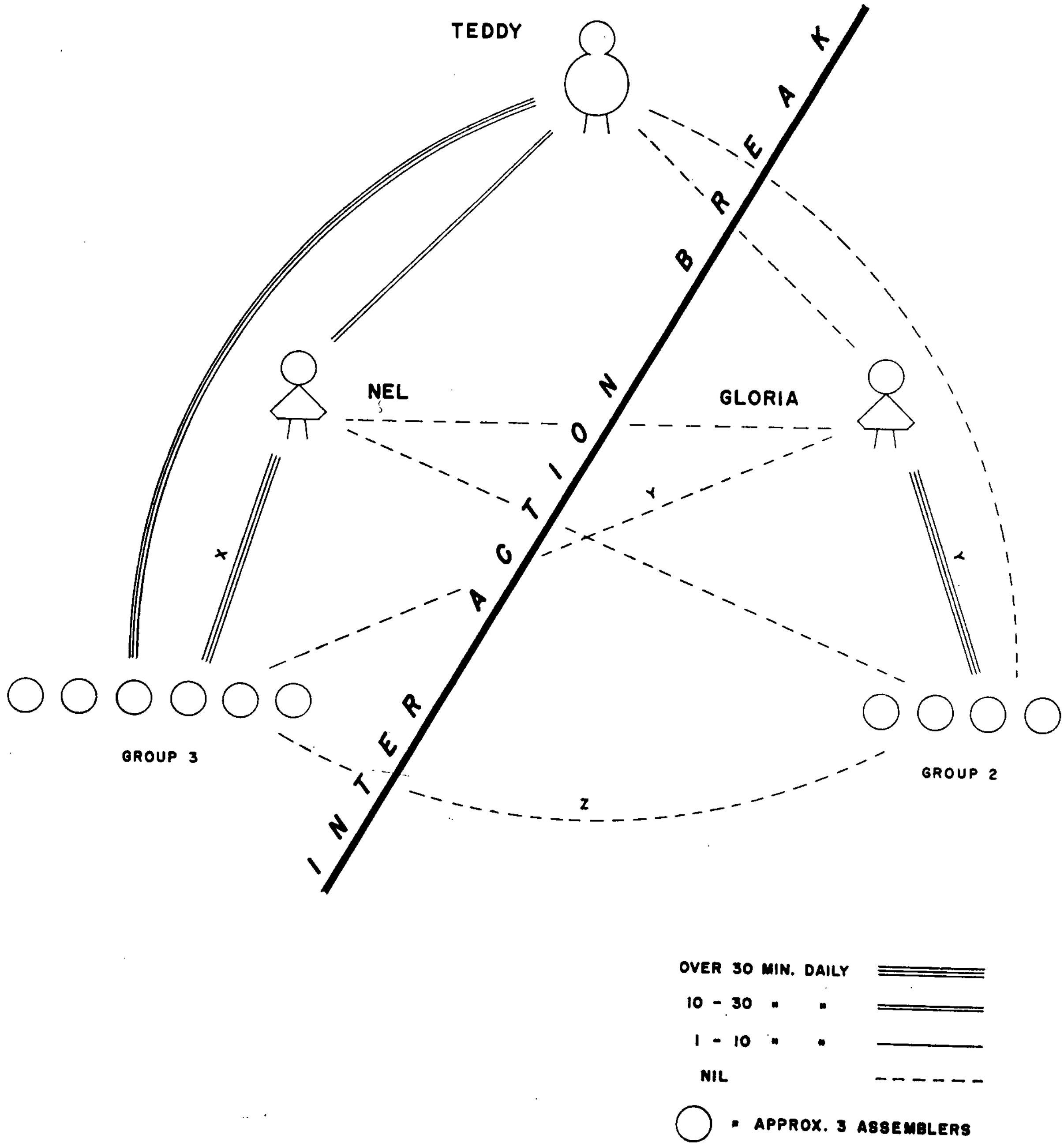


Adapted from source, p. 60

CHART VI

CONTACT DURATION PATTERNS WITHIN ASSEMBLY-LINE SECTION—MARCH AND EARLIER

Note Relative Isolation of Group 2 and Their Group Leader Gloria



Time Spent Conversing During Pair and Group Contacts Lasting Over 45 Seconds or 1 Minute. Based Mainly on Recorded Observations of Normal Work Activities.

X—Also includes 10-20 min. daily breakfast snack before work.

Y—Based on general observations and on interviews.

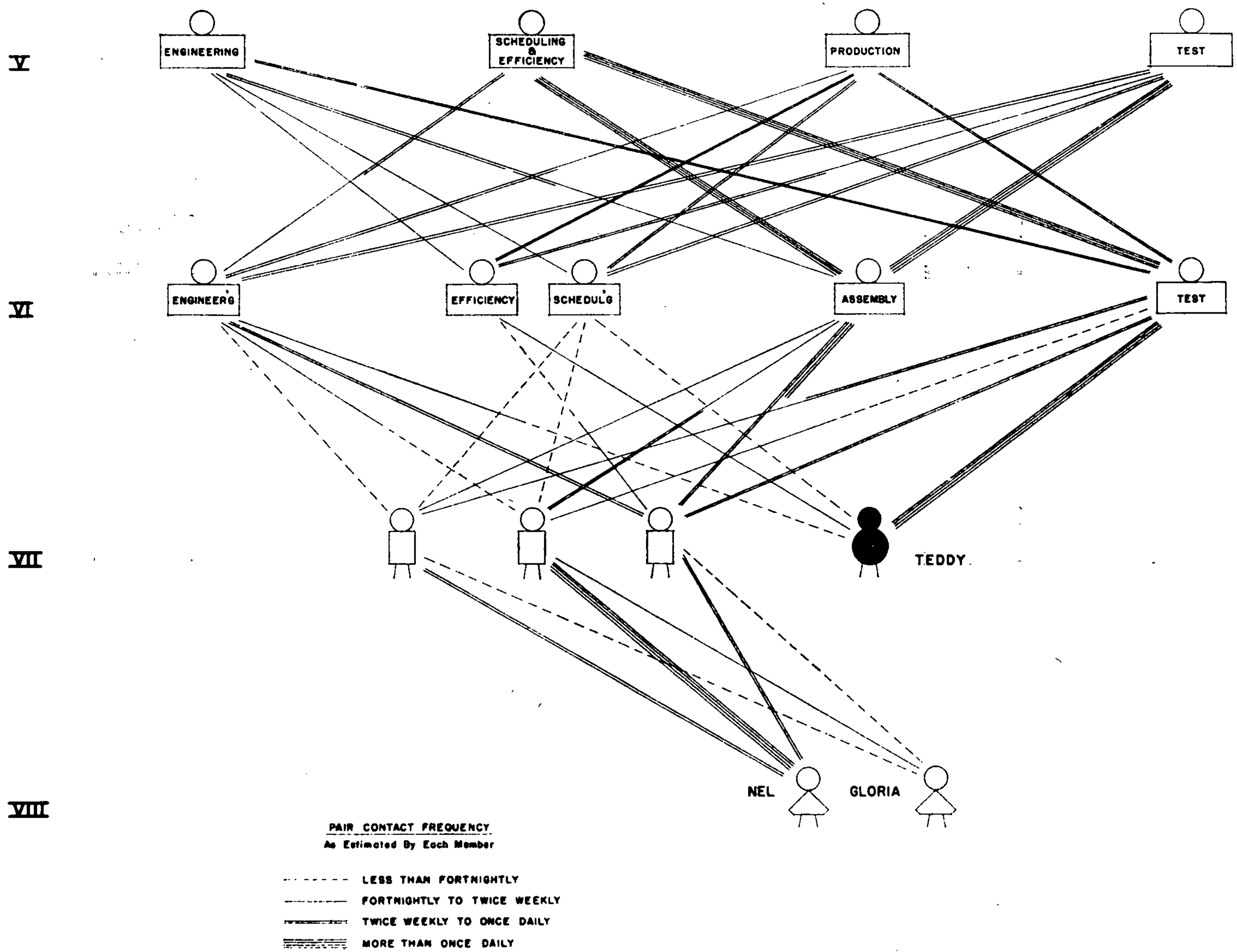
Z—Based on general and Rest Period observations.

Adapted from source, p. 54

CHART VII

DIAGONAL CONTACT FREQUENCIES BETWEEN PERSONS ON ADJACENT LEVELS

Assembly Line Section Supervisors and Related Management Personnel--February, Sage 2



Note Low Frequencies Between Persons on Levels VI and VII. This Relative "Break" in Interaction Coincided with a "Break" in Information Flow.

Adapted from source, p. 55

TABLE I

CHANGES IN FOREMAN AND GROUP LEADER CONTACTS
(Adapted from source: p. 66)

		NUMBER CONTACTS PER HOUR				NUMBER PERSONS PER HOUR				% CONTACTS SELF-INITIATED				CONTACT OVER 45 Sec. TOTAL DURATION PER HOUR (MIN.)				NUMBER CONTACTS PER PERSON PER HOUR			
		N^1	N^2	T	F	N^1	N^2	T	F	N^1	N^2	T	F	N^1	N^2	T	F	N^1	N^2	T	F
PAIR CONTACTS	TEDDY	8	x	/	x	1	x	/	x	50	x	/	x	3.2	x	/	x	8	x	/	x
	FRANK	x	5	x	/	x	1	x	/	x	41	x	/	x	0.3	x	/	x	5	x	/
	NEL	/	/	9	5	/	/	1	1	/	/	50	59	/	/	2.6	0.3	/	/	9	5
	GROUP 3	18	12	20	22	9	10	12	14	61	62	63	78	2.4	0.3	3.3	1.0	2	1.2	1.7	1.6
	OUTSIDE	3½	5	9.3	12	2	4	7	9	50	41	43	75	2.4	4.9	5.9	6.7	1¾	1¼	1.3	1.3
	ALL	34½	25	57	48	16	19	27	31	53	53	51	74	8	5.8	14.4	9.2	2.2	1.3	2.1	1.5
MEETINGS	GROUP 3	1	2	3	8	2	7	2	17	?	88	?	65	0	0.3	8	1.3	5	14	13	27
	ALL	2½	4	6	12	5	11	8*	29	67	72	67	72	0	1.4	15	3.4	7	14	10	20
TOTALS CONTACTS	ALL	37	29	63	60									8	7.2	29.4	12.6				

x—Not present /—Not relevant N^1—Nel Mid-March N^2—Nel Early May T—Teddy Mid-March F—Frank Early May

Case No. 4[26]

Background. General remarks regarding nature and organization of production

1. Zaleznik remarks that the work unit studied in this case was part of a large "multiplant organization." The production unit in question produced consumer electrical products.[27] He describes the technology of the assembly line as follows.

> . . . the [conveyor] belt was to move continuously and the girls [operators] were supposed to complete their work cycle by the time the unit had moved into the next work position. It became imperative that work be completed within the standard time allowances. Any delays or failure on the part of a single operator to complete her operations within the standard time allowance would result in upsetting the work flow.[28]

2. In observing the assembly line, the researcher focused his attention on the foreman and his behavior in supervising the line. The researcher was interested, however, in all aspects of the line's operations since the foreman was either directly or indirectly involved in whatever occurred on the line.[29]

Tony the foreman

3. The following excerpts from Zaleznik's case study have been chosen for their relevance to the specific hypotheses developed in Chapter III.

4. Tony as foreman of the study line is the key figure in this story. (See Figure [V] for an organization chart of the division, including Tony's assembly line.) He was in his late twenties, married, but he had no children. Tony had been with the company continuously since the early 1940's except for a period of service in the army during the war. He had started as an operator when the company was still rather small and had gradually worked his way up to a supervisory position in the organization. He had had previous experience as a foreman on a small assembly line in the company, but, because of some difficulty which was never made clear to the researcher, he

was transferred. When the company retrenched because of a seasonal reduction in business, Tony, along with several other supervisors in the division, was re-appointed as a group leader on another line, reporting to a foreman. When the company expanded operations in the new plant, Tony was appointed foreman of one of the three assembly lines, reporting now to the factory supervisor.30

The supervisor's position in the organization

5. Figure V below illustrates the structure of the formal organization in which Tony, the assembly line supervisor, found himself.

Assembly line technology. Characteristics

6. Tony's line consisted of a mechanized conveyor about 460 feet long. About half of the line was devoted to work positions and the other half to space for possible future expansion. Although only half of the conveyor had work setups, completed units rode down to the end of the line where they were placed on an overhead conveyor for transfer to the test department.

7. There were approximately fifty operators assigned to the line. Thirty-six of the operators had regular positions on the line where they performed simple assembly operations requiring about 4 1/2 minutes. The remaining personnel were repair men, who were stationed at tables off the main line to fix faulty units, and stock clerks, who kept the operators' bins supplied with parts. Of the thirty-six operators on the line, all were women except for approximately six men who assembled the heavier parts of the units.

8. The assembly work was very routine, with each worker performing a series of simple operations on each unit. The small component parts to be assembled were stored in convenient bins within easy arm's reach of the operators. The tools used in the assembly work were limited to hand pliers, soldering irons, and air gun nut runners and screw drivers. Despite the simple nature of the work, it did demand considerable manual dexterity, and it generally required four weeks of training before a new operator could perform her work steps in the standard time. During the training period, an extra girl was generally assigned to the work position with the new operator so that the entire line would not be held up by the new girl.

9. At about every twelve or thirteen work stations on the line, an on-line inspector was assigned to check

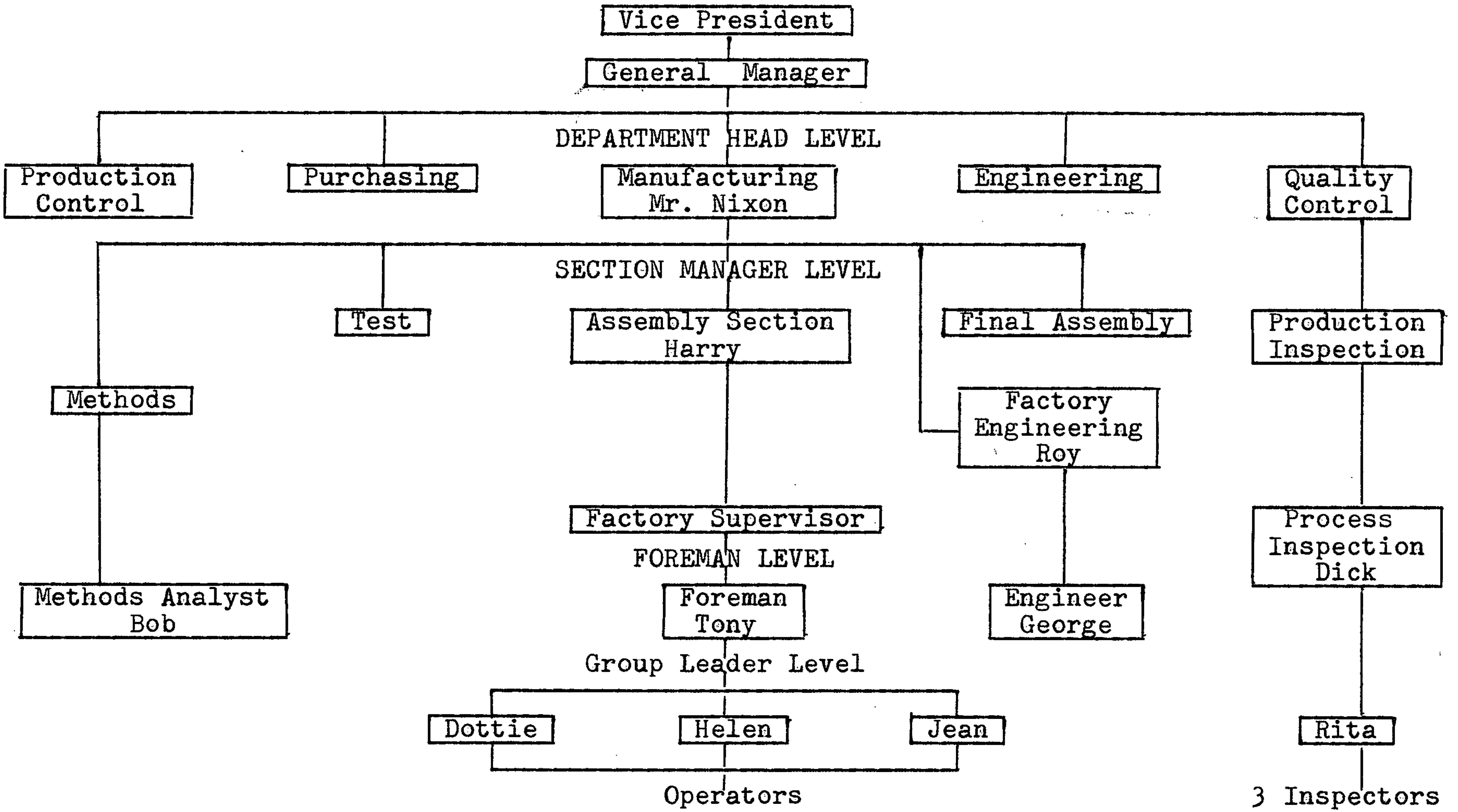


Figure V

ORGANIZATION CHART: CASE NO. 4
(Adapted from source: p. 91)

the work of the operators in the preceding positions. There were three such on-line inspectors, each of whom was considerably older than the average operator. These inspectors reported to Tony, the foreman, unlike the quality control inspectors stationed at the end of the work line who had their own group leader. This group leader in turn reported up through the quality control hierarchy. [See Figure V above]

10. The work organization was fairly simple too. All parts going into the assembly of the units on the study line came there with some preparatory work already having been completed in another department called sub-assembly. The assembly base, to which all parts were assembled, came to the first station on the line on an overhead conveyor. The first two stations on the line were not on the movable conveyor, probably because heavier assembly work was performed at these stations. Operator #1 passed the assembly bases to operator #2 by hand. Operator #3 had the first position on the conveyor. Beginning with operator #3, the work traveled from operator to operator on the belt. Each operator on the belt had about thirty-six inches of work space allotted to her and she had to complete her assembly work within that space on the conveyor. When an assembly base had fully entered each operator's work area, she was supposed to have completed her work on the preceding unit. The girls on the line had no control over the speed of the belt, and the operations had been timed and supposedly balanced by methods personnel so that each operator was theoretically able to complete her cycle within the standard time allowed. Furthermore, the conveyor was supposed to move continuously with no operator moving out of position or failing to complete her cycle of work within the allotted time.

11. At the end of the work portion of the conveyor, a male operator removed the assembly fixture and placed the completed assembly base flat on the conveyor where it would ride down to the end of the line for transfer by overhead conveyor to the test department. Before being placed flat on the conveyor, the unit passed through a series of three visual inspections by the quality control inspectors.

12. In the test department, the units were given thorough performance tests and subjected to inspection with the aid of very fine and precise instruments. Adjustments were made in the test department, and the assemblies were sent by overhead conveyor to the final assembly department where the units from Tony's line were joined to other major assemblies.

13. The unit assembled on Tony's line was the most important component of the finished product. Tony had roughly

three or four times the number of personnel on his line compared with final assembly and the units assembled on his line accounted for at least 70% of the total factory cost of the product.

14. The final product was a relatively new consumer item and design changes to improve it were made very frequently. The product was constantly being field tested and new improvements were incorporated regularly. The design changes varied in their effect on the physical organization of the line and on the work being performed. Sometimes a change would affect only one operator and, again, on other occasions, the entire line would have to be shut down while the girls received instruction on some new operations. To indicate the frequency of changes in design, the head of the methods department in the division reported that during an eight-month period there were over 700 design changes in the unit assembled on Tony's line. Again, some of these changes had little, if any, effect on the physical character of the line, while others involved a shuffling of operations requiring a temporary stoppage of the line.[31]

The Assemblers

15. There were mainly female operators on the line who varied from girls in their late teens to middle-aged women with grown families. Age, and hence common interests, seemed to be one of the dividing lines that marked the organization of informal groups within the line. The older women seemed to group together, while a number of the very young girls who were about to be married or who were contemplating marriage tended to keep together. Operators #1 and #2 were young men in their late teens or early twenties and the generally kept apart from the girls on the line. A number of women on the line were divorcees and some of them formed their own little group. Still another social grouping was formed by a few women in their early thirties who had been floaters, or utility operators, in the old plant. These operators were faster workers than the average girl on the line and they knew more of the work positions on the line as a direct result of their having been floaters in the old plant. Although there seemed to be a clustering of girls in one social group or another, as expressed in their choice of company during the rest periods (two a day lasting ten minutes), the groups tended also to shift somewhat and a girl could, in some cases, be numbered in, or on the fringe of, several of the informal groups.

16. Because of the simple and repetitive nature of the work, many of the girls could perform their operations in the allotted time and simultaneously carry on con-

versations. The conversations were generally restricted to neighbouring girls and the rule prohibiting operators from leaving their work positions except for the rest period, or if they were relieved, accounted in large measure for this limit on conversation. Whenever the line was shut down for one reason or another, conversations were more prolonged and general. The observer noticed considerable kidding among the operators regarding events in the company or personal matters. For example, operators #1 and #2, both male, used to kid back and forth concerning their work speed. They seemed to take pride in outdoing one another on boasts of not being forced to do more work than they could. Whoever was involved in getting them to increase their output, whether it was Tony or the methods analyst, would be the subject of their jokes and mimicking. Operators #3 and #4 would banter back and forth but on topics of little concern to the immediate work situation. Operators #13 and #14 who were both about the same age and were planning to be married at about the same time had many serious conversations concerning their wedding plans. The other girls in their immediate vicinity subjected them to much kidding. At times the observer was even asked by operators #13 and #14 to comment on various domestic problems; such as, should the husband help with the dishes, and how did the researcher react to his wife's first attempts at cooking. The bowling league in the plant was another subject of interest to some of the girls who talked about it from time to time. And, of course, the state of affairs on the assembly line became the focal point of much conversation and the outlet of many of the operators' feelings. As will be discussed in later chapters, the problem of disrupted work flow became the major aspect of life on the line and the operators took sides on the question of who was to blame, and what should be done about it.[32]

The Group Leaders

17. There were four group leaders on the line who reported to Tony. Three of these group leaders were women and each was responsible for one section of the line, or for about twelve girls. The fourth group leader was a middle-aged man who was in charge of the repairmen. The repairmen were definitely separated from the main line and seldom entered into the events which occurred there.

18. The three group leaders on the main line were Dottie, Helen, and Jean. Dottie was responsible for the first twelve stations on the line and inspector #1; Helen had the middle twelve girls on the line and inspector #2;

and Jean had the final section of the line and inspector #3. The group leaders supervised directly the operators in their section and were responsible for seeing that the workers maintained the proper rate of production and quality standards. They also relieved girls who had to be excused at other than rest periods, and filled in for girls who were absent from work or who had to leave work early because of illness or for other reasons. The group leaders had to be sure too that the operators were provided with parts, and they were responsible for reporting to Tony any time faulty parts were discovered. In addition, because the line was no longer staffed with floaters, the plant management had designated the group leaders as "working group leaders" and expected them to function as floaters as well as supervisors.[33]

Tony's Relationships with Group Leaders Dottie and Helen and Jean

19. Tony recognized Dottie's [high status] position on the line [as a working group leader]. He called upon her to help him out of difficulties particularly when he wanted to 'push' units off the line to get them in his day's quota. Dottie always responded to Tony's requests for assistance, although she told the observer that she disliked leaving her section. On the third day of work in the new plant, Tony asked Dottie to fill out all the merit rating forms for operators on the line.

20. During the height of the conflict between the other group leaders, the girls, and Tony over shutting down the conveyor, Dottie generally maintained a neutral attitude. She never defended Tony and she rarely criticized or antagonized him in front of the other girls. Although Tony had a difficult time as it was, his position would probably have become impossible if Dottie had decided to side against him.[34]

21. Throughout the observer's stay on the line, he noticed that Helen [a working group leader] and Tony were always in conflict. Tony tended to blame his troubles on Helen, and he even went so far as to threaten to fire her if conditions on the line did not improve . . . Helen continued to think that Tony was picking on her and treating her unfairly.[35]

22. Tony pretty much let [Jean, the third working group leader] alone and never blamed her for any of his problems. Jean used to be distressed over the fact that the girls were so often out of position, but she did not blame them. She expressed the opinion to the observer that the line should be shut down as soon as the girls began to get out of position, and she sympathized with Helen on this issue. She thought the line was poorly managed and she tended to blame Tony for its problems.[36]

Horizontal Interactions. (The Methods Men)

23. The methods department was responsible for the physical organization of the lines. It determined the breakdown, sequence, and methods of work on the assembly lines, the physical arrangement of the lines, and the positioning of tools and parts at each of the work stations. Methods was also responsible for installing engineering changes. It received engineering change notices from the engineering department and then determined the new process which would result from the change. A methods analyst introduced the changes to the line by rearranging the work positions if necessary, reinstructing the operators, and rebalancing the line.

24. According to the definition of methods work in the organization, the methods department determined how the work was to be performed, how many operators were to be used, and what the sequence of operations was to be. Methods then trained the workers and made certain the line was balanced so that work was divided evenly among the operators. The foreman of the line then became responsible for maintaining production, quality, and morale. The methods work was a continuing part of the activities on a line because of the frequent introduction of technical changes.

25. Fred was the head of the methods department and he reported to the manufacturing department head. Nevertheless, he appeared on a lower level in the organization chart than other executives who also reported directly to the department head.

26. Fred was very unpopular among line supervisors at all levels in the division. When the observer arrived at the plant, the conflict between methods personnel, particularly Fred, and line supervisors was an established aspect of plant life. Some of the hostile feelings toward Fred could possibly be attributed to his 'personality.' He seemed to be a moody person and he generally kept apart from his colleagues except for his dealings with them on work problems. A considerable part of the conflict, however, stemmed from attempts on the part of methods personnel and line supervisors to 'pass the buck.' Methods work and supervision were interrelated functions and it was difficult, if not impossible, to separate their responsibilities. Hard feelings developed when, for example, line supervisors believed the methods department, and, more specifically, Fred, had underestimated the number of men required to perform a certain job.

27. On one occasion the head of the test department had to modify some units that had been in inventory and were awaiting completion in the new plant. The head of the test department said, 'We've got 800 units that

have to be modified. That means a complete reworking as if the units were just coming out of the assembly line into test. Yet they tell me all I need is 4 men to do the job. Imagine, 4 men for 800 units.' The observer asked, 'Who is 'they'?' He replied, 'Methods, of course. They must be crazy.' The observer asked, 'Does methods always set the number of men?' The answer was, 'Yeah. And then they turn it over to me to get the work done.' The observer responded, 'The work is your responsibility.' The head of test said, 'You're damned right. And they tell me all I need is 4 men. Why it's a complete reworking. Well, I'm going to try and get some more men."

28. On the one hand, the head of the test department knew that an increase in personnel for the modification job would mean an increase in costs. The department head who would have had to authorize the extra personnel would have been very reluctant to do so. On the other hand, if extra personnel were not assigned, the head of test felt doubtful about meeting the schedule. He felt, in addition, that if he did not complete the work on schedule that he, alone, would be held responsible because Fred would claim that the personnel assignment was accurate, but that the supervision was at fault for not completing the work on time. This was but one example of the nature of the conflict between methods personnel and line supervisors.

29. During the period in which the new plant was being prepared for production, 'needling' between Fred and various line supervisors had increased. The observer asked Tony's boss, Dan, how methods was progressing in getting the lines ready. Dan replied, 'They'll never get finished. The way this thing was set up, they were supposed to do the process work, set up the lines, and place the tools in position. All that we were supposed to do was to put the materials in the lines. Well, it ended up that we're doing all their work.' The observer asked, 'What's the trouble, didn't they have enough men?' Dan replied, 'Nah, that's not their trouble. What's wrong with methods is that it's mismanaged. They'll never have enough men. It's just plain mismanaged." Fred had a different idea about that. He said, 'After we get all the work set up and the operators trained, we turn the lines over to supervision. What a snap they have. They don't have to do anything. We do it all for them and they just step in and take over.' Fred summarized his opinion of the plant's supervision with: 'This so-called supervision can't be depended on to do a job.'37

The Quality Control People

30. The company placed major emphasis on maintaining strict standards of product quality, and, for that reason, organized a separate staff group in the division called quality control. The head of the quality control department was on the same level in the organization as the manufacturing department head, reporting directly to the division general manager. The quality control organization was then divided into several groups. One group provided inspection for incoming materials, another for new product designs, and a third for units coming off the various assembly lines. This latter type of inspection was referred to as process inspection. Tony was most concerned with this group, since its personnel inspected the units assembled on his line.

31. Dick was the head of process inspection, and reported to the head of the production inspection section of the quality control department. Dick had three group leaders assigned to him and there was one group leader stationed at the end of each of the three assembly lines supervising three or four quality control inspectors. The inspectors on the lines checked the work visually to see that workmanship met quality standards and that parts were not left out in assembly. The inspectors also checked for faulty and broken parts. The quality control inspectors were separate and distinct from the 'on-line' inspectors who reported to the foreman. It will be recalled that Tony had three such inspectors on his line at about every twelve work positions.

32. Rita was the quality control group leader on the study line. She had two female inspectors and one male inspector working for her. These inspectors worked at positions following the last work station on the line. Each of the three quality control inspectors checked each unit produced and made a record of all the rejects found. There were a total of about ten types of rejects including unsoldered connections, poor connections, and broken parts. Rita worked along with her inspectors, checking on the thoroughness of their work as well as the quality of the work coming from the line. At the end of each day Rita turned in to the quality control office a report on the rejects found in the day's production. The next day the quality control office prepared and distributed a summary report showing the quality performance of each line. A copy of this report went to the manufacturing department head and all supervisors below him including the foreman of each line.

33. The quality control department also established reject standards which were considered a measure of the quality performance on the lines. For Tony's line, the standard was 0.5 rejects per unit, but the quality control depart-

ment hoped that this standard could eventually be tightened or reduced. At Rita's work space on the line she kept a clip board with quality control charts. She recorded rejects on the charts for each twenty units produced. Curves were plotted showing the rejects per unit produced against standard and these curves were clearly marked out in red. The clip board was visible to all who passed the inspection position on the line, and, since it was kept up to date, the current quality performance of the line could be seen at a glance.[38]

The Engineers

34. There were two groups of engineers of importance to Tony's line. The first was the factory engineering group and the second, product engineering.

35. The factory engineering department was a part of the manufacturing organization and the head of this group reported to the manufacturing department head. Factory engineering was a liaison group that had general responsibility for helping to interpret engineering changes which came from the product engineering department and for passing information from the production lines back to engineering. Their duties were not rigidly defined and they seemed to have been assigned various tasks because there was no other group in the organization to handle the jobs conveniently. Roy, the head of factory engineering, had very little direct dealings with the study line, although he visited the line from time to time. George, one of the factory engineers reporting to Roy, spent considerable time on the study line. He viewed his function initially as one of being helpful to Tony in keeping the line going, particularly where special problems arose. At first, he was very sympathetic to Tony's problems and offered to help out in many ways. Roy did not want Tony to grow dependent on George, however. He wanted instead to have Tony learn to solve his own problems.

36. The second engineering group, product engineering, was a full-fledged department whose head reported directly to the division general manager. There were only one or two occasions where representatives of this department appeared on the line and then only for brief visits at the request of some other authority. They had, however, a considerable indirect effect on the activities of the line since most technical changes had their origin in product engineering. As mentioned previously, product engineering sent technical changes, which seemed to be coming through continuously, to the methods department. Bob then installed the change on the line.[39]

Supervisory Interactions with Superiors

37. Dan was Tony's immediate boss. Dan had been in charge of the line at the old plant, but with the expansion and move to the new plant he was promoted to a position in which he had charge of all the assembly lines making large units. Tony and several foremen now reported to Dan so that he had considerably more responsibility than formerly.

38. Dan was in his middle or late forties. He had been a supervisor for about twenty years in companies manufacturing products similar or allied to those being produced in the company. Dan was a wiry individual with considerable energy. He walked and spoke rapidly and tended to stutter from nervousness rather frequently. Dan suffered from stomach ulcers which he attributed to worry.

39. He had developed a rather cynical philosophy about supervision as a result of his twenty years' experience. Dan's point of view concerning supervision and his work methods might best be illustrated by letting him describe them. He was talking of the kinds of problems he faced while running the assembly line and he gave many examples of these problems.

40. Dan: Here's another example. THere was a girl who wasn't keeping up with her work. So I called her into the office and I said, "What's the matter? Why aren't you keeping up?" Well, she said that she was trying her best and so on. So I said to her, "Look, I know what's the matter. Let me tell you what's wrong with you. In the first place, you were made a utility operator for a month and you didn't get a 10¢ raise, which you were supposed to get, until a week before you went back to your old job. Isn't that it?" She said yes. Imagine, I was telling her what was biting her. Just look, she's on utility for a month and her 10¢ raise doesn't come through until her last week. That was a dirty deal and I knew it. But what could I do? It just takes them a long time to get these raises through. So I said to her, "Now look, who are you spiting? You think you're spiting the president of the company. Well, you're not. You're spiting me. The old man don't care if you don't keep up. I'm the president to you, and I'm the guy you're spiting." Well, she said, "I'm still burned up and I think I'll quit." So I said, "I know you're burned up. But where can you go? Where else can you get $1.45 an hour and free insurance? You won't be able to collect unemployment unless you're laid off and if you quit you can't collect."

41. . . . Mr. Nixon, was the manufacturing department head of the division, and he reported to the division general manager. Mr Nixon was seldom seen on Tony's line, and

on the occasions that he appeared it was more or less for a tour of inspection. Tony came in contact with Mr. Nixon directly only when a production meeting was held in the latter's office, or when an unusual problem reached Mr. Nixon's level for a decision. The division general manager was even more remote to Tony, and he was seen quite infrequently while making a tour of the plant. The division general manager occasionally addressed the entire supervisory staff of the division, and it was only on those occasions that Tony heard him speak. The vice president of the division was the very top to Tony. Tony heard of the top management only when his immediate supervisor informed him that pressure was on to increase production or to improve quality.[40]

Figure VI summarizes the people with whom Tony dealt.

The following parts of Case No. 4 present data pertaining to: attitudes of supervisors toward their work; attitudes toward training given to supervisors; supervisory problems. The decision to include data regarding supervisor attitudes toward training is based upon the possible utility of these data in validating the specific hypotheses concerning sentiments of first-line supervisors. Case No. 3 lacked data in regard to supervisory attitudes toward training.

The reference to "I" in the following dialogue denotes the remarks of the interviewer, Zaleznik.

Supervisory attitudes--toward training

42. An Interview with Hal. Hal was a foreman of an assembly line and this interview took place on the work floor. There were a number of engineers, methods analysts, and other working on a new model on the floor.

Hal: You notice all these people standing around on the line?

I: Yes.

Hal: Well, they're engineers, quality control men, and methods men. You see they're supposed to have these things worked out before they bring the work down to us. But they never do. They ought to work out the methods

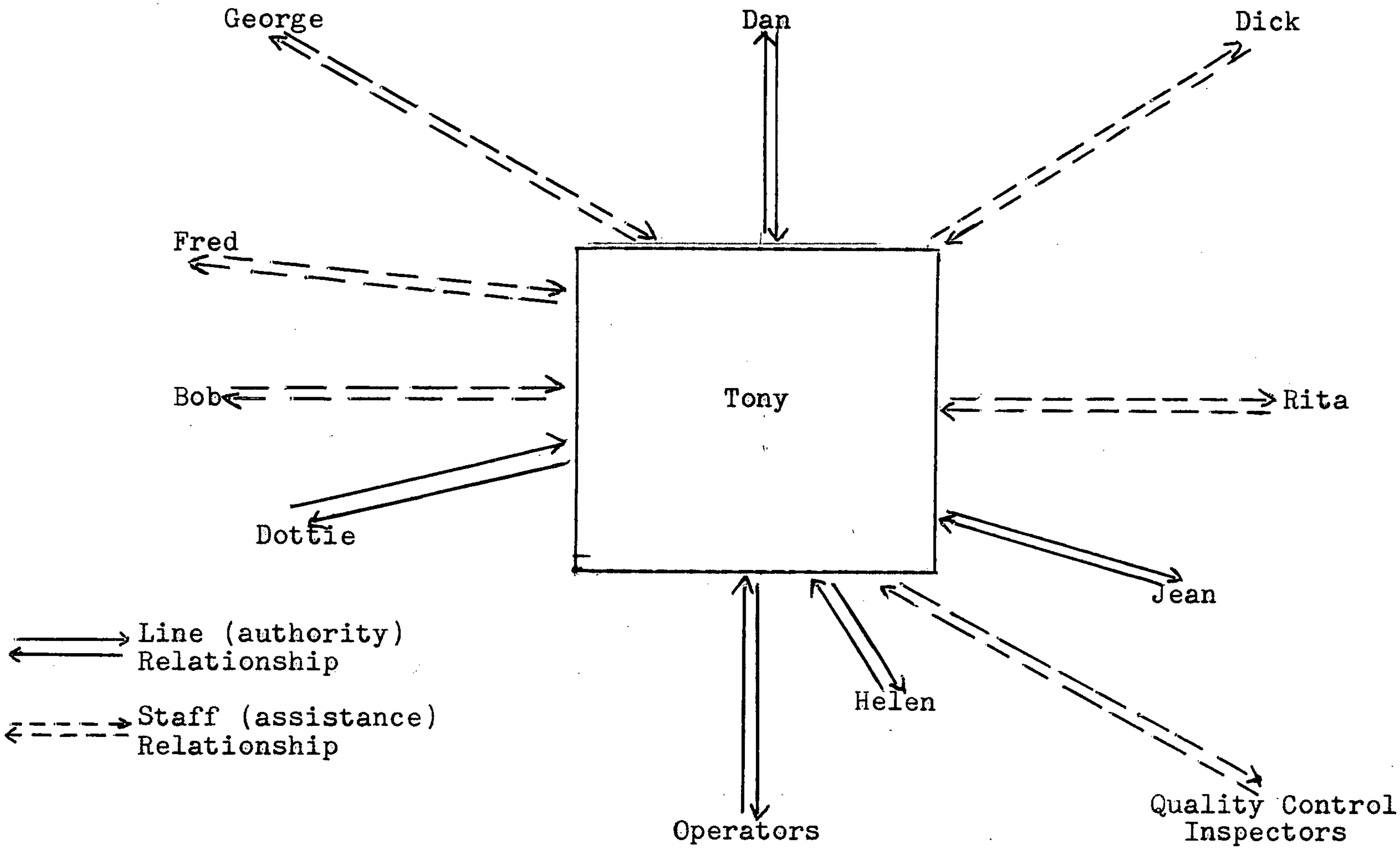


FIGURE VI

THE PEOPLE WITH WHOM TONY DEALT
(Copied from source: p. 120)

and engineering sitting at their desks and they ought to build a few units before turning it over to us.

I: You mean build a few units here?

Hal: Oh no. Build them upstairs or some place around where they work. Not here. But at least now it's better than it used to be. Now they come down here to work out the problems. Before they used to send parts down and say, 'Go ahead, build the units.' Then we were supposed to work out the problems. That way they weren't helping me. That's what they're in the organization for--to provide service for us in a line and at least now they come down to help us. But before when they came down at all, they were just getting in the way. That was after the work was turned over to me. It was my responsibility then. And I didn't hesitate to put them out when they were getting in the way. You know I actually put some of them out. But, of course, it was in a nice way, but just the same I asked them to leave. Once they turn the assembly over to me, well, it's my responsibility, and I have to meet schedule. But I want their help and I expect to get it when I call on them. But we're learning. At least they try to get the bugs out of new models before they turn it over to me. So we're learning how to work together little by little. It's the same with my boss. That's one thing about my boss, he doesn't hesitate to speak up when we're right.

You know we always have new models coming through. After all it's part of our business, and you have to expect changes. It takes a little while to get straightened out on new models, but not too long and then things run smoothly.[41]

43. T1[an anonymous trainee]: You'll find out that this training tries to build us up as supervisors. They try to compliment us and tell us we are big people and important, but when we're actually on the job we're nothing. How many people do any of us supervise? None. All we have are people over our heads--on top of us. So it's a lot of bunk. I guess it's all right for people like __________ and __________ who only have people under them and not over them. But it's not that way with us. All we see is people coming in over us. They bring people in and put them over us. Take _________ and _________. They just came into our department. The department head brought them in. Well, they're his boys. They can do no wrong as far as he's concerned. Meanwhile we taught them all we know and then have to report to them.

T2: That's right. We see it going on all the time. They bleed us white for our knowledge and then we have to report to them. We actually spend more time explaining the rules and exceptions to them--there are a thousand exceptions--than we do getting our work done. Then they have these policies in writing. Allright, so they have policies.42

Attitudes toward work

44. . . . many supervisors complained in the interviews about their particular work situations, . . . The worries reflected in the interviews seemed to be of four types. First, some supervisors were concerned about their status in the organization; secondly, there were those disturbed over their rate of advancement. Thirdly, some supervisors reflected negative attitudes which arose out of unsatisfactory relations with their superiors or with staff specialists. Finally, there were supervisors who were torn between the demands of workers and the demands imposed upon them as supervisors by company policies and practices.

These four types of worries were not sufficiently clear-cut so that only one type would ordinarily appear in any one interview. Most interviews contained reflections of more than one major problem.43

45. . . .: This human relations is very important. That's what we need in this company. As it is now, they're not doing a good job at it. Of course, this company's organization just grew fast and I suppose eventually they'll work out these problems. And when I talk about human relations, I don't mean just to workers, but I mean to supervisors too. That's very important.

As it is now, there aren't any policies set up, or clear-cut lines of demarcation on a supervisor's job.44

46. . . . . George was a highly insecure individual, and he was concerned with several aspects of his work situation. He was a college graduate, the only one among all the supervisors whom the author had met at the company. In addition, George had had considerable experience in supervising large numbers of workers. He was extremely conscious of his background and felt that his abilities and experience were not being given full scope in his present job. His statement, "They don't really need a foreman here," implied strongly "a foreman of my caliber." His past work history ended in his being "promoted out the door" when business cut back. His present situation with the company seemed to him to be the prelude to a repetition of his previous experiences. The company had retrenched and George found himself supervising a relatively small group, a comedown from the responsibilities he had held previously. His feelings about his educational background and work experience set the context for understanding George's other worries.

47. George's concern with the lack of 'policies' or 'clear-cut lines of demarcation' of the foreman's authority reflected the unsatisfactory nature of his relationships with staff specialists and executives in the higher levels of the division management. George felt that it was not right for the person in quality control to send out a memorandum with "the supervision on the line stinks." It was, as he saw it, a direct attack on him, and George felt it was unjustified in view of the lack of policies. Similarly, George felt frustrated at not being given information by the department head. Without this information, George felt that he was not able to do the supervisory job of which he was capable. The lack of direct dealings with the department head also seemed to George a reflection of his lowered status in this organization.

48. George kept coming back in the interview to his major concerns--his feeling of insecurity and his feeling of being limited in his present work situation. George expected the training meetings to cure the ills in the organization and to improve the human relations practices particularly with regard to the position of supervisors. He was waiting for that part of the course which would deal with such problems and he planned to speak his mind even though he felt that he would "get slapped down." George was used to being "slapped down," and expected this treatment.

49. The interviews with other supervisors revealed problems similar to George's and included worry over status, advancement, relations with superiors and staff specialists, and conflicts in reconciling company policies and practices with the demands imposed upon them by the work situation.[45]

50. Another complaint voiced by supervisors in the interviews centered around their unsatisfactory relationships with superiors and staff specialists.

One supervisor complained about his superior as follows: You know, the trouble is the people above me want to do it all by themselves. They give you responsibility, but no authority. Here's an example of what I mean. I came in one morning and found I was hit pretty hard with absenteeism. Well, I was in a spot, but to me it was no problem. I knew where to get replacements. But no, I couldn't do that, I had to wait for my boss and he doesn't come in until after 9. And so I had to wait until he came in to see him about it. But he couldn't decide. He had to go in to see his boss about it. So that takes us until 10 o'clock. By the time the thing is decided, I'm behind schedule. So there it is. It was a pretty simple thing and I knew what to do. But no, I had to wait to see my boss and then he had to see his boss. You know what it is? They're just afraid to let someone else decide things. They're just scared.

51. Another supervisor complained about not getting help from the methods department. He said, "People look at this line and think there's nothing to it. Well, they're wrong. I have to do all the work by myself. We never get a methods man here. I had to put up all the tools by myself and arrange the line. Well, I don't mind cooperating with methods, but you'd think they'd get around to helping me once in a while."46

52. A number of supervisors, particularly those on the group leader level, were torn between conflicts caused by the workers' demands and the demands imposed upon them by what they saw as company policies and practices. One supervisor, Bill was extremely agitated during the interview. He spoke rapidly and with considerable feeling.

53. Bill: I don't mind talking to you and I've got a lot of things on my mind. You don't get any consideration around here. Some guys are always pushing to get work out. Well, I don't agree with that. You can't crack a whip and get any work out. After all the girls have feelings too. You just have to use your common sense. That's all there is to supervision. Now, I'm not perfect, but I know when I'm right and I'm going to stick up for it. Now they call me a hot head around here. Well, maybe that's true. I argue in these meetings when I think I'm right, and I stick up to it.

54. Come over here. See that girl [pointing]. She can't even use a power tool--she has to use a hand tool, and does that take time! And she's real nervous. Look at her! Why I've even had girls ready to cry. I remember one girl I fought for. They wanted to fire her, but I wouldn't let them. I had confidence in her. I found out that an inspector was picking on her. This inspector didn't know her work. She used to alibi by blaming this other girl. I looked into it and found there was nothing wrong with this girl's work. The inspector was picking on her and this poor girl was nervous. I told the inspector to report all rejects to me and not to say anything to this girl. Well, did that girl's work pick up! She was like a new person. It justified my confidence in her. I eventually had the inspector fired for picking on her. I go to bat for my girls. They were doing poor work at the beginning of the line so when it came to our part of the line my girls couldn't work. Well, I had that changed soon. I went over and fought against it.

I fight for the girls and they have confidence in me. That's the only way to work. You can't drive them.

55. Look at this work. How do they expect the girls to get at it? See this work? Look, it's spoiled. The girl was so nervous she couldn't work. It's tough on them. Look at this. The girl showed me her hands. They were all scarred up from trying to loosen this nut so that she could get at her work. I'm telling you, they get nervous and aggravated.

I: What makes them nervous and aggravated?

56. Bill: Well, I'll tell you. It's those little things. You take some of these girls. They're 27 and 28 and are worried because they haven't got children. It's things like that. And another thing, they get no consideration.

I: Consideration?

57. Bill: Sure. Once when they wanted the girls to work overtime on a Saturday, they didn't give them any notice and some of them made appointments they could not break. Well, they called them into the front office and talked to them and tried to get them to come in. You should have seen those girls. They came out of the front office scared and they were crying. When the other girls saw that, they didn't want to work. Heck, I could see their point. They had an appointment so they couldn't work overtime. They didn't give them any notice. It makes sense! But no, they had to call them into the front office.

I: Front office?

Bill: Aw yeah, you know what I mean [nods his head in the general direction of the offices].

I: Sure, I see.

58. Bill: Now, what could I do? It puts me in a tough spot. I can't take the girls' side too much. I wouldn't look good. After all, the girls have to respect my position. I can't get too familiar. But I didn't feel right about it. I could understand how the girls felt.

I: What did you say?

59. Bill: Well, I said, "Look, I know how you feel. I know it isn't right, but maybe they couldn't help it." Help it! How do I know they couldn't help it. But what could I say? It's just like my wife says. She works as an operator in the ________ company. She said to me, "What's the matter with you people? Why do you think we don't have no brains for? You don't give us credit for knowing anything." You see. My wife knows. They don't think the girls got any brains. They do. They get upset quick. They expect the girls to do things but they don't explain why they should do it.

60. Look, it's just common sense. I can go over and yell at the girls and drive them to get out more work; but that way you get less work. You hurt their feelings and upset them and they can't work. It just doesn't make sense. But some people believe in driving, but I know better. It doesn't work.[47]

61. Where does the foreman fit into this picture? He does not possess the technical knowledge required for product design and he is not required to have this knowledge for his job. Product design is in the bailiwick of the engineer. He may have some understanding of methods work, but he does not have to be an expert in this function either. A foreman can distinguish between products with acceptable or unacceptable quality, but he does not have to determine the standard of quality and whether it is being met. These functions belong to quality control specialists. The foreman could probably perform many of the production operations, but he does not have to be proficient; in fact he probably is less skilled in performing actual operations than many of his subordinates.

The foreman function in a modern work unit, unlike the specialist functions, is administrative. The successful operation of a work unit depends on attaining the collaboration of many people, with specialized skills and functions, for the common purpose of the organization. The chief function of the foreman as an administrator is to attain collaboration of people in the work group.[48]

Additional Illustrations of Supervisory Behavior

62. For the first four days following the plant opening, Tony's line succeeded in exceeding the scheduled output. Dan considered Tony's performance very successful. But in continuing to attain the output Tony had many knotty problems to solve. The following incidents highlight some of the problems that Tony faced on the fourth day of the plant's operations.

Jean, the group leader of the third section, called Tony over to show him some pieces of insulating sleeving in one operator's bin.

Jean: Tony, take a look at this sleeving.

Op.: They're cutting the sleeving too short. Look at how much bare wire there is after I make the connection.

Tony: That shouldn't be.

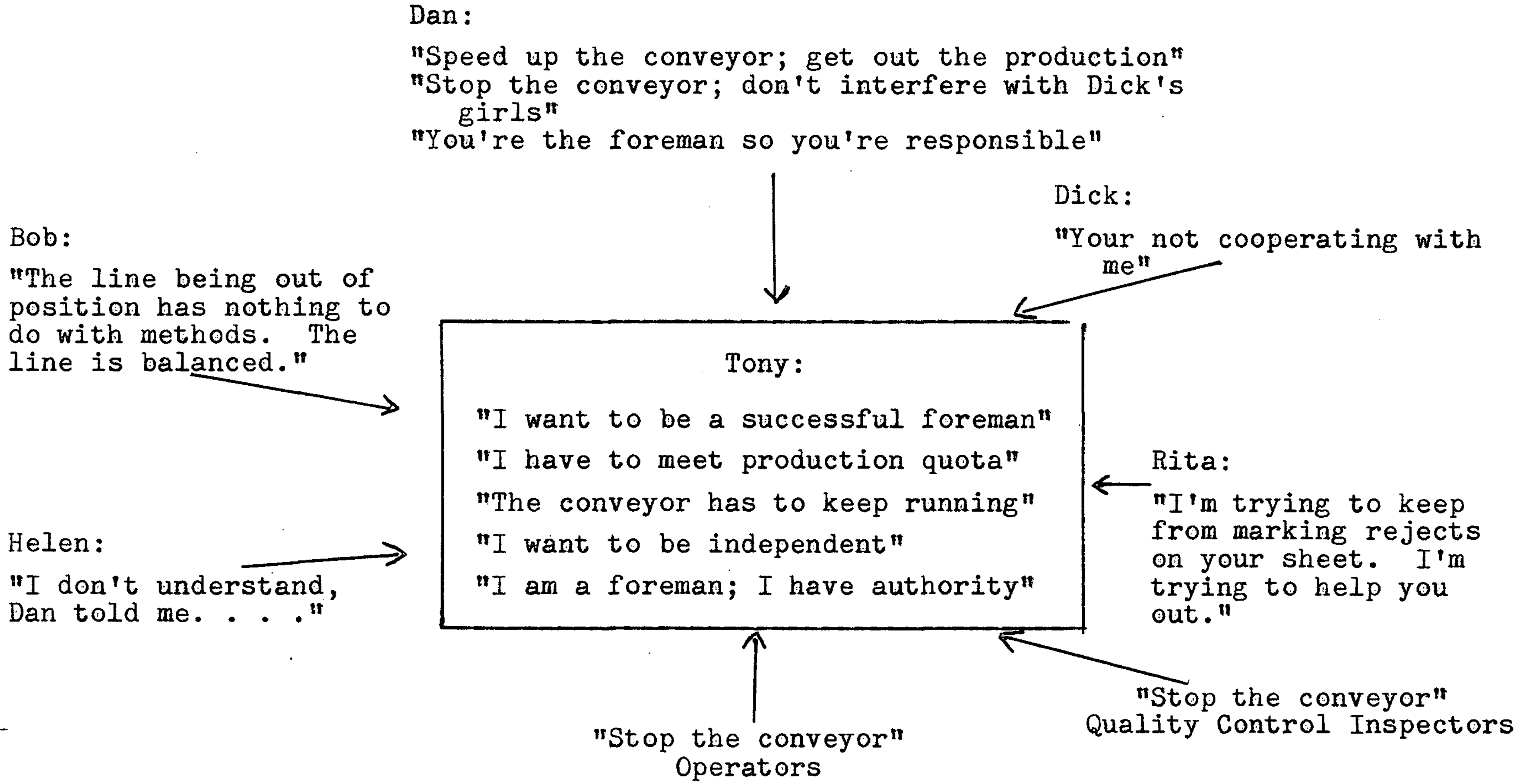


FIGURE VII

AS TONY PERCEIVED HIS SITUATION
(Copied from source: p. 201)

Op.: We had the same trouble over at the old plant.

Jean: This has been going on a long time. We complained about it to Bob, but it hasn't done any good.

Tony: Let me take this part over to Bob [the methods man] and a piece of the sleeving and I'll find out what the process sheet calls for.

Tony and the observer started to walk over to the methods office. On the way they met Dan. Tony showed Dan the part and the short sleeving and explained the problem.

Dan: We'd been having that same trouble over at the old plant. I couldn't get anything done about it. It's an old story.

Tony: I was going over to Bob with this.

Dan: Yeah. Go ahead in to see Bob and ask what the specifications are for this on the process sheets. [Smiling.] Yeah. You do that. Go ahead in and see what the specifications are.

Tony walked into the methods office and found Bob seated at his desk. Bob's desk was piled high with process sheets and he seemed to be quite busy.

Tony: Say, Bob, this sleeving is too short and it's a hot circuit and leaves the wire bare. That's bad. Dan told me it's an old story. What is the size called for on the process sheets?

Bob: What does the lead wire measure and what does the sleeving measure?

Tony: [After measuring them on a rule.] It's 1 3/4" for the lead wire on each side and 7/8" for the sleeving. That's too short.

Bob: Well, maybe they're not cutting it right in sub-assembly. Why don't you check with Frank [foreman of sub-assembly]?

Tony: First I'd like to know what the process sheet calls for.

Bob: All right.

Tony: I'm sorry to take your time if you're busy, but I'd like to get this straight once and for all.

Bob: Well, I'm pretty busy now, but I'll look it up. What's the part number?

Tony: [Pause] Well, to tell you the truth, I forgot to look.

Bob: [Impatiently] Well, what's the operation number? Is it operation 88?

Tony: I don't know.

Bob: It looks like it's part number 304. I think that's operation 88. Let me look it up. Yeah. Operation 88, part number 304. It should be 1 1/2" for each of the lead wires, not 1 3/4". I guess this is something they've just done in sub-assembly. Go out and check with Frank on this.

Tony: Look, Bob, you come out with me. I want to get this straight once and for all. Dan just told me it's an old story.

Bob: What do you mean, old story [angrily]? You go out and see Frank. I haven't got time. I'm busy working on these process sheets.

Tony walked over to the subassembly work area and saw Frank. Tony explained that the lead wires were too long and not according to the specifications on the process sheet. Frank got his copy of the process sheet and he saw that the lead wires were longer than specified. At this point Bob came over.

Frank: This must have just been changed.

Bob: No, it hasn't. There haven't been any recent engineering changes through.

Frank: Wait, I'll call my group leader over and see what she says about it.

He called his group leader over and explained the problem.

Group Leader: Oh, I remember now. You see this part number 209 down here on the sheet. Well, we couldn't get them so they told me to substitute 304 for it, and I cut it to the specifications of 209. That's 1 3/4". See it here. I was told these parts are interchangeable. I guess they took 304's that were cut for 209's and used them in another position. Wait and I'll get you a handful of 304's with 1 1/2" lead wire.

Bob: Yeah. I see it now. They're used interchangeably.

The group leader returned with the parts and gave them to Tony. Tony returned to the line. When Tony had left, Bob said to the observer, "Look how complicated Tony made that thing. If he had used a little initiative, he could have used the 1 3/4" leads just by having the operator make an extra size larger connection and bending the wire upward as it leads out of the part. That would have taken care of the problem. Instead, he wants me to make changes on the process sheet and that gets involved in a lot of paper work and it would take too long to come through. You see, if he had only taken the trouble to think about it. I wish he'd use some common sense and work these things out on the line himself. Then he wouldn't have all this trouble.

A little later, Rita called Tony.

Rita: Tony, look at how this lead wire is dressed. It's terrible and I've been telling the girls about it.

Tony: Whose operation is that?

Rita told Tony the name of the operator responsible for the operation and Tony cautioned her about it and pointed out the problem to the operator's group leader. Just then, Bob came walking by and Tony called him over.

Tony: Look, Bob, I'm having trouble with this lead dressing. I want to work out a system for controlling that. Come on over to Rita with me and see if we can straighten this out.

They walked over to Rita.

Bob: Now what's the trouble with this lead dress business, Rita?

Rita: This is terrible. We have to do something about it. These wires are touching and they're all going to short out.

Just then, George, the factory engineer, came by and Tony left Bob and Rita while he went to speak to George.

Tony: George, I want to work out a system on this lead dressing business. Can we get together tomorrow on that?

George: Sure: That's a good idea. We should get after that.

Bob watched Tony and George talking for a moment and then he wheeled around and left the line in a huff, saying, "What is this? You call me over on the lead dress and while you're talking about it, you walk over to somebody else. I came over here to help you and if this is what you're going to do, I'll go back to the office. I'm busy and got plenty of things to do over there." Tony hardly noticed what Bob said and he continued talking to George. Then Rita called out to Tony again.

Rita: Tony, come over here and take a look at this. They're getting the lights bent on these units. Can't you do something about it?

Tony: Bob was supposed to bring some brackets over to hold up the assembly bases. He's got some over here now and I believe more are coming.

Dick came up to the line and Rita showed him the bent lights. Dick commented, "Methods was supposed to bring those brackets over a long time ago. They're sure taking their time about it." Rita went back to her inspection positions and a few minutes later called out to Tony again.

Rita: Look at this. They're putting in the pins reversed. We've got a whole line of completed units now like that.

George: Oh, that's serious. That can cause a lot of trouble. You'd [to Tony] better get that straightened out.

Tony: I told the pin-up operator about it. He shouldn't be doing it that way.

Tony, George, Rita, and Dick went over to the pin-up operator's position.

Tony: [To the operator.] You're putting the pins in wrong. Didn't I show you how they were supposed to go in?

Op.: You told me? I'm doing it the way I was shown. No one told me different. It goes like this [pointing] 1, 2, 3, 4.

George: No, you're reversing the pins.

Tony: I told you that.

Op.: You did not! No one told me to do it different than I am.

Rita: Tony, why don't you get him a pin-up chart? How's he supposed to remember where they go?

Tony: All right. I'll go over to the office and get him one, and I'll bring some extras back for you.

Bob reappeared on the line and he immediately spoke to Tony angrily.

Bob: What's the idea of calling me over to check on the lead dress and then leaving me in the middle to go over to somebody else? I'm busy over at the office and I take my time off to help you and you haven't got the manners to stay with me. You run off. That's what I call being impolite.

Tony: How can you say that, Bob? I just walked over to George to see if we can get together tomorrow to work out a system on this lead dress. I didn't mean to be impolite, but if you think I was, I'm sorry. I apologize. I didn't think I was impolite.

Bob: [Raising his voice.] Well, what else would you call it but impolite? That's what it was, wasn't it?

Tony: Well, I'm sorry, Bob. I didn't mean to be impolite. I went over to George about that lead dress.

George: That's right, Bob. We all ought to get together tomorrow morning on that.

Rita came up to the group again.

Rita: Tony, I thought you promised to bring a pin-up chart for the operator.

Tony: [Raising his voice in anger.] Now wait a minute, Rita. Stop putting words in my mouth. I did not say I'd bring a pin-up chart over. I said I'd <u>try</u> to get it.

Rita: Well, I said you told me that you'd try to bring it over.

Tony: I never promised anything like that. I said I'd try.

Rita: Well, now I have to go all the way down the line and change the pins. [Rita started to walk away. Dick followed her.]

Dick: Rita, you will not change those pins. That's not your job, Rita, and I don't want you to do that.

Tony: I'll go down to the office and get those pin-up charts. [Tony left.]

Dick: Boy. They call this supervision. This line is getting all fouled up.

George: Now wait a minute, Dick. Don't say that. Give Tony a break. He's just getting started.

Dick: Well, nobody's giving me a break. I was in Nixon's office and he gave me hell about the quality. No one's going to take the rap for me. By God, this has got to change. We're going to get quality out of this line, or else.

George: Well, don't blame Tony. He'll be all right.

Dick: O.K., George [smiles], let's you and I cooperate. Do you want to cooperate with me?

George: Sure. We'll cooperate [laughs].

Tony returned with several pin-up charts. He gave one to Rita and one to the operator at the pin-up station. Tony then came over to where Dick and George were standing. Rita then called Tony, Dick, and George and showed them a unit with a reject tag containing a long list of rejects. Rita read off the rejects one by one and she showed Dick a questionable piece of work.

Dick: Rita, reject it! Reject everything like that. Don't take any chances. We're going to tighten up now.

Tony walked away without comment and he was rejoined by Dick and George. Rita then came over with the pin-up chart that Tony had given to her.

Rita: This looks like the pin-up chart for the other lines.

Tony: Aw, I'm sorry. I didn't look and brought the wrong chart. I'm sorry.

George: Look, Tony, I'll take a walk over to the office and get you some charts for your line.

Tony: Would you do that, George? Gee, thanks a lot. And while you're there, would you get me some extra charts? Get about 7 of them so that I have them, will you?

George: Sure, Tony.

A little later, Tony spoke to the observer. He said, "I don't know why Bob got sore and called me impolite. I guess he's still mad about that sleeving business this morning.[49]

63. During the second week of operations and thereafter during the observation period, a full-fledged feud broke out on the line. The feud centered around the conveyor. The conveyor was supposed to operate continuously except for the luncheon and rest periods, but it did not work out that way.

64. The operation of the conveyor line was based on the

assumption that each assembly sequence would be performed within the standard time allowed. The speed of the conveyor belt was set so that when each operator completed her work (if within the standard time allowance), the unit had entered fully into the next operator's work position. Therefore, there was supposed to be a unit in each work position at all times.

65. It did not take Tony very long to figure out that each 4.5 minutes that the conveyor was stopped he would lose one unit in that day's production. For the first week of work, Tony did not seem concerned over the fact that the conveyor was being stopped when a girl got out of position. After all, it was the first week, the quota was set fairly low, and Tony was exceeding it. No one had too much cause for complaint. But, beginning with the second week, the situation became chronic. Apparently some of the girls could not or would not, perform their work within standard time allowances. They would get out of position moving along the line into other operators' work stations in order to follow the uncompleted unit as it rode down the conveyor. Other girls were forced out of position, and the cumulative effect of the situation became serious. As the girls got out of position, they had to walk back to their regular work stations for parts. Soldering iron lines crossed making it difficult for the girls to work with the irons. These interferences increased the work times so that the operators moved even further out of position.[50]

66. The girls disliked getting out of position because it was physically tiring to walk from their regular stations to where their unit had moved and then back for parts. Furthermore, they were unable to carry on their normal conversations and the work climate became very tense. The girls therefore began to pressure Tony to shut down the conveyor to give them a chance to get back to their normal work positions. Tony, on the other hand, was determined to keep the conveyor running at all costs. What kept running through his mind was "every 4.5 minutes, I'm down one unit." Tony believed Helen was responsible in some way for the problem and he let her know about it. Meanwhile, Helen and Jean were caught between the girls' demands that the conveyor be stopped and Tony's insistence that it continue to run. As the days passed, the situation grew worse because absenteeism increased and new operators assigned to the line could not keep up with the work on unfamiliar positions. Dottie tried to keep neutral, but Tony assigned her to help 'push' out units at the end of the line. As long as she was away from her section, it too began to have

difficulty keeping up, which only intensified the problem.[51]

67. One morning the girls were out of position and they began pressuring to have the conveyor shut down. The girls kept insisting to Helen that she should shut down the conveyor. Helen kept repeating at each request, "Tony doesn't want the line to stop." Because several girls were absent from Helen's section she was busy on the line helping fill-in operators and she took positions herself until a fill-in operator could be assigned. At one point in the day, while the girls were far out of position, Helen called for Tony.

Helen: Tony, ______ is out for relief. You better shut down the line. She shouldn't be away.[52]

68. Tony was worried. He said to the observer, "These girls [referring to the group leaders] have me behind the eight ball. I have to depend on them for answers in case Nixon calls me into his office, and I don't know whether they're telling me the right stuff or not. They've been on the line longer. So I've just got to wait and get straightened out. Meanwhile, they've got me behind the eight ball and I have to depend on them for answers. When Nixon or Harry call me in, they want a quick answer and it has to be right. It doesn't look right for me to hesitate. So I have to depend on my group leaders, but I'm not sure they're telling me the right answers. Well, I'll be straightened out soon and I'll know for myself.[53] . . . .

69. Operators #1 and #2 kept their word. Following the rebalancing, they were always behind in feeding units on to the assembly line, and the line had many gaps where there should have been units. This lag further reduced daily production.

Bob ran into a snag toward the end of the line and he did not complete his work until late in the afternoon. The line had to be shut down for a good part of the day and this upset Tony. He said, "Look, Bob promised it wouldn't interfere with the line and yet the line has stopped and I'll be lucky to get 35 units off the line today. And that throws my costs up. I sure hope this rebalancing was checked. I don't have confidence in Bob's work. If something is wrong tomorrow and I don't get production, they'll have me on the carpet because the line is now supposed to be rebalanced. Dan called me into Harry's office and yelled about having extra people on the line and about quality. That quality is terrible. I'm going to have to work something out on that. Boy, I'm on the carpet, and I know it! With these extra people on the line, that throws my costs up. I've got to find out what my costs are. Nobody tells me anything, but if I don't know what my costs are and keep them down, they'll call me in the office and nail me. I want to find out what my costs are and get them down before they put me on the spot.[54]

70. After the rebalancing, events on the line took a turn for the worse for Tony. The line could not keep running steadily and production was down. Dottie had been transferred from the line and so had Carol. Pete remained on the line and Bob spent most of each day there. In addition, George, the factory engineer, was temporarily assigned to the line full time to try to improve quality. The operators began starting and stopping the conveyor almost at will. Pete also began to control the conveyor. He had the idea that it would improve the situation to run the line continuously for about 15 minutes and then to stop it for 3 or 4 minutes so that the girls could get caught up with their work. He started to do this without consulting Tony. When Tony learned of this, he wanted to know, "Who does this Pete think he is?" He told Pete to forget about his plan.

Bob also acted as though he were a supervisor on the line. He told the girls to fill in the gaps on the line by moving the units along the conveyor.[55]

71. Observer: Tony, you've told me a number of times that in your job as foreman you are responsible for production, quality, and personnel. Tell me, what does that mean?

Tony: [Smiling.] Well, production means that I'm supposed to get a certain quantity out every day. The schedule . . .

Observer: Yes, but tell me in your own words.

72. Tony: [Laughing.] Well, methods is supposed to set up the line for me so that I can get out a certain amount. If they don't balance the line or if they don't set it up right, I'm not going to get our the quantity on my schedule. So I'm responsible for that. That means I'm going to get put on the carpet for that. Now, I don't have to let methods come in here to rebalance the line or anything. After all, I'm in charge of the line. But if I don't, then Fred is going to see Nixon and tell him I don't want to <u>cooperate</u>. Now that's going to make me look bad. So I have to cooperate with them. [Laughing.]

You know something? You see a lot of people who come down to the line and try to tell me what to do. Look at all the people I got to confront with. There's methods, then there's inspection and engineering, and than I got to confront with my boss. That means I got to confront with 5 different people. And they don't want to know the other side of the story. They only look at their side. I don't know. I think things will be all right. As soon as I get my inventory and find out where I stand, I'll get everything straightened out. It's got to straighten out![56]

73. The company's standard job description of the foreman function assigned certain responsibilities to a foreman and granted him a measure of authority. The responsibilities of the foreman function were defined as follows: "The job involves responsibility for employees' conduct and for discipline in the department, also quantity and quality of work produced." The job description also stated that the foreman "must be able to use independent judgment and regularly exercise discretionary powers."

The organization granted the foreman a certain amount of authority which gave him a measure of control over the actions and future of others. He could initiate action in hiring, discharging, promoting, and disciplining employees. A foreman also prepared merit ratings, which were used in awarding pay increases to employees.[57]

74. There were at least two key relationships on the assembly line in which the potential for growth and development existed: (1) in Tony's relationship with his boss, and (2) in Tony's relationships with the staff specialists. The negative quality of these relationships resulted in the development and perpetuation of negative relationships between Tony and his subordinates. A kind of vicious circle was in process, therefore, which consisted of three elements. First, we find Tony with a set of fixed beliefs and attitudes which did not help him understand events about him. Second, a set of negative relationships existed between Tony and his boss, and Tony and the staff specialists, in which Tony did not receive any help in modifying his beliefs or in learning from his experience. Third, the fortification of his beliefs and attitudes in his relationships upward led to unsatisfactory relationships between Tony and his subordinates. The results of this vicious circle, as we saw in the description of Tony and his line, were the failure of the line to meet production and quality goals; the low state of morale among the operators; and finally Tony's own feelings of being pushed around.[58]

FOOTNOTES ON CHAPTER V

[1]F.L.W. Richardson, Talk, Work and Action (Ithaca, New York: The Society for Applied Anthropology, Cornell University, New York State School of Industrial and Labor Relations, 1961).

[2]p. 17.

[3]pp. 17-18.

[4]p. 18.

[5]p. 18.

[6]p. 19

[7]p. 19.

[8]p. 22.

[9]p. 19.

[10]p. 25.

[11]p. 25

[12]p. 22.

[13]p. 26.

[14]p. 26.

[15]p. 26.

[16]p. 26.

[17]p. 28.

[18]p. 33.

[19]p. 29.

[20]p. 29.

[21]p. 29.

[22]p. 30.

[23]p. 30.

[24]p. 56.

[25]pp. 56-57.

[26]A. Zaleznik, Foreman Training in a Growing Enterprise, (Boston: Harvard University School of Business, Division of Research, 1951).

[27]p. 87.

[28]p. 88.

[29]pp. 88-89.

[30]pp. 90-91.

[31]pp. 93-96.

[32]pp. 96-97.

[33]pp. 97-98.

[34]pp. 104-105.

[35]p. 105.

[36]p. 106.

[37]pp. 106-108.

[38]pp. 110-111.

[39]pp. 113-114.

[40]p. 119.

[41]pp. 61-62.

[42]p. 65.

[43]p. 72.

[44]p. 73.

[45]pp. 76-77.

[46]pp. 79-80.

[47]pp. 80-82.

[48]p. 216.

[49]pp. 123-129.

[50]p. 134.

[51]p. 135.

[52]p. 135.

[53]pp. 142-143.

[54]p. 158.

[55]p. 159.

[56]p. 166.

[57]p. 184.

[58]p. 189.

CHAPTER VI

CASE STUDIES: CATEGORY III TECHNOLOGY

Introduction

Chapter VI is the last of the three chapters devoted entirely to the presentation of empirical data in the form of case studies. The chapter consists of two case studies which serve to demonstrate examples of the nature of first-line supervisory role demands and environmental characteristics under continuous-process technology. The two case studies of the chapter have been edited in order to present only those data which are pertinent to the analysis.

Case 6 is atypical of the preceding five studies. In effect, it represents a composite case-study-commentary drawn from two distinct sources. The content and organization of Case 6 reflects the objective of attempting to validate the specific hypotheses formulated in Chapter III.

CASE NO. 5

A STEEL PLANT[1]

Production and the Organization

1. [This] study of male supervisors was carried out in one of the plants of a steel company, in which are employed almost 3,000 people. Production consists almost entirely of 'flat' steel, that is to say 'slabs' which vary in size but are something of the order of thirty feet by six, and 'billets,' long bars about six

inches square. The production work is done in four departments: Coke-Ovens, Blast-Furnaces, Melting Shop and Rolling Mill, all of which are working round the clock. There is a substantial number of maintenance men, mostly on day work, but with a few on shifts. In all there are about eighty foremen and of these slightly more than half are engaged on production work and the remainder on maintenance. This study is concerned mainly with the production foremen in the four departments named above.

2. For present purposes the plant may be regarded as an independent company, with an autonomous management. . . . . [See Figure VIII below]

3. Each of the managers of the four production departments has under him an assistant manager and a number of foremen. To explain the position of the foremen it is necessary to describe the work of the departments and the responsibilities of some of the people in them. First, . . . the processes of the plant can be summarized as follows. The raw materials of steel-making are iron ore and coal. The coal is made into coke in the coke-ovens, coke and ore are heated together in the blast-furnaces to become iron; the iron is transformed into steel in the Melting Shop, and the steel ingots are then passed through the Rolling Mill, where they are rolled down to the required sizes.2

The Work of the Foremen

The coke-ovens

4. This department employs 200 men, of whom thirty or so are on permanent day-work and the rest on shift-work. There are three shifts, and the four groups of shift workers rotate on a weekly basis. The supervisors include four shift-foremen, and two day-foremen, one of the latter in charge of the washing and crushing plant, and the other in charge of heating.

5. As coal arrives it is tipped on to conveyor belts, and passes on for blending, washing, and crushing. In its crushed form the coal then remains in a storage tower until it is charged into the coke-ovens. After it has been coked, it is pushed from the ovens, quenched, screened for size and then transported to the blast furnaces.

6. The first part of the process, from the delivery of the coal until it is ready for charging, is the responsibility of one of the day-foremen who controls a work-force of about twenty men. The other day-foreman, the Heater Foreman, is responsible for the heating of the hundred or so ovens. It is his job to decide what temperature is needed in every oven, and

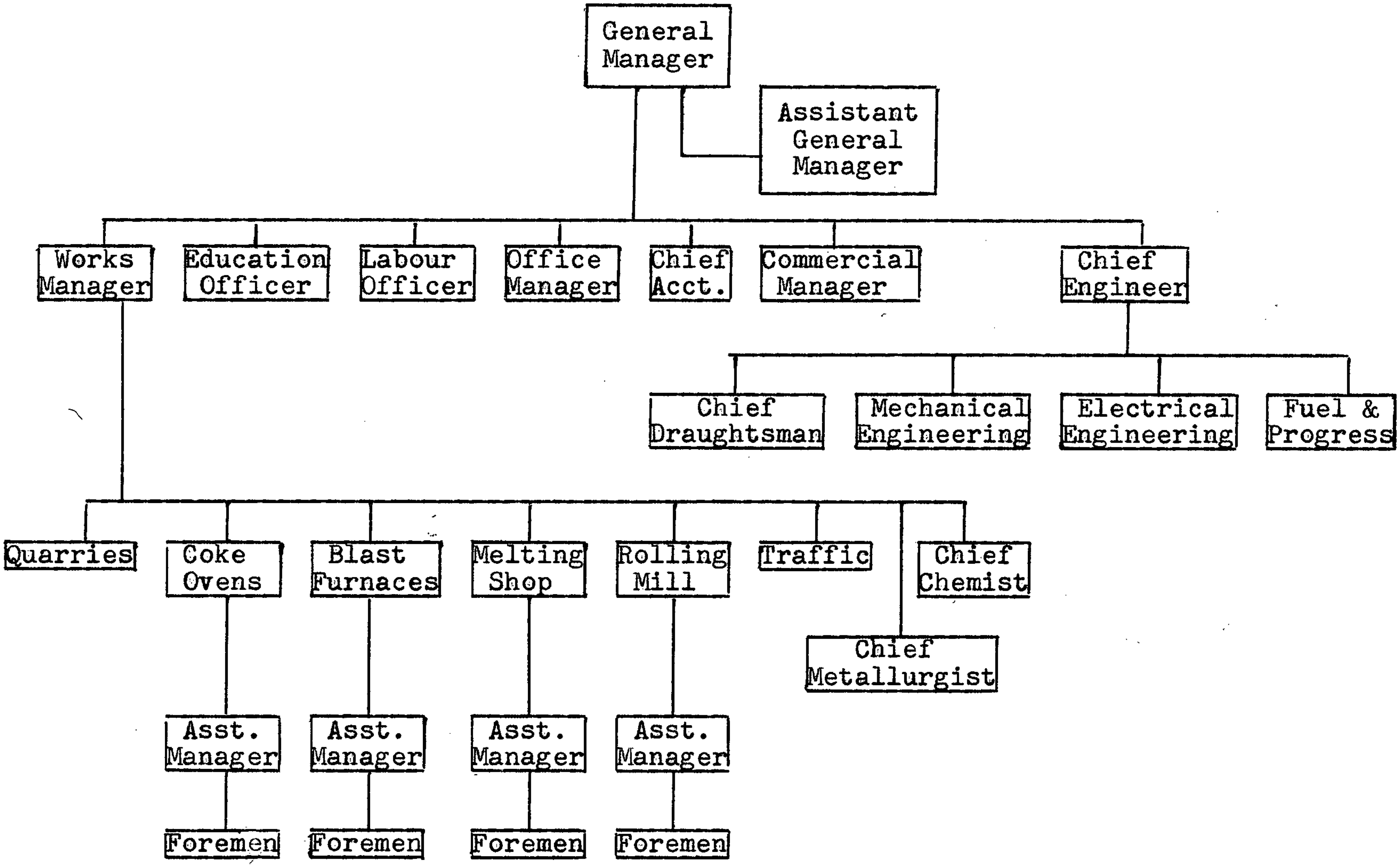


FIGURE VIII

MANAGEMENT ORGANIZATION IN" A STEEL PLANT"
(Developed from source data: p. 83)

to ensure by regular inspection that the ovens and their apparatus and flues (of which there are twenty-seven to each oven) are in serviceable condition. He and his assistant are both on day-work, but he has one man on each shift. The work at the coke-ovens proper is shift-work controlled by the shift-foremen, each of whom has an assistant who pays special attention to supervising the five men employed on each shift in the by-product plant.

7. On the maintenance side there is one foreman and and assistant foreman attached to this department but responsible to the Mechanical Engineer, and a foreman responsible to the Electrical Engineer. These men are on duty during the day-time only.

8. To summarize the situation, there is always a shift-foreman on duty, but the other foremen mentioned are at work only during the day, that is during the latter part of the morning shift and the earlier part of the afternoon shift. The manager and assistant manager of the department, moreover, and the heads of the different maintenance departments are also at work, as a rule, only during the day. This means that for the whole of the night-shift and for parts of the morning and afternoon shifts the shift-foreman is the only supervisor on duty, so that at these times his span of control is considerably widened. For example, when the Heater Foreman is not there the shift-foreman is in general charge of the heaters though the latter are responsible to the Heater Foreman for the technical side of their work.

9. The extent of the shift-foreman's responsibility must be emphasized. The foreman is, of course, working according to instructions issued by the departmental manager, but the actual progress of the work remains his province. He is in charge of only a medium-sized working group but of plant which is physically large and covers a fair amount of ground. This plant is working round the clock seven days a week, and it is important to spot any signs of trouble as early as possible so that minor maintenance can prevent major repairs later. For the greater part of the time the shift-foreman is in entire charge, without a manager on the spot to help or advise him if he is in difficulties.

The blast furnaces

10. There is much the same arrangement of supervisors in this department as in the previous one. In addition to the shift-foremen, who are responsible for the work at the furnaces themselves, there is a number of day-foremen. Those foremen who may be said to belong to

the department include one in charge of the gas-cleaning plant, two responsible for the ore delivery and crushing section (each working one shift daily), and one in control of a gang of labours. There are also two foremen responsible for mechanical maintenance, and one for electrical maintenance.

11. The departmental manager has under him two assistant managers, one concentrating on the material supply side and one on the work of the furnaces proper. During normal day working hours, therefore, the latter is in close touch with the shift-foremen, one of whom is on duty at any time.

12. In this department various kinds of ore are received, put through the crushing plant and then stored in bunkers to await charging into the furnaces. Coke is brought by trolley from the coke-ovens and also stored. Up to this point, the work is under the control of a day-foreman. According to proportions laid down by the manager of the department the furnaces are charged with coke and the different types of ore. About every six hours each furnace is tapped by its furnacemen, under the supervision of the shift-foreman.

13. An additional activity of this department is gas-cleaning. The gas that is given off by the furnaces is treated in an elaborate cleaning plant for which a day-foreman is responsible. His work is distinctly more technical than that of most of the production foremen, and it requires a more technical background than theirs.

14. In this department the shift-foremen are again in sole charge for that part of the time when the day-foreman and managers are not on duty, and their responsibilities are again heavy. As in most other production departments, each shift-foreman has an assistant foreman working with him.

Melting shop

15. After the operations of the blast-furnaces we come to the actual steel-making, which is carried out in open-hearth furnaces. Briefly, the procedure is as follows: hot metal (iron) is carried from the blast-furnaces, stored in a mixer, and de-siliconized. The furnace it is intended for is charged with scrap metal and limestone in proportions laid down by the office of the Melting Shop Manager and then charged with the special quantity of hot metal. After twelve hours or so the furnace is tapped and the steel poured into ingot moulds (the process known as teeming).

16. The supervisors include four day-foremen, two in charge of gangs of labourers and two in control of bricklayers engaged on furnace maintenance work. There

is also one mechanical maintenance foreman attached to the department. Then there are the equivalent of shift-foremen, called in this case sample-passers, one of whom is in charge of the furnaces during every shift. They each have an assistant sample-passer.

17. The sample-passer's job consists of supervising the work on all furnaces, each of which is under the charge of a first-hand and employs three other workers. The work includes both charging and teeming; in addition the sample-passer oversees a variety of work connected with the sorting and preparation of the material for charging. Although the first-hands control the work of each furnace, directing its charging and watching for the moment when it should be tapped, the sample-passer is responsible for ensuring that the steel is produced to the specifications laid down. He is present when furnaces are tapped and has a laboratory report made on a sample of steel just before tapping, in accordance with which he controls the throwing in of manganese. Like the other shift-foremen, the sample-passer is in sole control for a good deal of the time. Like them, he is responsible, through the assistant manager, to the manager of the department.

The rolling mill

18. After the steel has been tapped and transferred to ingot moulds, the ingots are placed in soaking pits, where they are heated to a uniform temperature throughout. They are then fed into the cogging mill where they are shaped into slabs of various sizes and blooms, five inches square and upwards. The latter pass on to a finishing mill where they are shaped into long billits, from two to five inches square. In addition, after passing through the rolls, slabs and billets are cut to required lengths by hot or cold shears, and surface dressings are applied in some cases.

19. In addition to shift-foremen, there are in this department two maintenance foremen on day-work and a day-foreman in charge of labourers and a chief stocktaker, the latter responsible for the steel and its dressing after it has been rolled. There are no assistant foremen, but what are in effect leading-hands control the work at its different stages; for example, the Roller is in technical control of the operation of the cogging mill and the finishing mill, the Heater controls the work at the soaking pits. These men, however, are not supervisors, and the overall responsibility remains that of the foreman, who follows weekly instructions which give details of the type and amount of production needed. The Melting Shop works from the same instructions, producing steel of the quality and quantity

specified as may be most convenient during the course of a week but not in a set order. The Rolling Mill Foreman must therefore keep in touch with the Melting Shop and with the laboratory which tests the quality of steel so that he can plan his department's work. He tries to do this so as to achieve as good a flow of work as possible, which means attempting to get a run of similar sizes through the mill to avoid frequent changing of the rolls.3

The demands of the foreman's job

20. We have seen that, in any of the departments, the day-foreman is responsible for a particular part of the work, e.g. the washing and crushing of coal in the Coke-Ovens Department. The shift-foreman, on the other hand, is generally responsible for the main work of production in his department, e.g. sample-passing in the Melting Shop, and, in addition, is responsible for the sections controlled by the day-foremen when the latter are not on duty. In either case there is not more than a small amount of paper-work, confined for the most part to keeping simple records of quantities and kinds produced and hold-ups encountered.

21. Foremen also have responsibilities in connection with the training of production workers. Until recently, training has been fairly informal but there is now the beginning of organized departmental training, and the foremen have a big part to play in this. One or two specific job training courses have been run by foremen and other production people, helped and encouraged by the staff of the Training Department. Meetings are also held in some department for discussion of various production processes. The success of this training depend to a great extent on the enthusiasm of the foremen, for it is a new departure and one in which interest must be stimulated among older workers.

22. Foremen have a great deal to do with other people in the course of their work--with other foremen, with the maintenance engineers and their workers, with other production and specialist departments. An important demand on them, therefore, is that they should be both willing and able to co-operate with all of these. The fact that the plant is working round the clock emphasizes this demand--problems of co-ordination cannot be sorted out when the plant has closed down, but must be foreseen and prevented.

23. Finally, the foreman's job requires a high degree of physical fitness. More than most factory foremen, those in this plant are 'on the go," up and down stairways and over a considerable amount of ground. The

Rolling Mill territory, for instance, is certainly not less than half a mile long and the only means of communication, as a rule, is by word of mouth. To supervise adequately, the foreman must patrol his territory; he may have to walk from one end of his department to the other to give an instruction, climbing several flights of stairs on the way. . . .4

Selection and Training of Foremen

Selection

24. In the four departments just described, the work of the operators ranges from unskilled labouring to very skilled work requiring considerable experience, as in the case of the first-hand on a furnace. The advancement of workers from one job to another takes place along lines which have been agreed in the past between the union representing the production workers and the management. As a rule, promotion is by set stages and on the basis of seniority. New employees, then, must start at the bottom and work their way up through jobs of rising status and interest and, usually, of increasing rates of pay. For example, in the Rolling Mill a man will begin as a painter or rack-driver, and move up when a vacancy occurs to be an assistant-straightener. His next move will be to scaling, greasing, or assisting on the shears and, according to which of these jobs he goes to, his promotion is determined for the future up a particular avenue. He may end up as a roller, on the one hand, or as the heater in charge of the soaking pits, on the other.

25. In the past, promotion to assistant foreman and then to foreman of production work usually followed in this same line of advancement. This was so, provided that managers agreed that seniority went with ability to supervise and that the union was agreeable to the appointment. The exception to this practice included the more technical or specialist foremen's positions, such as that of the Heater Foreman in the Coke-Ovens. The majority of the present production foremen, then, have been with the firm for many years and have worker their way up the rigid system of advancement, finally becoming foremen by reason of their seniority, their ability and their acceptance by the union. Because of this system they are all highly experienced in what might be called their own lines, the lines they themselves have come up, although their practical experience of other kinds of work in their departments is limited. In fact, while the day-foremen, on the whole, are supervising only processes in which they are highly experienced, the shift-foremen supervise at times a

variety of work in all of which they cannot possibly be expert. They therefore have to rely considerably on the knowledge and judgment of the first-hands, or senior workers, on some of the operations. For this reason, more than any other, shift-foremen prefer to stay with the same group of workers as it rotates from one shift to another. They feel that they need to know the capabilities of the senior workers.

26. Some of the present assistant foremen have reached their positions in the same way as the foremen but others were appointed under a different policy of the last few years. They are men, comparatively young ones, who started their careers with the firm in the laboratories and who have therefore more technical knowledge of the processes, though less practical experience in the plant, than their foremen. The average assistant foreman of this kind is now about thirty-five years old and has worked for four or five years in a laboratory and, by this time, for about ten years in a production department. Some of these new-style assistant foremen say that they have found that there is a great deal to learn about the practical problems of production, 'how to deal with snags through experience.'

27. The new policy for the appointment of assistant foremen has resulted from higher management looking at the foreman's position in a new way. It wants the foremen of the future to be younger on appointment than the present foremen and their predecessors were. It also wants them to have good technical knowledge and a reasonable standard of general education. This is partly because the demands, and the importance, of the foreman's job are recognized and partly because managers feel that the foreman's position should be made, to a much greater extent than hitherto, the first rung of the management ladder.

28. At the same time, there have been changes over the years--in the output of the plant and in methods of production--which add force to the new policy. The increase in production is exemplified in the Melting Shop; working with furnaces built at the time of the first war it has more than doubled the load it was originally intended for. In these circumstances, an extra burden is inevitably placed on managers and supervisors; it is particularly important to foresee difficulties and deal with them before they become serious problems, especially where the plant is working round the clock. Great attention must be paid to maintenance so that major overhauls and consequent losses of production are avoided. Good timing and co-ordination both within and between departments have

become more important than ever.

29. The second change is in the use of more mechanical methods of handling. Whereas years ago, for instance, the charging of the furnaces in the Melting Shop was done by hand by a number of men it is now done by one man operating a charger. The result of this change is that the foreman today is not supervising manual labour to the same extent as previously; the work is becoming gradually more skilled, with less emphasis needed on the physical condition of workers.

Training

30. There is little formal training for foremen in this plant, though some T.W.I. courses have been held. On the other hand, regular foremen's meetings have been recently introduced for the plant as a whole and for individual departments. These meetings are, indirectly, a form of training, and possibly one of the best forms. They provide the opportunity for foremen to meet their colleagues from different departments and from different jobs and also for them to meet representatives of various levels of management for discussion of plant affairs. In addition to these regular meetings, special training courses for foremen, on such topics as safety, are also occasionally held.5

The Attitudes of the Foremen

. . ., we shall consider how the foremen feel about their position, how they stand with other people, and so on.

Reactions to change

31. The majority of the production foremen have been in this plant for a great many years. They feel that it is their plant, in a way, and they are rather proud of its efforts. They are also thoroughly accustomed to its ways.

32. As we have seen, there are changes in the air at present: more mechanization, new methods of training, etc. These all affect the foremen very closely and so the foremen's attitudes to them are of particular interest. Whereas the older ones, at any rate, might be expected to resist new things and look longingly back to the past, this was seldom found to be the case. . . . . In some cases, it is true, there was certainly some regret expressed for the old days, when it was easier to enforce discipline because workers were more concerned about keeping their jobs. Even so, there was usually at the same time a realistic recognition

that conditions have changed and that methods of supervising have to be modified accordingly.

33. Though there is this general readiness to accept change, it is not always accompanied by understanding. Some foremen feel, for instance, that there are many more people employed on 'odd jobs' nowadays than in the past and that these people spend their time telling other people to do things. With regard to the training of operators, for example, some real enthusiasm was expressed for organized training, and there was general agreement that it is a 'good thing'. . . . At the same time, foremen of those departments which have not yet introduced formal training tend to think that the staff of the Training Department should do the job themselves and not come round urging departmental people to do it. . . .

Relations with managers

34. On the whole, the foremen appear to feel that they are very close to their managers, and this feeling seems to have grown in recent years. 'I doubt if the shift-foremen have ever been closer to management than they are today.' There was a little criticism of managers for not giving more support to the foremen in disciplinary matters, but this seemed to be more a means of relieving occasional feelings of frustration than anything else.

35. The importance to supervisors of the man at the top is emphasized here by the fact that hardly any mention was made by foremen of changes or advances without reference to the General Manager. 'The place has progressed more under this man than ever before; there's more heart in the job altogether.' . . . 'He mixes more with both men and managers.' . . . 'He's done it almost by personality alone.' It is interesting that comments did not refer to the technical knowledge or ability of the General Manager. What they did often imply was that he is willing to delegate responsibility to those capable of doing a job, and prepared to support and encourage. 'Without interfering,' it was said, 'he is interested enough to go round to the different departments to see how things are going on.' This informal contact is well regarded. 'Meetings are very useful but managers and especially the General Manager speaking to men in the works is far better than meetings.'

The position and status of the foremen

36. The foremen's relations with their managers are probably also due, in part, to the confidence they have in their position. This comes from a number of factors.

The foremen are 'on the staff' and they enjoy the status of staff members, including participation in a contributory superannuation scheme. Their jobs are highly responsible ones and they are allowed to get on with them without much interference. (To some extent this is inevitable because of the sheer size of the departments and the fact that the foremen are constantly moving round them. Problems in communication alone make it difficult for people to interfere very much.) But apart from allowing the foremen a fairly free hand, higher management has made deliberate attempts to build up the position of the foremen. We have already seen that the new policy on selection and training of future foremen is aimed at making the foreman's position more of a management one. As well as this, higher management has introduced such things as the Foremen's Council, which is attended by all foremen and various managers, and the Foremen's Panel, a company management committee which discusses matters relating to foremen and which is concerned with such things as their status and their training. (These are in addition to the weekly departmental meetings, attended by foremen.)

37. Finally, . . . the work that the foremen supervise in this plant is not becoming less skilled. In fact, if anything, it is becoming more skilled, with the increasing use of mechanical handling. For this reason also the status of the foreman is growing.

Conclusion

38. The production foremen of this study are in responsible positions requiring a fair amount of technical knowledge. This they have acquired through many years of experience, as production workers of rising degrees of skill, as assistant foremen and in their present positions. The importance of the foremen is recognized by higher management which has made considerable efforts to build up their positions and add to their status. Relations between senior managers and the foremen are particularly satisfying to the latter, largely because of the attitudes to the most senior manager.

39. It has been recognized in the plant that the traditional methods of appointing foremen do not altogether meet the needs of today. A policy of appointing assistant foremen who are both younger and more technically knowledgeable than their predecessors were on appointment has been in operation now for some years.6

CASE NO. 6[7]

Description of technology

1. A continuous-process plant is quite different from a typical factory. There are no recognizable machines and very few workers visible. Except for a few maintenance workers . . . welding or painting pipes, you see very few people doing anything and nobody making anything. Instead, one sees a large number of individual buildings with vast areas of open space between them, huge networks of pipes, and large towers and other equipment which one later learns are various types of distillation units or chemical reactors. The chemicals which are made and the oils which are refined flow through these pipes from one stage of their processing to another, usually without being handled at all by the workers. . . . The flow of materials, the combination of different chemicals, and the temperature pressure, and speed of the process are regulated by automatic control devices. The automatic controls make possible a continuous flow in which raw materials are introduced at the beginning of the process and a large volume of the product continually emerges at the end stage.8

The alternation between routine and crisis seems to be characteristic of process technology. . . .9

Organization

2. Because of the extremely complex technology and the high level of capital investment necessary to produce industrial chemicals and the products of the oil industry, the continuous process industries are dominated by large companies.10

Despite the size of the major companies, individual plants do not employ as many workers, on the average, as in the automobile industry. [Category II technology] . . . This is because automation has reduced the size of the work force in the continuous-process industries and also because of a conscious policy of decentralization. The large companies have preferred to operate many middle-sized plants rather than a few big establishments. . . . The average chemical plant has about 69 employees; the average oil refinery, 142 employees. . . .11

3. Decentralization is a decisive feature of the continuous-process industries, expressed not only by the distribution of the plants of a single company but also by the organization of individual plants. Continuous-process technology results in a layout of work that is

very different from textile and automobile production, where the bulk of machine and assembly-line operations and the majority of workers are concentrated under one roof. Chemical and oil refining operations are divided among many buildings or subplants with large stretches of open space between the buildings. In a sense, a chemical factory or a refinery does not consist of one plant, but a large number of plants, in each of which a particular product or a particular reaction is processed. . . . The danger of fire and other hazards, as well as the range of products and processes, makes such decentralization necessary. Even in the largest continuous-process establishments, the 'social density' of the work force is very low.12

Management expectations and characteristics

4. Because of the high degree of responsibility that continuous-process technology demands, management is particularly interested in a permanent, stable work force; and indeed, employment in the oil and chemical industries is often for life. . . . [the] industries have moved from a commodity to a welfare concept of employment . . . [management] and the prospective employee think of employment in terms of a whole work career--a long-term relationship in which the employer takes on an increasing burden of fringe benefits covering the man and his family, and the employee acquires tenure, job rights, and rights to promotion opportunities. . . .13

5. The welfare concept of employment in these young [continuous-process] industries partially reflects the socially progressive viewpoints of their managerial elites, who are usually college trained. It is a conscious policy, but one which stems naturally from the economic basis of production in continuous-process plants.14

Responsibility and Variety in 'Automated Work'

6. Very little of the work of chemical operators is physical or manual, despite the blue-collar status of these factory employees. Practically all physical production and materials-handling is done by automatic processes, regulated by automatic controls. The work of the chemical operator is to monitor these automatic processes: his tasks include observing dials and gauges; taking readings of temperatures, pressures, and rates of flow; and writing down these readings in log data sheets.15

7. . . .with the emergence of automated continuous-process technology, traditional craft skill has been completely eliminated from the productive process. . . .

In the place of physical effort and skill in the traditional, manual sense, the major job requirement for production workers in continuous-process technology is responsibility.16
Within each of the buildings that make up a continuous-process plant, a small crew, generally numbering from three to seven workers per shift, is responsible for the particular products or processes of their subplant. Each team is directed by a head shift operator who has considerable training and experience, and each is made up of workers of diverse levels of training and with varying degrees of responsibility. . . . [The operator calls upon the head shift operator when something is seriously wrong.]17

For our purposes of analysis it will be useful to interject into this commentary by Robert Blauner data gathered by William F. Whyte.[18] The observations recorded below pertain to a continuous-process avaition gasoline plant.

8. The work duties of the [catalyst plant] control room were largely divided between the fractionator operator (#3) and the hydro-stillman (#2). The poly operator (#1) was responsible for control room, catalyst plant and engine room, but there were charts in the control room registering the engine room operations, so little human contact there was necessary. The poly operator hardly ever walked over to the engine room. The engine operator usually came into the control room once a day, to join others at lunch, and perhaps once more during the working day. There was nothing to take the poly operator into the catalyst plant except his responsibility for checking on work activity; the catalyst operator was hardly ever seen in the control room.

9. The work of the three control-room men (for each shift) is difficult to describe because, except for regular hourly samples of product for testing to be drawn from various pieces of equipment, the activity depended very largely upon the condition of the process. When operations were going smoothly, the men had little to do but watch their charts; when operations were not going quite right, there were adjustments to make almost constantly. Since any adjustment made by the fractionator operator affected operations in the area of the hydro-stillman (and vice versa), this would be a period of accelerated communication between them and

and with the poly operator.

10. An emergency would generate greatly accelerated activity. For example, if one engine broke down, the control-room men had to respond quickly in order to lighten the load on the other five. Otherwise, the other overloaded engines might all go down, and the process would come to a very costly halt.

11. The poly operator had a large and heavy responsibility but few specifically assigned duties. Every hour he was required to look into the cracking furnace from both sides, to check the condition of the tubes. . . . While the poly operator had certain other checks to make, his job consisted primarily of co-ordinating the activities of the other two men.

12. It was <u>technically</u> possible to operate the control room with <u>only two men</u>, and, in fact, the plant was set up on this basis. However, the company found it necessary to set up the poly-operator position to assure a proper coordination between the other two men.

13. Above the poly operator, in the line of authority, were the foreman, plant manager, division superintendent, General Superintendent of Field Operations, Department Manager, Vice President for the Natural Gasoline Department, President, and Chairman of the Board of Directors. [i.e., 6 levels of line management]19

To continue with Blauner's commentary.[20]

<u>Responsibility of head shift operator</u>

14. The responsibility of a head shift operator is extremely great; he co-ordinates the work of all the members of his team, arranges for maintenance priorities and for the transport of materials and products to and from his plant, and serves as the link between his work team and management.21

Scheduling of maintenance work is determined by what piece of equipment breaks down, and there is obviously no way to standardize this.22

<u>Workers' control over time and movement; production quantity and quality; work methods</u>

15. The special technological and economic characteristics of the continuous-process industries give workers a great deal of control over their immediate work processes. . . . The lack of constant job pressure in continuous-process plants is not a product of management's humanitarian concern for the employees but is principally due to the nature of an automated technology.23

16. The relaxed work atmosphere during smooth operations allows chemical workers to control their pace of work.24

17. Chemical workers control the pace of their work; they do not, however, control the pace of production . . . the automatic processes taking place within the chemical reactors determine the speed of production.25

18. . . . chemical workers are able to control the quality of their production. In fact, control of the quality of the product is their major job responsibility.26

19. Chemical-process work is not as standardized as work on the automobile assembly line or in the textile mill. The worker has more freedom to determine techniques of doing his job. This results from the variety inherent in the work; the lack of time pressure, which allows experimentation and change; and the new situations for which new solutions must be found.27

20. An unusual degree of mobility results from the organization of the plant in [sic] a large number of individual buildings spread over a wide area, the high proportion of maintenance and distribution workers, and the generally relaxed pace of work.28

<u>Small primary work groups</u>

21. The responsibility demanded of the chemical worker is a collective, as well as an individual, responsibility. Since the process is integrated and continuous rather than divided in the manner that labor is divided, the responsibility of any one employee for his share of a plant's process is inevitably linked to the responsibility of other workers. An increasing interdependence develops, and automated plants tend to be based on team operations. The worker's shift from skill to responsibility therefore fosters thinking in terms of the collective whole rather than the individual part.29

22. The technology, economic situation, and social structure of the chemical industry also contribute significantly to the integration of the work force in a cohesive industrial community. Of first importance is the small size of the plants in the industry and the decentralized organization within the plant. . . . Communication between workers and management representatives is more frequent and is especially likely to be two-way communication in which advice is sought, as well as orders given. . . . Chemical-process operators are clearly identified with a particular shift and a particular department; the departmental work teams are not only clearly defined, they also have an explicit hierarchy of authority and status. . . . Work teams in the chemical industry develop identities: teams on different shifts strive to outdo each other in the quality of their product. . . .30

<u>The quality of supervision in continuous-process plants</u>

23. The overbearing supervision characteristic of past industrial practices is unlikely in a modern continuous-process plant. Chemical production requires responsible workers who will not need to be watched too closely. Due to decentralized operations, the large amount of outdoor work, and the considerable physical mobility possible, individuals often work out of the range of their immediate supervisors. As for operators, three-quarters of the time they are working nights or weekends, where there may be only one supervisor on duty in the entire plant.31

Insight into the nature of supervisory practices in Category III technology is found in the following observations made by W.F. Whyte.[32] Here Whyte is quoting the words of the foreman of the catalyst plant as the latter discusses his use of the Daily Operating Data sheets.

24. That sheet is not there primarily for my checking. The purpose of it is to enable the men to know what they are doing. By just looking over that sheet, I can tell how things are going. If something is wrong, I just ask the men to explain it to me. I never try to fix responsibility or say who is to blame. If a man's explanation is weak, he knows it as well as I do. I don't have to tell him. In telling me, he tells himself. That is all that is necessary. These men are very sensitive; they have thin skins and they take great pride in their work.33

To continue with Blauner's report:[34]

25. The chemical workers interviewed all felt that the load of supervision was light and that they were given considerable scope to do their jobs in their own way. . . . This freedom is possible because the work team which runs an individual plant takes over many of the functions of supervision in other technological contexts. A worker will come to work and do his job well, not out of fear of a particular boss, but because he feels the other operators in his crew are depending upon him to do his part of the total work. Many of the co-ordinating and administrative functions of supervision fall to the head shift operator, the leader of each plant's work crew. Since the head operator is an

hourly blue-collar employee and the most experienced man in the particular department, his guidance is not felt to be oppressive supervision. The face that he has previously worked at each of the jobs in his department in the course of working his way to the top is an important basis of his authority and respect.35

26. The chemical operator probably has more personal contact with persons in higher levels of supervision than do workers in mass-production industries. These contacts generally are for consultation on production problems and are therefore more satisfying than administrative or disciplining contacts. In automated production, when the workers' function becomes responsibility rather than skill, consultation with supervisors, engineers, chemists, and other technical specialists becomes a regular, natural part of the job duties. Because the operator is responsible for an important and expensive process, he can initiate interaction with those higher in status. Because he is the person closest to the actual operations, he must be listened to. . . . Automobile assemblers and textile operatives [Category II technology] may call upon a foreman or maintenance machinist when some mechanism is not working perfectly, but their own advice is rarely consulted by their superiors. Technical consultation with superiors does take place in craft industries [e.g., printing, Category I technology], but since craftsmen have a more independent domain, it is built into the system less than in continuous-process technology.36

27. A climate of collaboration is necessary for successful operations because of the interdependence of work teams and the importance of individual responsibility. Because the technology, work organization, and social structure of chemical plants allow the worker to become integrated into the company through his work group and to identify with the enterprise, the quality of supervision is extremely salient.37

The following observations by Whyte strengthen the foregoing analysis. The data pertain to the role of the first-line supervisor in the manufacture of an experimental product.[38]

28. At 6:30 on Tuesday night, Tom Lloyd [the foreman] received a telephone call from the main office with the order to start the tri-isobutylene run as soon as possible. He had known some time in advance that a product of this nature was to be made, but this was the

first time he was given exact specifications (initial boiling point and dry point temperature). Lloyd asked if he could start the run the following morning, but he was told that this was a rush order, so that it was necessary to start work immediately. Since Lloyd was not familiar with the detailed operations of the fractionating column, he telephoned Dan Benton, his staff engineer, and asked him to return to the plant to take charge of operations at once.

29. The fractionating column in which the product was to be made was under the direct charge of the fractionator operator, but, having had a good deal of fractioning experience, the hydro-stillman was naturally interested also, and both men normally worked under the supervision of the poly operator.

30. To this group were added Lloyd [the foreman] and Benton [staff engineer] who ordinarily spent little time within the plant. During the run, Lloyd spent most of his time at Hi-Test, consulting with Benton and the operators. He also took samples from the fractionating column up to the laboratory in order to run distillations tests on them. When he went home to sleep, he called in catalyst-operator Thompson to do the distillations.

31. Benton was in active charge from Tuesday night until Friday morning. During that period, he was in the plant almost continually, getting only 10 hours sleep. At the start, he took over the #3 fractionating column himself and directed the fractionator operator in all changes. Since otherwise the plant was operating in a routine manner, there was little for the poly operator and hydro-stillman to do except watch Benton and the fractionator operator.

32. Benton had certain definite ideas as to how the run should be started, and it appeared that by Tuesday morning he had been successful. The product at that time tested to specifications, but by the time the test results were reported the column had become flooded and was no longer making the product. Having been unsuccessful in this effort, Benton listened to the suggestions of the operators and tried out a number of their ideas.

33. At the start of the daylight tour (7 a.m. to 3 p.m.), fractionator-operator Kendall gave his opinion to Lloyd that no further progress could be gained along the lines then being pursued, and went on to outline his ideas as to how the fractionating column should be handled. Lloyd had a high regard for Kendall and therefore determined to turn the column over to him without restrictions or supervision. By now Benton was physically and nervously exhausted and Lloyd sent him home.

34. At the end of Kendall's tour he still had no results, but he was able to convince Lloyd that he was moving in the right direction. Lloyd ordered Kendall to work another eight hours, remaining in charge of the key column. Walling was poly operator on evening tour (3 to 11 p.m.). Lloyd instructed Walling to pay close attention to the way Kendall was operating the column.

35. At the end of evening tour, the product was still to be made. Lloyd sent Kendall home and held Walling over for another eight hours, ordering him to take exclusive charge of the column. Early Saturday morning, 22 hours after Kendall began trying his plan, the product came over, and shortly thereafter the brief run was completed.

36. One operator expressed the general viewpoint of the workers when he said:

> It wasn't until they left it to the operator that they got the thing lined out. Sure, it would have gone much faster if they had made it that way in the first place. The operator knows these columns better than the technical man.39

Case 6 concludes with the following observations by W.F. Whyte.[40] The remarks pertain to supervisor-worker relations as found in the introduction of the experimental product described above.

37. [The foreman] . . . got along exceedingly well with the men, and yet he was not able to solve some of the basic problems of worker-management relations. Why not?

38. In the first place, we note the limitations of the foreman's position. Even as the workers expressed their respect for Tom Lloyd, they spoke in quite different terms about other top management officials who could introduce sudden changes at any time. Nor was Tom Lloyd able to do anything about the policy regarding promotion of non-college men, even though he believed that several of his Hi-Test operators were well-qualified for supervisory positions.

39. In the second place, the tri-isobutylene run demonstrates for us the way in which a change in technology or process can upset worker-management relations, even when the foreman continues to be regarded as a good supervisor. This run brought about a sudden and drastic change in the relations among the operators and between operators and management. Dan Benton, the

staff engineer, in effect took over operations, leaving the poly operator little to do. Benton and Lloyd enormously increased the time they spent with the operators in the plant. Thompson, a lower-status man from the catalyst plant--a previous source of friction --came in to run tests which, in effect, told the Hi-Test men how they were progressing. Finally, when the job was left to operators, first a fractionator operator and then a poly operator was held over for an additional eight hours to take control of operations from the men regularly assigned.

40. The run yielded poor results both in technical efficiency and in human relations. In fact, it demonstrates the mutual dependence of efficiency and human relations.

41. How should such a run have been handled? The operators believed that if it had been left to them, they would have been able to produce the product in a much shorter time. In discussions afterward Tom Lloyd, while admitting the failure of his approach in the case, was not sure that the operators were right. He argued that, in the best of circumstances, it would take more than eight hours to produce the new product. Thus, if different poly operators had different theories about how to reach this goal, by just leaving it to them it would be impossible to attain the necessary consistency that efficient progress required. Perhaps that is true, but conversations held with the operators before the run suggest that there may have been more consistency in their approach than the foreman recognized. Several of these men, as they contrasted their own operating approach to that of the engineers, said that the engineer tends to shoot straight at the target, as his theories locate that target for him. On the other hand, the operator, with his more intimate familiarity with the equipment, is inclined to make a little change and wait to see what effect it has. Then he makes another small change and waits again and so on. He is content with a gradual approach to the target. It is interesting to note that in the tri-isobutylene run the engineer's performance fitted in with the previous statements of the operators. He aimed for the target, he got there too fast, he overshot the mark, and the whole job had to be done over.

42. However, even if we accept Lloyd's statement regarding the need for a uniform approach, it does not necessarily follow that the engineer must take over in order to provide the approach. If Lloyd and Benton had had time before starting the run to consult of the operators, this could have led to a decision regarding a uniform approach, which would then have been carried

out under the direction of the poly operators. Perhaps Lloyd and Benton would have approached the problem in this way, had they been given time. If so, top management's demands for immediate action simply prolonged the process.41

FOOTNOTES ON CHAPTER VI

[1]*The Place of the Foreman in Management*. Seven case studies undertaken by the National Institute of Industrial Psychology (London: Staples Press, 1957) pp. 83-94.

[2]pp. 83-84.

[3]pp. 84-88.

[4]pp. 88-89.

[5]pp. 89-91.

[6]pp. 91-94.

[7]Robert Blauner, *Alienation and Freedom: The Factory Worker and His Industry* (Chicago and London: The University of Chicago Press, 1964).

[8]pp. 124-125.

[9]p. 157.

[10]pp. 126-127.

[11]p. 127.

[12]pp. 127-128.

[13]p. 130.

[14]p. 130.

[15]pp. 132-133.

[16]p. 133.

[17]pp. 133-134.

[18]W.F. Whyte, "Engineers and Workers: A Case Study," *Human Organization*, Vol. 14, No. 4, 1956, pp. 3-12.

[19]p. 4.

[20]Blauner, *op. cit.*,

[21] p. 134.

[22] p. 134.

[23] p. 135.

[24] p. 137.

[25] p. 138.

[26] p. 139.

[27] p. 139.

[28] p. 140.

[29] p. 143.

[30] p. 146.

[31] p. 147.

[32] W.F. Whyte, *op. cit*.

[33] p. 6.

[34] Blauner, *op. cit*.

[35] p. 147.

[36] pp. 147-148.

[37] p. 148.

[38] Whyte, *op. cit*.

[39] p. 8.

[40] *Ibid*.

[41] p. 11.

CHAPTER VII

ANALYSIS OF DATA

Introduction

The analysis carried out in Chapter VII compromises two distinct approaches. First, the case studies of Chapters IV, V and VI will be analyzed in order: (1) to demonstrate the process and logic by which the cases were classified according to category of technology (2) to test the validity of the specific hypotheses enunciated in Chapter III, and (3) to suggest bases for modifying the specific hypotheses as may be required in the light of the data. Second, the additional empirical data found in the appendices will be scrutinized. Where these data support the observations and inferences drawn from Woodward's study, and where they tend to confirm the validity of the specific hypotheses of Chapter III, the sources of confirmation will be cited. Alternatively, where the additional empirical data question the validity of the specific hypotheses, an attempt is made to account for the discrepancies.

It is important to note that the completeness, specificity and objectivity of the various data vary widely from case to case and appendix to appendix. The predilections, special interests and research perspectives of the authors of the source materials differ both among themselves and from those of the author of this study. Therefore, as the subsequent analysis will reveal, inferences, guesses and hunches figure prominently in the attempt to validate the specific hypotheses of the study.

A portion of the specific hypotheses enunciated in Chapter III were phrased in a manner designed to suggest the variation of certain dimensions of supervisory behavior as a function of technology. The following analyses of Cases 1 and 2 will contain only limited references to such phenomena. In the subsequent case analyses the variation of the dimensions of supervisory behavior across the categories of technology will be made more explicit. For the latter analyses, the interpretations of Case 1 and 2 will be utilized.

Citation of source data

Each of the six case studies will be analyzed separately. The source for statements made in the analysis of a case will be indicated by citing the appropriate paragraph of that case. Following the analysis of the two case studies for a given category of technology, the additional empirical data pertaining to that category will be considered. The source of statements which draw upon the additional empirical data will be indicated by citing the appendix number, section and paragraph. For example, a statement followed by the designation "(V,A,1)" refers to paragraph 1 of section A of Appendix V.

CATEGORY I TECHNOLOGY

Interpretation of Case No. 1: "A Dyeing and Cleaning Plant"

Justification for Classification as Category I Technology

The technologies of cleaning and dyeing described in the case appear to be associated with a number of organizational correlates belonging to Category I technology. For example, Figure II above shows three levels of management organization, which equals the median observed by Woodward. Similarly, one notes the corresponding short management communication line. In addition, one notes the existence of several small primary work groups: 5 workers in the dry-cleaning operation, 8 in wet cleaning, 3 in the dyehouse, 2 in the carpet cleaning section, and 4 girls working in silk spotting.(paragraphs 5, 8, 10, and 13). For these 22 workers there are 3 foremen, suggesting a first-line supervisory span of control of about 7, a figure well below the range of 14-27 suggested by Woodward (Chart II).

Other organizational correlates peculiar to Category I technology are described in the case study. Note, for example, the scarcity of staff specialists. The assistant general manager (paragraph 2), and the "important" Inspection and Investigation departments (paragraphs 16 and 17) might be considered to be staff specialist units. Although the latter two departments appear to be an integral part of the work flow and, hence, to belong to the "line" activity. The extensive technical competence and responsibility of first-line supervisors (paragraphs 9, 10, 12, 14, 18, 24) conforms well with the correlates of Category I technology described in Chart II. Similarly, one notes the high degree of functional interdependence between marketing (shops) and production (the factory) (paragraph 23). Such interdependence is in accord with Category I technology.

It is clear from the case material that the factory operation consists of unit production based upon firm customer orders only. Each order receives unique, individual treatment in the production process (paragraph 17).

The preceding observations suggest the justification for classifying the case within Category I technology. The justification of this classification is strengthened further by certain elements of organic management processes which appear to exist within the enterprise. Specifically, paragraph 24 illustrates that supervisors "run their own shops." They are their own technical experts. The first-line supervisor does not have to consult with others about plans, or raw materials. In other words, there is evidence for the "ad hoc location of control authority and communication based on expertise." Paragraph 21 provides additional evidence of this characteristic of organic management processes. The fact that first-line supervisors "are directly responsible, to a very great extent, for the firm's reputation with its customers" (paragraph 25), suggests an additional exemplification of organic management; namely, that suprevisory personnel contribute their "special knowledge and experience to common tasks of the enterprise."

It is concluded, therefore, that the case study deals with an enterprise which may be classified under Category I technology.

Support for Specific Hypotheses

The following analysis consists of observations and inferences drawn from the preceding case. The analysis is organized in accordance with the categories of Chart I. The code designations following each sub-heading refer to this chart. In addition, the analysis reflects the conceptual scheme (Figure I) relating supervisory activities, interactions and consequent sentiments felt or expressed toward others.

Nature of supervisory activities (I-A-1)

With the exception of the Dry-Cleaning department, it is noted that the first-line supervisor exercises both his technical knowledge and skill and that he executes administrative activities in order to organize and coordinate the work of his subordinates (paragraph17). For example, in Wet-Cleaning the supervisor exercises his technical knowledge and issues instructions regarding the correct treatment to be given the items. He utilizes his technical knowledge to identify fabrics and to assess the effects of different treatments on them (paragraph 9). In addition, the supervisor of the Wet-Cleaning department endeavors to organize a smooth production flow within his unit.(administrative activities). Another example is the supervision of work in the Finishing, Inspection and Silk Spotting departments. Paragraphs 12, 14 and 16 illustrate supervisory activities of an administrative nature: the coordination and monitoring of work flow. The first-line supervisor in the Repairs department performs both technical and administrative activities. On the one hand she advises on repairs. On the other hand she records work done for purposes of costing and wage determination (paragraph 15). In general, then, both technical and administrative activities are significant elements in the behavior of first-line supervisors in this case (paragraph 18). Furthermore, one finds, as hypothesized, evidence for the supervisor's personal involvement in the direct production activities (paragraphs 9 and 16).

Although the case material fails to demonstrate face-to-face verbal interactions with others, it is inferred from the data that such interactions do occur in this factory and that they comprise a significant element of the supervisor's overall behavior. It was hypothesized that one element of the supervisor's administrative activities in Category I technology would consist of the coordination of work flow between successive work units, negotiation with fellow supervisors for access to scarce resources, etc. The data of the case do not generally support this hypothesis (paragraph 23). It appears that only the supervisor of the Finishing department engages in such activities (paragraph 12).

Frequency of performance of activities (I-A-2)

The data of the case are not sufficient to allow analysis in regard to the hypotheses of this section.

Nature of interactions

With subordinates (I-B-1-a). The data of the case appear to provide indirect support for the hypothesis regarding the face-to-face task-oriented nature of interactions between the first-line supervisor and his subordinates. The supervisor's typically heavy technical responsibilities; his exercise of these responsibilities based upon his technical expertise; the existence of small primary work-groups, and continually changing treatments of work items--all these characteristics of the factory appear to support the hypothesis by inference.

Furthermore, the data lend support to the hypothesis that supervisor-subordinate interactions will tend to be "relaxed"; that is, devoid of conflicts over authority and responsibility. For example, one observes (1) that discipline is not a problem (paragraph 19); (2) that relationships are "very easy and friendly" (paragraph 22), and (3) that there is a high perceived security of employment (paragraph 22).

<u>With superiors (I-B-1-b)</u>. The specific hypotheses regarding interactions between first-line supervisors and their line superiors were the same as those for interactions between supervisors and their subordinates. On the whole, the case data support the hypotheses, although it is not possible to confirm that the interactions are mainly task-oriented. In general, one notes features of organic management processes which tend to support the hypotheses. The supervisor is largely independent and free to run his department as he sees fit. The organization is "informal": managers and supervisors know each other well. There are virtually no problems associated with technological change. The supervisor has "easy access" to the Works Manager, his immediate superior (paragraph 21).

<u>Horizontal interactions (I-B-1-c)</u>. For the most part, the specific hypotheses regarding horizontal interactions involving the first-line supervisor are not well supported by the case data. Such interactions apparently are not technologically required to any extent. For those horizontal interactions which do occur part of the hypothesis is

supported by the case. Specifically, it is observed that, as hypothesized, these interactions are "relaxed." According to paragraph 22 relations between supervisors are "good."

Frequency of interactions

The case does not provide information concerning frequencies of interactions. Inferences appear to be unwarranted.

Supervisory sentiments

It was hypothesized originally that supervisory sentiments toward subordinates, superiors, fellow supervisors along the work-flow, and staff specialists would be similar: that is, neutral to friendly, fairly constant and based upon mutual respect for technical expertise plus the effects of organic management processes. If one accepts the preceding analysis regarding the nature of supervisory interactions with others, then it might be inferred that the hypotheses regarding supervisory sentiments are substantiated by the case data.

Interpretation of Case No. 2: "An Electrical Engineering Works"

Justification for Classification as Category I Technology

Case 2 poses problems of classification not found in Case 1. The sources of certain classification ambiguities are two in number (1) the necessarily ideal nature of the specific hypotheses for Category I technology, and (2) the fact that industrial production technology might be regarded as a continuum, the divisions of which (e.g. Category I) tend to be somewhat arbitrary. Technologies approaching the boundaries of the divisions of the continuum pose unique difficulties of classification and attempts to develop support for the specific hypotheses. Case 2 illustrates the phenomena described above.

In the second paragraph of the case one learns that originally the company was engaged entirely in production for individual orders of small quantities. Such a type of production continues to be the major part of the company's output. The small batch nature of production is confirmed in paragraph 4. This paragraph shows that the enterprise tends to specialize in the production of small lots of slightly non-standard switchgear and electric motors, although production also consists "partly" of long-term contract work. It might be concluded, therefore, that the case study describes what is substantially a small batch production technology (Catagory I) but with the possibility of there being a relatively small amount of large batch production as well.

What of the organizational correlates which have been associated with Category I technology? The preceding discussion suggests that, in accordance with the correlates of Category I technology, production is based upon firm orders only. It suggests that the order of the manufacturing cycle is from marketing to development to production. In addition to these correlates of Category I technology, one observes from Figure III that the enterprise comprises three levels of management. This number equals the median for Category I technology observed by Woodward.(Chart II above). Thus the length of the management communication line is "relatively short" as suggested by Woodward. Furthermore, in approximate accordance with the characteristics of Category I technology a portion of the direct labor force consists of skilled workers (paragraph 12). This fact suggests to us the probability that the enterprise possesses a relatively high, but declining, proportion of skilled to unskilled labor. Finally, we observe from the data of paragraphs 15 and 16 that the required technical competence of supervisors is high. Most supervisors have previously served apprenticeships in either mechanical or electrical engineering (paragraph 15). The foremen in part supervise the kind of highly skilled technical work for which they themselves were trained. The trend, however, is toward increasingly unskilled labor.

Briefly, then, the case exhibits a number of the organizational correlates associated with Category I technology. However, one also observes one or two structural correlates which do not conform to the ideal features observed by Woodward. Specifically, one notes the presence of organizational correlates suggestive of the location of the technology described in the case as being close to the boundary separating Categories I and II. For example, Figure III above illustrates the fairly elaborate staff specialist organization in the enterprise. As paragraph 19 reveals, the sequencing and scheduling of production are partially specified for the first-line supervisor by the Progress Department. The Planning Department prescribes production methods. In spite of the presence of these staff groups, their degree of control over supervisory behavior is only partial. The supervisor is required to consider carefully the technical instructions (not directives) of the staff specialists. He criticizes these instructions when necessary and takes steps to see that work is done in the most economical way (paragraph 19). An additional example of organizational correlates failing to conform to the ideal types of Category I technology is found in the use for control purposes by management of staff department reports (paragraph 21). Finally, a key characteristic of organic management appears to be absent from the enterprise described in Case 2: namely, the adjustment and continual redefinition of individual tasks through interaction with others.

Not withstanding the foregoing departures from Category I organizational correlates, one notes additional aspects of the enterprise which do conform with Category I organizational correlates. Paragraph 19 of the case demonstrates that the supervisor is consulted on any technical matter out of the ordinary before production methods are decided upon. Similarly, one notes that the supervisor consults with Personnel regarding hiring; the final decision concerning the hiring of additional labor is his (paragraph 19 and 25). These two characteristics of the organization support features of organic management involving the communication of advice and information rather than decisions, and the contributive nature of special knowledge and experience to the common tasks of the enterprise.

It is concluded, therefore, that although Case 2 contains elements which fail to conform with the ideal characteristics of Category I technology structural correlates, classification within Category I is at least partially justified.

Support for Specific Hypotheses

In this section the analysis of Case 2 is continued. The goal is to demonstrate the degree to which the case materials either provide support for the specific hypotheses regarding supervisory behavior in Category I technology, or indicate the qualifications and refinements required in the specific hypotheses.

Nature of supervisory activities (I-A-1)

The data provide support for the hypothesis regarding the application of technical knowledge and the exercise of technical skill. For example, one notes the strong technical background of the first-line supervisor (paragraph 16). His extensive technical training and many years of experience as a skilled workman are of immediate relevance to the technically skilled work performed by a portion of his subordinates (paragraph 17). He has a considerable measure of technical responsibility (paragraph 19).

More specifically, and as hypothesized, the first-line supervisor in this enterprise is the "man on the spot," the "man of practical experience" (paragraph 19). It was hypothesized that the supervisor "personally makes a relatively broad range of technical decisions, or gives technical advice regarding (1) choice of work tools and methods" etc. Analysis of the case reveals that the supervisor applies his technical knowledge and skill in evaluating and criticizing planning department specifications on production methods. He consults with staff specialists when out-of-the-ordinary jobs are scheduled. Finally, the technical experience and knowledge of the first-line supervisor are utilized in the establishment of piece-rates (paragraph 19).

It appears, therefore, that the technical role demands of the supervisor in Case 2 are of a consultative nature. Sole responsibility for technical decisions does not figure predominantly in his role.

The data do not support the hypothesis that, when unforeseen problems or excessive work loads arise, the supervisor becomes personally active in contributing his technical skills to the direct production work of his subordinates.

Among the set of ideal structural correlates of Category I technology listed in Chart II are (1) the existence of few or no staff specialists (2) a limited development of formal production control and planning systems, and (3) the minimum reliance for control purposes by all levels of management upon the formal reports of staff specialists. In the preceding discussion regarding case classification the departures from the ideal Category I correlates were noted. They concerned mainly the presence in this case of the foregoing types of structural correlates. Finally, it was hypothesized originally that "in the absence of extensive, highly rationalized staff production planning and control activities, the supervisor personally carries out a range of administrative activities. . . ." Indirectly, therefore, the latter hypothesis is confirmed by the case materials. That is, the first-line supervisor in the enterprise reported in Case 2 does not perform all these adminstrative activities because of the existence of staff specialists in the organization.

However, the foregoing analysis is not meant to imply that in this example of Category I technology administrative duties and activities of the first-line supervisor are non-existent. Rather, as the data of the case indicate, the nature of his administrative activities differ slightly from those originally hypothesized. (This difference might be interpreted as reflecting the closeness of the technology to the boundary separating Categories I and II.) Thus, paragraph 23 contains evidence that the administrative activities of the supervisor "can be substantial and [are] always considerable." Basically, the data support the two sub-hypotheses regarding the nature of administrative activities: "the issuance of verbal or written reports regarding attendance, absenteeism, etc.," and the "issuance of written or verbal reports regarding production achieved, in process, etc." In paragraphs 22 and 23 one notes evidence to the effect that the first-line supervisor is involved in activities designed to provide production and personnel staff specialists with up-to-date information. It is these types of administrative activities, rather than those dealing with the allocation of jobs and tasks, or the scheduling and monitoring of work flow, which comprise the administrative activities of the first-line supervisor in this case.

The foregoing observations regarding the departures from hypothesized supervisory activities indicate a basic deficiency in the specific hypotheses of this study; namely, their essentially modal or ideal nature--a characteristic which fails to acknowledge the continuum-like nature of the range of production technolgies from Category I to Category III.

The case data do not demonstrate support for our other hypothesis regarding the nature of supervisory administrative activities. We find no evidence to support the hypothesis that the first-line supervisor is involved in behavior designed to (1) coordinate work flow between successive work units, or (2) negotiate access to scarce resources in demand by fellow supervisors.

Our final hypothesis under the "Nature of supervisory activities" dealt with the existence of activities the nature of which consists of face-to-face verbal interactions with subordinates, line superiors, staff specialists (if found in the enterprise), and fellow supervisors along the work flow. The data of the case provide no direct confirmation of this hypothesis. Presumably, however, such interactions are a basic component of the overall set of activities of the first-line supervisors discussed in the case.

<u>Frequency of performance of activities (I-A-2)</u>

The case data are insufficient to permit detailed analysis under this section.

<u>Nature of interactions</u>

<u>With subordinates (I-B-1-a)</u>. For the most part the data appear to support the hypothesis that interactions between first-line supervisors and their subordinates would be face-to-face, task-oriented and relaxed, that is devoid

of conflicts over authority and responsibility. One notes, for example, that the supervisor is personally involved with training new-comers, and that he keeps in close personal touch with their progress (paragraph 27). Furthermore, these interactions appear to be relaxed, the atmosphere of the factory is considered to be "happy" (paragraph 31).

It is not possible to demonstrate support for the specific hypotheses stating that supervisor-subordinate interactions will "tend to allow feedback and evaluation by the parties" and that "The technical expertise of both the parties will allow the interactions to be based upon the communication of advice and information rather than explicit instructions and directives."

With superiors (I-B-1-b). The specific hypotheses regarding the nature of supervisor-superior interactions were the same as those for interaction between first-line supervisors and subordinates. The hypotheses are not well substantiated in this case. The explanation for this failure appears to lie in the effects of the structural correlates noted in the case which depart from the ideals of Category I technology. Thus, contrary to the hypothesis that supervisor-superior interactions would tend to be devoid of conflicts over authority and responsibility, one finds a suggestion that some ambiguity exists regarding the limits of supervisory responsibility and authority (paragraphs 36 and 38). Furthermore, the presence of staff specialists and formal planning and control systems suggests that interactions between the first-line supervisor and his line superiors will be mediated by the reports integral to these systems. In spite of these potential limitations to face-to-face, verbal, task-oriented interactions free from conflicts over authority and responsibility, relations between the first-line supervisor and his superiors appear to be relaxed. The data indicate that their relations are "good and friendly at the personal level" (paragraph 38).

Horizontal interactions (I-B-1-c). The preceding discussion applies to the specific hypotheses regarding the nature of horizontal interactions. As noted previously, the hypotheses regarding interactions between fellow supervisors along the work-flow find no support from the data of the case. Given that the supervisor frequently fails to execute his administrative responsibilities (paragraphs 34 and 35), his interactions with staff specialists appear to be face-to-face and task-oriented as hypothesized. Also, because the atmosphere is considered "happy" (paragraph 31), and because relations between supervisors and their superiors are "good and friendly" (paragraph 38), it is inferred that interactions between the staff specialists and the supervisor are free from conflict over authority and responsibility. Thus, although paragraphs 32 and 35 hint at the possibility of resentment between these two groups, one notes from paragraph 33 that staff specialists are careful to recognize the prerogatives of the first-line supervisor and that they attempt to uphold the supervisor's authority With the exception of horizontal interactions between supervisors along the workflow, the hypotheses seem to be confirmed by the data.

Frequency of interactions

Analysis under this section is not justified given the quality of data in Case 2.

Supervisory sentiments

It was originally hypothesized that supervisors' sentiments toward subordinates (I-C-1), superiors (I-C-2) and parties to horizontal interactions (I-C-3) would be uniform; namely, neutral to friendly and fairly constant over time. The data in the case appear to confirm these hypotheses. The preceding discussion regarding the atmosphere in the enterprise, the nature of supervisor-superior relationships, and the care taken by staff specialists to protect and respect the prerogatives of the first-line supervisor imply partial support for the hypotheses regarding sentiments.

The failure of the specific hypotheses pertaining to supervisory sentiments are evident in regard to sentiments toward line superiors. Thus, as indicated above, interactions between first-line supervisors and their line superiors are not entirely devoid of conflict over the authority and responsibilities of the supervisor. In addition, supervisor-line superior interactions tend to be mediated by the reports of staff specialists. The status of the first-line supervisor is, therefore, rather ambiguous.

The foregoing characteristics of supervisor-line-superior interactions suggest that the quality of sentiments between these two classes of organization actors tend toward those found in enterprises under Category II technology. This phenomenon may find its origins in the nature of the technology and technological correlates of Case 2, which, as noted above, do not completely conform to the ideals of Category I technology.

Analysis of Additional Empirical Data

In the following section the data of Appendices I and II are examined. Appendix I consists of a number of empirical observations bearing upon supervisory behavior in what appear to be instances of Category I production technology. Appendix II consists of observations pertaining to: (1) the structural and organizational process correlates of craft technology, and (2) the implications of these correlates of technology for the behavior of first-line supervisors.

A note on organic management processes. Preparatory to the enunciation in Chapter III of specific hypotheses concerning the dimensions of supervisory behavior under Category I technology, the centrality of organic management processes for this category of technology was discussed. To what extent do the data of Appendices I and II demonstrate organic management processes as a correlate of Category I technology?

A characteristic of organic management processes is the contributive nature of special knowledge and experience to the common task of the enterprise. The data provide evidence of the skilled craftsman bringing to bear his traditional skills and technical experience upon the continually changing nature of the work to be performed (II,5). See also (I,32(a), 32(b), 33(c) and 33(a)).

A second characteristic of organic management processes involves individual tasks being set by the total situation of the enterprise. Paragraph 5 of Appendix II suggests that in craft industries such is the case. Depending upon the nature of the job at hand the craftsman selects his tools and exercises discretion over his work methods and sequence. Paragraph 21 of Appendix I demonstrates that work pace is largely influenced by the nature of the item being produced. Paragraph 32 is another example of the presence of this feature of organic management processes in Category I technology.

Organic management processes may also be characterized by the adjustment and continual redefinition of individual tasks through interactions with others. Because each miner under hand got method of coal-getting is capable of performing all tasks of his crew, his performance of a given task is probably the product of mutual agreement among crew members (I,32(d)).

A fourth characteristic of organic processes of management is the _ad hoc_ location of control authority and communication based upon expertise. See (I,32(a)-32(d)) for confirmation of this characteristic of organic management in Category I production technology. The relative absence of "functional rationality" in printing, plus the "little need for external controls" over printers and other craftsmen, are additional confirmation (II,4 and 6).

Under organic processes of management lateral rather than vertical communications appear to be predominant. The fact that, "to a large extent the workers run the composing room" (II,8), indicates (by inference) the importance of lateral communications in this example of Category I technology. The "extensive free interactions among crew members" under the hand got method of coal getting is another example of this phenomenon (I,32(c)).

The sixth characteristic of organic management processes concerns the communication of advice and information rather than instructions and decisions. See (I,27 and 32(b)) (II,6, 7 and 8) for confirmation of this phenomenon under

Category I technology.

To summarize the foregoing paragraphs, the empirical data of the appendices appear to confirm our hypotheses regarding the presence of organic management processes in Category I technology. We now turn to an analysis of the data of the appendices from the point of view of our specific hypotheses concerning the dimensions of supervisory behavior.

<u>Nature of supervisory activities (I-A-1)</u>

<u>Frequency of activities (I-A-2)</u>

The data of the appendices are of insufficient quality to allow either confirmation, modification, or refutation of the specific hypotheses of these two sections.

<u>Nature of interactions</u>

<u>With subordinates (I-B-1-a)</u>. It was originally hypothesized that the nature of supervisor-subordinate interactions would be characterized by the following features: they would be face-to-face, task oriented, and devoid of conflicts over authority and responsibility; that they would allow reciprocal feedback and evaluation based upon the communication of advice and information. None of the data of the appendices appear to contradict these hypotheses. The data at (II, 6 and 7) tend to support them by inference.

<u>With superiors (I-B-1-b)</u>. <u>Horizontal interactions</u>

(I-B-1-c). The additional empirical data lack the quality needed to justify comments regarding the validity of the latter two groups of hypotheses.

Frequency of interactions

With subordinates (I-B-2-a). The specific hypotheses of this section included the prediction that the extensive technical and administrative duties of the supervisor, plus the technical expertise of direct workers would tend to limit interactions. See (II,3, 6,23 and 32(b)) for confirmation. The portion of the specific hypotheses of this section which predicted that the frequency of interactions between first-line supervisors and their subordinates would be less in Category I than in Category III technology tends to be supported by (II,7).

With superiors (I-B-2-b). Horizontal interactions (I-B-2-c). The quality of the additional empirical data is insufficient to permit a discussion of the validity of the specific hypotheses under these two sections. Similarly for the specific hypotheses pertaining to supervisory sentiments.

CATEGORY II TECHNOLOGY

Interpretation of Case No. 3

Justification for Classification under Category II Technology

How well do the technological-organizational characteristics of the plant described in Case No. 3 approximate the correlates observed by Woodward (Chart III)?

First, one observes from Figure IV above that the number of levels of management in the enterprise is 5, one more than the median number observed by Joan Woodward. On the other hand, the chief executive span of control is 5, two less than the median of 7 found in Woodward's sample.

Second, the first-line supervisor's span of control falls within the range Woodward noted for Category II technology. Paragraph 5 shows that the supervisor directed the activities of 40 subordinates. Woodward notes a range of 30-44 as representative of Category II technology.

Third, and in accordance with Woodward's data, one finds little evidence for the existence of small primary work-groups. The size of the two work groups studied in this case ranges from 11 to 18 (paragraph 5).

Fourth, as noted in Woodward's study (Chart III), skilled labor focuses upon indirect activities. That is, the direct labor appears to be semi-skilled while the staff specialists probably can be classified as skilled.

Fifth, staff specialists appear to perform many crucial activities in the enterprise outlined in Case No. 3.

The five preceding characteristics suggest that the case describes Category II production technology. However, paragraphs 1 and 2 indicate the difficulty in attempting a neat, unequivocal categorization of the technology involved in Case No. 3. It is clear that one is dealing with an enterprise in a particular stage of what in fact is a process of technological evolution--a phenomenon perhaps characteristic of contemporary economic organizations. Both unit production and assembly-line technologies are employed in the productive processes of the enterprise. Yet, for the production unit studied in this case, the technology is obviously that of the assembly line. In addition to the foregoing characteristics of Category II technology one notes that (1) emergencies are common (paragraph 11), suggesting a high sense of urgency of production (2) management processes tend to be mechanistic (paragraphs 13, 14, 19, 20 and 21) (3) interdepartmental relations tend to be poor (paragraph 17) and (4) interdepartmental interdependence seems to be highly developed (paragraphs 8, 17). For the purposes of analysis, therefore, it appears justifiable to classify Case No. 3 under Category II technology.

Support for the Specific Hypotheses

The following analysis of the data of Case 3 is organized in accordance with the observational categories of Chart I. Like the preceding analyses, its rationale and development follow from the conceptual scheme (Figure I) relating supervisory activities, interactions, sentiments and the organizational correlates of Category II production technology.

Nature of supervisory activities (II-A-1)

The data of Case 3 suggest that the primary focus of the supervisor's activities is to achieve and maintain a regular work flow along the assembly line within his work unit (paragraph 11). Such a regular flow of production must meet the combined demands of quality control, "efficiency," and production scheduling specialists.

The data also suggest that the chief characteristic of first-line supervisory activities is that they consist mainly of interactions with others. For example, paragraph 11 indicates that the supervisor interacts with superiors to secure the required number of workers. Paragraph 13 is also suggestive of *ad hoc* task-oriented verbal interactions between the supervisor and his superiors. From paragraph 16 the possibility of interactions between the supervisors and staff specialists is inferred. Similarly, one finds evidence in paragraph 17 for the existence of interactions between the supervisor and his subordinates. One finds no evidence illustrating the nature of supervisory activities beyond the interacting behaviors described above.

<u>Frequency of supervisory activities (II-A-2)</u>

The materials of the case are at best suggestive. It has been indicated that the case points to interactions as the primary activity of the supervisor. Information pertaining to the frequency of interactions is outlined below.

<u>Interactions</u>

<u>Nature and frequency of interactions with subordinates</u> (<u>II-B-1-a</u>). Paragraph 17 indicates the rather ambivalent nature of the supervisor's interactions with his subordinates. Although such interactions as those designed to calm and soothe "the ruffled dispositions of the girls" appear to be non-task-oriented, one might infer that the supervisor's motivation is to relieve some of the obstacles to achieving production targets, namely, those obstacles found in the sentiments of his subordinates.

Paragraphs 17, 18 and 21 are suggestive of the task-oriented nature of interactions initiated by the supervisor. Also, they suggest the neutral to aggressive nature of such interactions.

<u>Superiors (II-B-1-b)</u>. The interpersonal relations between the first-line supervisor and his line superiors appear to be based upon technologically required interactions (II-B-1b). Such interactions are frequently face-to-face, although they are also typically mediated by the various

production control reports used by management to monitor performance (paragraph 20). Overall, interactions between the supervisor and his superiors are task-oriented (paragraph 21). In particular, as paragraph 19 indicates, these interactions focus upon the strength and disposition of the supervisor's work force.

Horizontal interactions (staff specialists) (II-B-1-c). Interactions between the supervisor and the staff specialists tend to be initiated by the latter (paragraphs 16, 17). We infer that the tone of these interactions is hostile or aggressive due to the apparent ambiguity concerning the supervisor's authority and responsibility for production (paragraphs 16, 17), plus the supervisor's burden of meeting demanding production schedules (paragraph 11), a burden which probably increases when staff specialists interfere with the assemblers' tasks.

Frequency of interactions

With subordinates (II-B-2-a). Within the case description reference to the frequency of interactions between the first-line supervisor and his subordinates is minimal. Paragraph 17, however, indicates that the supervisor spent "much time" interacting with his female subordinates in order to calm and soothe their "ruffled dispositions."

For the purpose of hypotheses testing under this section, the quantitative data included in Case No. 3 is appropriate.

The quantitative data contained in Case 3 cover the regimes of two supervisors while the case description has dealt solely with the regime of a single supervisor, Teddy of Chart V. The case study focused on the role of Teddy because this was the emphasis in the source material. For the purposes of analysis, however, it will be useful to consider the quantitative information pertaining to both regimes.

Chart V indicates that the foreman in assembly line technology interacts with (communicates verbally) subordinates about once per day, as estimated by each party. However, Chart VI, which deals exclusively with the interaction patterns of the supervisor discussed in the case, presents a more complex picture. Chart VI is a record of "time spent conversing during pair and group contacts lasting over 45 seconds or 1 minute."[1]

The data presented in Chart VI introduce further refinements in the inferences stated in the preceding section. The case material reveals that the supervisor, Teddy, preferred to deal with the group leader Nel. His interpersonal relations with Gloria tended to be rather poor. Thus, one notes a measure of voluntarism in the frequency and duration of contacts with subordinates. (Note also that Nel's contacts with Gloria were nil.) In effect, then, interactions between the supervisor and his subordinate Gloria were apparently not technologically required.

Similarly, as Chart V illustrates, interactions between the supervisor and the assemblers of Gloria's group were not required. Thus, by inference, the rather extensive contacts shown between the supervisor and Nel on the one hand, and between the supervisor and his subordinate assemblers on the other hand, were not demanded exclusively by the requirements of technology.

Therefore, as we hypothesized above, it is concluded that assembly line technology requires, on the average, only minimally frequent contacts of short duration between the supervisor and individual subordinates (see also Chart VII). Interactions in excess of this minimum may or may not be task-oriented. The data do not permit a more concise statement. Table I appears to support the conclusion that the frequency and duration of supervisor-subordinate interactions are only minimally required in Category II technology.

Finally, the data of Chart V and Table I support the hypothesis that the frequency of interactions between the supervisor and his subordinates as a group will be relatively high.

<u>With superiors (II-B-2-b)</u>. Although Chart V implies a measure of discretion concerning the frequency of interactions between first-line supervisors and staff specialists, the apparently technologically required interactions between the supervisor and his sub-division chief superior appear

slightly more determinate in frequency. With the exception of Frank's more frequent interactions with the sub-division chief of the testing department, the frequency of interactions between assembly line supervisors and superiors appears to be approximately constant for both Frank and Teddy. On the average, such interactions occur more than once daily. The frequency of interactions between the assembly line supervisors (Teddy and Frank) and the engineering department sub-chief appear to be unrelated to personality differences between Frank and Teddy. By inference, then, the minimum frequency of this particular set of interactions may be technologically required, being a function of the structural correlates of Category II technology.

Once again, however, the patterns are obscure. Differences in interaction frequency between Teddy and Frank with top management suggest that personality rather than technological requirements may be operative for this class of interactions. Paragraphs 14 and 16 suggest the relatively low frequency and short duration of interactions between the first-line supervisor and his line superiors.

With staff specialists (II-B-2-c). In general, the high incidence of technological change and the difficulties associated with such changes (paragraphs 16 and 17) are suggestive of fairly frequent interactions between the first-line supervisor and staff specialists.

Chart V prompts the inference that a measure of discretion is possible regarding the frequency of supervisory interactions with staff specialists. For example, according to Chart V, Frank interacted more frequently with the scheduler and the efficiency man than did Teddy. Conversely, Teddy interacted more frequently with the foreman of the Test section than Frank.

Supervisory sentiments toward:

Subordinates (II-C-1). The preceding portions of the case study suggest that the sentiments of the supervisor toward his subordinates will tend to be neutral to slightly negative. Paragraph 17 indicates the general lack of harmony prevailing in the unit, while paragraph 21 refers to the disciplinarian norm the supervisor was expected to enforce. Paragraphs 12, 13, 14 and 18 suggest that this class of sentiments may be generally variable or unstable due to the irregular demands of technology on the assemblers, and the irregular demands of staff specialists upon the assemblers.

Superiors (II-C-2). From paragraph 16 one learns that the supervisor regards management as an "inexorable, unfriendly, and mysterious force." Apparently the supervisor's superiors lack confidence in his ability to resolve the production problems (paragraph 19). The supervisor receives virtually no advance notice of changes in procedures and no assistance from management regarding the introduction of technological changes (paragraphs 16 and 19). Management evaluation of the supervisor is highly subjective, efficiency reports not withstanding (paragraph 21). These factors suggest that the sentiments of the supervisor toward his superiors will be neutral to negative in nature and generally stable over time.

Staff specialists (II-C-3). Paragraph 17 points to the consistently hostile relations between the first-line supervisor and staff specialists.

Interpretation of Case 4

The attempt to validate the specific hypotheses pertaining first-line supervisory behavior in enterprises under Category II technology continues with an analysis of the data of Case 4.

Justification for classification

Paragraphs 1, 2, 4 and 6-14 leave no doubt that Case No. 4 pertains to assembly line technology. The characteristics of the technology described in the case are sufficiently precise to preclude any possibility that production technology Categories I and III may be involved. For example, one notes the existence of many of the structural correlates of Category II technology identified by Woodward in Chart III. Specifically, one observes 6 levels of operating management (paragraph 5), 2 more than Woodward's median. In addition, the first-line supervisor's span of control over 36 regular assemblers falls within the range of 30-44 recorded in Chart III. As Woodward suggested, there is little evidence for the existence of small primary work-groups. Paragraph 6 indicates that there is about 7.2 feet between assemblers. Also, the social groupings which do emerge (paragraphs 15, 16) appear to be unrelated to technological requirements. Also, one notes that the direct labor is manual and semi-skilled in character. The focus of skilled labor is apparently in the realm of indirect labor (e.g. testing, quality control, methods, etc.). Another structural correlate of Category II technology noted by Woodward is the existence of staff specialists, and formal production control systems. Figure V and paragraphs 30-33, and 35-36 demonstrate the existence of these correlates in this case. Finally, the high frequency of product design changes (paragraph 14) suggest that the planning and time perspective of management conforms with Woodward's data. Clearly, then, the classification of this case into Category II technology appears amply justified.

Support for Specific Hypotheses

Supervisory Activities

Nature of supervisory activities (II-A-1)

In general, the assembly line supervisor's activities are directed toward "maintaining production, quality and morale" (paragraph 24). From the limited data presented in the case, it is inferred that the majority of the behaviors exhibited by the supervisor consist of verbal, face-to-face interactions, or exchanges of communications. The description of the operation of the assembly line unit found in paragraphs 6-14 is noteworthy because of its lack of references to activities performed by the supervisor other than entering into interactions with others.

It is inferred from the case description that the assembly line supervisor interacted with (spoke to) the on-line inspectors (subordinates) and the factory engineering department (paragraph 35) whose general responsibility was to interpret engineering changes and to act as liaison between production and product engineering. It appears that the purpose of such interactions is to allow the supervisor to monitor the performance of the assemblers and to permit him to exercise direction and coordination over the various stages of production along the assembly line (paragraph 18, 19). Similarly, interactions between the supervisor and top management occurred only in routine production meetings or when special production problems came to the attention of top management (paragraph 46).

Although the first-line supervisor of the assembly unit apparently does interact with the quality control inspectors at the end of the line (paragraph 30), he lacks supervisory authority over these persons (paragraph 31). Presumably, then, he is unable to direct, or realistically monitor their performance.

Paragraphs 17-22 indicate that a portion of the supervisor's activities consist of face-to-face verbal interactions with his three subordinate working group leaders. It is through these group leaders, by means of his interactions with them, that the assembly line supervisor coordinates the activities, output and production quality of the assembly line workers.

Finally, it is inferred that an additional element of the supervisor's behavior consists of attempts to mediate, via face-to-face interactions, conflicts arising from, on the one hand, the demands of the workers as expressed through their group leaders (paragraphs 1, 14, 20-22), and, on the other hand, the production demands and expectations of management, plus the conflict between methods and supervision over authority and responsibility for production (paragraph 26).

It appears, therefore, that first-line supervisory behavior under Category II technology consists primarily of listening and talking in order to achieve the "collaboration of people" (paragraph 61). Through his face-to-face interactions with others the first-line supervisor attempts to monitor the performance of his subordinates and to effect that regular flow of specified parts and information required if production is to meet the quantity and quality standards imposed by staff specialists and whose achievement is expected by the management.

Frequency of supervisory activities (II-A-2)

The case lacks any empirical observations regarding the frequency with which the above components of supervisory behavior occur. Inferences appear to be unjustified.

Nature of supervisory interactions

Interactions with subordinates (II-B-1-a). As suggested above, the nature of the supervisor's interactions with his subordinates, and particularly the group leaders and on-line inspectors, consist of face-to-face interactions whose purpose is to facilitate the coordination of work activities along the line and to monitor the performance (quantity and quality of production) of the assembly line workers.

Although the case lacks information regarding the direction of initiation of such interactions, it appears that there is a wide measure of discretion open to the supervisor regarding with whom, how frequently and to what end such interactions will occur. Thus, it appears that the supervisor chooses to work primarily with group leader Dottie, with whom his interpersonal relations were relatively effective (paragraph 19). Interactions with group leader Jean were neutral in tone and apparently occurred infrequently (paragraph 22). The supervisor's interactions with Helen, the third group leader, were hostile in tone and probably occurred less frequently than the interactions with Dottie (paragraph 21).

All the available data point to the exclusively and immediately task-oriented nature of interactions between the supervisor and his subordinates.

Interactions with superiors (II-B-1-b). Paragraphs 37 and 41 suggest that interactions between the supervisor and his superiors occur relatively rarely. The first-line assembly supervisor is one of "several" reporting to his immediate superior (paragraph 37). It was only "seldom" that the supervisor "saw" the head of manufacturing and even less frequently the general manager (paragraph 41). Interactions between the first-line supervisor and his superiors appear to be exclusively task-oriented (paragraph 41).

Horizontal interactions (II-B-1-c). Although the work unit dealt with in this case was one element of a work flow connecting a preceding sub-assembly unit and the succeeding test department (paragraphs 10-12), there are no references to the requirement for the coordination of work among these three sequential work units. It is diffcult to infer that interactions are required among first-line supervisors in the work-flow (see Figure VI). Therefore, the discussion of horizontal interactions will be confined to the interactions between the assembly line supervisor and the various staff specialists (see Figure VI and Figure VII).

It appears from the data that horizontal interactions between the supervisor and the staff specialists consisted of face-to-face verbal exchanges of information dealing with immediate production requirements. Furthermore, the data suggest that interactions between the assembly line supervisor and the staff specialists were frequently hostile in tone (paragraphs 26-29). While part of the source of hostile relationships may be explained by the personal dispositions of, for example, the methods supervisor (paragraph 26), they were also due to the typical "buck passing" (paragraph 26) of both methods and line supervision. Apparently the parties frequently failed to agree upon the assembly line staffing requirements (paragraph 26). In addition, the hostile relations between the first-line supervisor and the staff specialists may be explained by the apparent ambiguity regarding authority and responsibility for production as indicated in paragraph 26. Paragraphs 30-33 and 41 indicate that staff specialists in engineering, methods, inspection, etc. all managed to exercise considerable authority over the operation of the assembly line and, hence, over production itself.

Frequency of supervisory interactions

In contrast to the preceding case of this chapter, reliable information pertaining to interaction frequencies is almost non-existent in this case. Therefore, the following inferences are suggestive at best.

With subordinates (II-B-2-a). It is inferred from the data of paragraphs 19-22 that the assembly line supervisor may exercise a large degree of discretion over the frequency and duration of interactions with subordinates. The same data indicate that the first-line supervisor is able to discriminate among those of his subordinates with whom he will interact.

On the basis of Figure VI and paragraph 41 it is inferred that interactions between the supervisor and his subordinates as a group probably occur more frequently than interactions with line superiors. Figure VI points to the larger number of potential interactions with subordinates. The high frequency of product design changes (paragraph 14) plus the large number of staff specialists with whom the supervisor may interact (Figure VI), suggest that the supervisor interacts more frequently with staff specialists than with his line superiors. Finally, Figure VI plus the high frequency of product design changes requiring interactions with staff specialists, suggest that interactions between the assembly line supervisor and staff specialists may occur more frequently than between the supervisor and his subordinates (see also Figure VII).

With superiors (II-B-2-b). If one accepts the preceding arguments, then the frequency of interactions between the first-line supervisor and his line superiors is relatively low.

With Staff specialists (II-B-2-c). The argument of the foregoing section suggests that first-line supervisors enter into relatively frequent interactions with staff specialists. The high order of frequency of product design changes (paragraph 14) and the importance of staff specialists in effecting these changes, are the compelling facts in this conclusion.

Interpretation of Case 4, Part II

Paragraphs 42-60 of the case study contain statements reflecting the attitudes of assembly-line supervisors toward their work and the interactions associated with work. Of interest are those attitude components of an evaluative nature which may point to supervisory sentiments toward subordinates, superiors and parties to horizontal interactions.

Sentiments toward subordinates (II-C-1)

Considerable caution must be exercised in drawing inferences from the data of paragraphs 42-60 of the case. At best, the raw data are limited in terms of the reliability and comprehensiveness of statements pertaining to sentiments.

On the one hand, paragraphs 54-57 indicate that supervisory sentiments toward subordinates may be characterized in part as empathetic. These same data suggest that assembly line supervisors share the desire and expectations of the workers that work pace, content, methods and equipment be kept as reliable and regular as possible.

Thus the data of paragraphs 54-57 point to the need to revise the specific hypothesis to the effect that, under Category II technology, the sentiments of supervisors toward subordinates would tend to range from neutral to suspicious to aggressive depending upon circumstances.

That a wide range of sentiments does exist between the first-line supervisor and his subordinates in Category II technology is evident from the data of Case 4. Thus, on the one hand, one notes the expressions of empathy in paragraphs 54-57. On the other hand, paragraphs 62, 65, 66 and 68 suggest that the sentiments will indeed fluctuate rather widely depending upon circumstances. For example, group leader Rita continually brings minor technical problems to the attention of the foreman (paragraph 62). Such problems inevitably involve the foreman in conflictful interactions with staff specialists. At one point (paragraph 62), the first-line supervisor raises his voice in anger against Rita. From paragraph 65 one notes the chronically poor production situation prevailing in the second week of operation of the assembly line. The girls were continually out of line, thus creating line balancing problems for the supervisor. Paragraph 66 records the conflict experienced by the supervisor because of the conflicting demands imposed upon. Finally, it appears that the female operatives have the supervisor "behind the eight ball" (paragraph 68); the supervisor is unable to evaluate the information provided to him by his subordinates. According to paragraph 74, relations between the first-line supervisor and his subordinates might be characterized as "negative."

Sentiments toward superiors (II-C-2)

The sentiments of assembly line supervisors toward superiors appear to be primarily those of resentment; a feeling of hopelessness. Apparently these sentiments are intense.

Paragraphs 42-60 demonstrate that the source of the supervisor's largely negative sentiments toward his superiors (paragraph 74) lies in the lack of authority possessed by the supervisor to deal with the variable demands placed upon him and his subordinates by the technology itself, plus the behavior of staff specialists (see paragraphs 42, 47, 52). As an illustration, it is noted that the assembly line supervisor seems to resent greatly (1) the lack of "clear policies" (paragraph 47) (2) the absence of "clear lines" of supervisory authority (paragraphs 45, 47, 50), and (3) lack of information coming from his superiors (paragraph 47).

Sentiments toward staff specialists (II-C-3)

The nature and origin of supervisory sentiments discussed in the two preceding sub-sections apparently are closely related to supervisory sentiments toward staff specialists. On the whole, these latter sentiments appear to be those of hostility and frustration or hopelessness. The behavior of the staff specialists, combined with the ambiguity experienced by the assembly line supervisor in regard to his authority and responsibility for production, result in a situation in which the supervisor is constantly buffeted about by staff specialists. He appears to feel as though he were caught in a fiendish maze in which three obnoxious bulls pursue him relentlessly: management, staff specialists and workers (see also paragraphs 62 and 74).

Analysis of Additional Empirical Data

In the following paragraphs the data of Appendix III are examined.

The data consist of a number of empirical observations relevant to supervisory behavior in what appear, on the basis of the descriptions of technology found in the source materials, to constitute Category II production technologies. The data of Appendix III are utilized to demonstrate either support for the specific hypotheses pertaining to supervisory behavior under Category II technology or to illustrate the extent to which the hypotheses must be refined or qualified.

A Note on Mechanistic Management

In formulating the specific hypotheses pertaining to Category II technology, the implications of mechnaistic processes of management for the behavior of first-line supervisors were elaborated. In particular, the tendency for directions and decisions to flow primarily downward from more senior line managers to the first-line supervisor and laterally to him from staff specialists was inferred. Support for the existence of the foregoing characteristics of mechanistic management processes under Category II technology is provided by the data (III,1, 3, 5, 6, 12, 23, 24, 31, 32, 34(c) and 35).

These same items equally confirm other observations regarding characteristics of mechanistic processes of management, namely: (1) reliance upon staff specialists and their various production planning and control systems (2) a high sense of urgency regarding production (see, for example, (III,36)), and (3) a high degree of functional interdependence among first-line supervisors and staff specialists, on the one hand, and first-line supervisors related to each other along the work flow, on the other (III,5, 6, 31). However, as will be demonstrated below, the data of the appendix also support observations derived in the case analyses; namely, a tendency for the theory of mechanistic management to break down in practice.

Nature of supervisory activities (II-A-1)

It was hypothesized that first-line supervisory activities under Category II technology consist, for the most part, of verbal and non-verbal interactions with subordinates, superiors, staff specialists, and fellow supervisors in the work flow, with the primary object of such interactions being to effect the directives transmitted to the supervisor by line superiors and staff specialists.

Analysis of Additional Empirical Data

The data (III,1, 3 and 5) demonstrate the importance of interactions involving the supervisor and others. (Items 10 and 17.) Also, they suggest that such interactions occur mainly with "non-workers" (subordinates) (III,10 and 17). However, the importance of supervisor-subordinate interactions is noted (III,25). The data of the appendix provide no direct support for the hypothesis regarding non-verbal interactions. However, the above mentioned items do demonstrate the importance of verbal interactions with others as perhaps the major component of supervisory activities.

As the specific hypotheses predicted, and as the additional empirical data confirm (III,1, 2, 4, 6, 7 and

and 10), the interactions of the first-line supervisor are directed toward effecting production objectives and mediating the conflicting demands of others which center upon the supervisor.

The empirical data of the appendix indicate that the specific hypotheses concerning the nature of supervisory activities under Category II technology need some qualification. In addition to immediately task-oriented interactions with others, the first-line supervisor under Category II technology appears to enter into interactions with subordinates in order to assure their training (III,33). Furthermore, the data (III,38) suggest that the supervisor encounters certain subtle pressures to interact with subordinates on matters other than those relating to the work. It appears that individual workers prefer to work under a supervisor high in consideration for them and to dislike working under supervisors high in "initiating structure" (III,13 and 38). These latter two observations appear to support the phenomenon noted in the case analyses; namely, the tendency for the theory of mechanistic management to break down in practice (see (III,32)).

Frequency of activity performance (II-A-2)

In the statement of the specific hypotheses for Category II technology it was observed that, for the most part, the frequency of activity performance by supervisors reduces to the frequency of interactions with others. See the following sections for a discussion of this matter.

Nature of interactions

With subordinates (II-B-1-a). It was hypothesized originally that interactions between the supervisor and his subordinates would be a dominant feature of supervisory activities. In addition, it was argued that, given the mechanistic nature of management, they would tend to be face-to-face, primarily task-oriented, and tense, that is, hostile, threatening, or aggressive.

As demonstrated above, the theory of mechanistic management tends to break down in practice (III,15 and 38). These data demonstrate a tendency for supervisor-subordinate interactions to be more than exclusively task-oriented. On the whole, however, the data of the appendix seem to support the specific hypotheses regarding the nature of supervisor interactions with subordinates (see (III,2, 3, 7, 10, 11, 16, 17, 22, 26, and 36)).

With superiors (II-B-1-b). Originally it was hypothesized that, given the nechanistic nature of management, the urgency of production, the frequency of crises, the supervisor's relative inability to influence production, etc., relationships between the supervisor and his line superiors will tend to be hostile and task-oriented in nature; that they will consist of both verbal and written communications.

The importance of supervisor-superior relationships and the consequent jeopardization of the feelings of subordinates are revealed in the data (III,3). It is suggested that this datum tends to support the hypothesis regarding hostile supervisor-superior interactions (see also (III,4, 25 and 26)). These data also demonstrate the hypothesized task-oriented nature of such interactions.

Horizontal interactions (II-B-l-c). It was hypothesized that horizontal interactions involving the first-line supervisor in Category II technology would be largely task-oriented, verbal as well as non-verbal and frequently tense in nature, that is, characterized by conflict over authority and responsibility.

The task-oriented nature of horizontal interactions is demonstrated in the data (III,3, 5, 6, 10, 31 and 36). It appears that such interactions may be both informal and a source of complication in supervisor-superior relationships (III,5). The latter observation is further evidence of the breakdown in practice of the theory of mechanistic management. Presumably, there is an element of tension in such horizontal interactions. However, it appears that fellow supervisors are generally seen as "helpful" (III,31). Does this fact contradict the hypothesis? No, because the recognition of the desirability of cooperative interactions would not appear, *a priori*, to exclude the possibility of tensions in such horizontal interactions.

The importance of interactions between the staff-specialist and the first-line supervisor in Category II technology is confirmed (III,4, 10, 24, and 30). The hypothesized tense and hostile relationships between the first-line supervisor and the staff specialists with whom he interacts find support in the data (III,4 and 24). However, it appears that "human relations problems" are "minimal" among line supervisors and staff groups (III,30). It might be concluded, therefore, that the data demonstrate at least a significant potential for tense and hostile interactions between first-line supervisors and staff specialists.

Frequency of interactions

With subordinates (II-B-2-a). In the original specific hypothesis it was predicted that the frequency of interactions between the first-line supervisor and his subordinates as a group would be relatively very high; that the frequency of interactions with particular individual subordinates would, however, tend, on the average, to be very low relative to the frequency of interactions with superiors, or fellow supervisors, or staff specialists.

The data indicate that emergencies are normal in Catagory II technology (III,36). Presumably such common crises situations result in frequent interactions between the first-line supervisor and his subordinates as a group, particularly when production runs are fairly short. The additional empirical data illustrate the importance of supervisor-subordinate interactions in Category II technology (III,25, 28, 29, 33 and 34). It is inferred that these data support the hypothesis regarding the frequency of such interactions.

The data also appear to support the hypothesis regarding the relatively low average frequency of interaction between the supervisor and individual subordinates (III,22). Here one notes especially the relatively large span of supervisory control and the short (1 1/2 min.) time cycle of worker tasks. Most supervisor interactions tend to be with non-workers (III,10).

With superiors (II-B-2-b). It was hypothesized originally that the frequency of interactions between the first-line supervisor and his line superiors would be fairly low relative to the frequency of his interactions with either subordinates as a group or staff specialists.

The data indicate the importance of superior-supervisor relationships (III,3), but provide no insight into the frequency of this class of interactions. Apparently the line superiors utilize a variety of non-verbal communications from staff specialists in order to monitor first-line supervisory performance (III,4). The data are suggestive of a fairly low frequency of interaction, assuming that productive output is meeting expected standards of quantity and quality. On the whole, the data of Appendix III neither support nor challenge the hypothesis.

Frequency of horizontal interactions (II-B-2-c). A relatively high frequency of horizontal interactions, especially of those involving the first-line supervisor and staff specialists, was hypothesized.

The single datum points to the inherent nature of supervisor-supervisor (work-flow) relationships under Category II technology (III,31).

Sentiments toward others (II-C-1; II-C-2; II-C-3)

The data of Appendix III do not provide sufficient information to permit either additional confirmation, or clarification and refinement of the specific hypotheses regarding supervisory sentiments toward others.

CATEGORY III TECHNOLOGY

Interpretation of Case No. 5

Classification as Category III Technology

The classification of this case poses difficulties because the technology of the enterprise appears to lie at the boundary separating Category II and Category III production technologies.

In general, the production process appears to be continuous (paragraph 3). Raw materials pass through a continuous series of processes to the final stage of finished steel. The process as whole never ceases; each stage of production depends upon those which precede and succeed it.

How well do the structural correlates of technology in this case conform to those noted by Woodward? (Chart IV above.) The number of levels of management is 5 (Figure VIII); that is one less than the median number noted by Woodward. The chief executive span of control is 8 (Figure VIII), 2 less than Woodward's observed median. In terms of first-line supervisory span of control the figure is about fifteen for the Coke Ovens (paragraph 4); a number which lies in the range observed by Woodward. Also, there appears to be evidence for the existence of small primary work groups. For example, in the Melting Shop each furnace is attended by four workers (paragraph 12). Woodward suggests that, within enterprises under continuous-process technology, the few staff specialists which exist will not be easily distinguishable from line personnel. She suggests that "ideological" conflict between line supervisors and staff specialists will be minimal. Paragraphs 20 and 22 of the case suggests that production control within this enterprise is relatively simple and easily handled by the supervisor himself. The type of line-staff consultation described in paragraph 19 indicates that conflicts will be rare; the staff specialist in the testing laboratory appears to provide an unmistakable service to the line supervisor. The source of technical competence of supervisors in this plant is undergoing change in a direction consistent with that noted by Woodward (paragraphs 25, 26 and 27). It is inferred from paragraph 22 of the case that management by committee may be fairly common, and therefore conform with Woodward's observation. It is noted from paragraph 23 that communications tend to be mainly verbal, an additional structural correlate of continuous-process technology. Because the supervisor receives his production orders on a weekly basis (paragraph 19); and because the products and processes are probably very stable over time, it is inferred that the sense of urgency of production is fairly low. According to Woodward (Chart IV) a characteristic of continuous process technology is the minimal interdependence among marketing, production and development. Figure VIII above denotes the absence of well-developed marketing and development functions in this enterprise. By inference, then, Woodward's observation is supported by the case data. Paragraph 22 provides additional indirect support of this inference. The latter paragraph indicates that the supervisor's interactions occur mainly with maintenance personnel, fellow production supervisors and unidentified staff specialists.

Clearly, the classification of the technology in Case 5 rests upon many inferences from rather incomplete data. Classification under Category III technology would appear to be the most reasonable choice. Given the relatively great subjectivity of the classification, it will not be surprising if the data do not support fully the specific hypotheses regarding first-line supervisory behavior under continuous-process technology.

Presence of Organic Management Processes

Although analysis of the case does not indicate that mechanistic management processes exist to any significant degree within the enterprise described in Case No. 5, some evidence in favor of organic management processes is to be found. Rather considerable inferences are required to support the argument for the presence of organic processes of management.

For example, the fact that the nature of the furnace operator's work is "very skilled" (paragraph 24) suggests the "contributive nature of special knowledge and experience to common tasks of the enterprise." Similarly, for the policy regarding the promotion of Coke Oven supervisors. In this instance technical expertise and experience count heavily (paragraph 25).

By inference, individual tasks tend in part to be set by the total situation of the enterprise. For example, the fact of shift work in the enterprise results in variable responsibility and spans of control for supervisors on different shifts (paragraphs 8 and 20). Similarly, the very nature of preventative maintenance in continuous-process technology appears to confirm this attribute of organic management processes. Finally, because steel production quantity and quality is based upon "convenient" situations during the week rather than according to set orders, it appears that individual tasks are partially a function of the total situation of the enterprise (paragraph 19).

An additional characteristic of organic processes of management consists of the adjustment and continual re definition of individual tasks through interactions with others. The importance of continuous preventative maintenance in the enterprise of Case 5 suggests that this attribute of organic management processes may be partially realized (paragraph 9).

The case data indicate that the <u>ad hoc</u> location of control authority based upon expertise may be a feature of the enterprise described. Thus, the shift-foremen tend to rely upon the knowledge and judgement of experienced workers (paragraph 25). Furthermore, the foremen's jobs are "high responsible" and they go about their work without much "interference" from superiors (paragraph 36).

Given the requirement for continuous coordination among supervisors in order to attain steady production; and given the fact that vertical communications are difficult due to the size of the area supervised, it is inferred that lateral communications play an important role in this enterprise (paragraphs 22, 28 and 36).

Finally, the fact that lateral coordination and communication are required if continuous production is to be achieved (paragraph 22) suggests that advice and information, rather than instruction and decisions, are communicated to and by the supervisor.

In other words, the observations regarding the presence of organic management processes in continuous-process technology appear to be supported by the case data, assuming the validity of the foregoing inferences.

Support for Specific Hypotheses

Supervisory activities (III-A-1)

(1) Application of technical knowledge and the exercise of technical skill

Generally, the specific hypotheses of this sub-section are supported by the case data. Thus, one notes the foremen responding to fairly long range production schedules (e.g. one week in advance) (paragraph 19). On the basis of these schedules the supervisor makes a fairly narrow range of complex technical decisions--e.g., the sample chaser monitors the production of steel in accordance with specifications (paragraph 17). In the Rolling Mill and Melting Shop foremen adjust production as they see fit, but in accordance with the weekly schedule (paragraph 19). Similarly, one finds indirect evidence that the supervisor advises subordinates regarding technical adjustments required. For example, the Coke Ovens supervisor decides upon the required temperature for each oven and coordinates production through his assistant (paragraph 6).

The data do not illustrate the behavior of supervisors under situations of crises.

(2) The data do not confirm the specific hypotheses regarding administrative activities. In fact they contradict those hypotheses.

It was originally hypothesized that the supervisor's administrative activities under Category III technology would not correspond to those under Category I technology. That is, the supervisor would not typically be involved in coordinating work flow between successive work units, and negotiating with fellow supervisors along the work-flow (e.g. maintenance). To a degree, each of these supervisory activities appears to be present in the enterprise described in Case 5. As hypothesized, one finds evidence that the supervisor does utilize production reports to monitor the performance of his subordinates and the processes they control (paragraphs 12 and 20). However, contrary to the specific hypotheses, one notes evidence for supervisory administrative activities pertaining to coordinating work flow between successive units (paragraph 19), and, by inference, negotiating with fellow supervisors along the work-flow.

(3) Evidence confirming the specific hypothesis regarding supervisory activities, the nature of which consists of face-to-face interactions with others, is considerable although indirect. By inference, such interactions are part of the Coke Ovens supervisor's activities (paragraphs 6 and 9). Similarly for the supervisor of the Blast Furnaces (paragraph 12 and 14), the Melting Shop (paragraph 16), etc.

<u>Frequency of performance of activities (III-A-2)</u>

The quality of the data does not permit either substantiation or rejection of the specific hypotheses of this sub-section.

Nature of interactions

With subordinates (III-B-1-a). The data lack useful insights regarding the nature of this class of interactions.

With superiors (III-B-1-b). It was hypothesized originally that supervisor-superior interactions would be face-to-face, task-oriented and largely devoid of conflicts over authority and responsibility; that interactions would be based upon the communication of advice and information as well as instructions and directions.

The data of the case include indirect references which appear to confirm these specific hypotheses. By inference, the continuous-process, three-shift operation of the enterprise will require face-to-face interactions between first-line supervisors and the day-shift superiors. Paragraphs 11 and 35 provide explicit evidence of face-to-face interactions between the supervisor and his line superiors. The fact that (1) generally the actual progress of work remains the responsibility of the first-line supervisor (paragraphs 9 and 12), (2) first-line supervisors experience little interference from their superiors (paragraph 35), and (3) supervisors feel very close to their managers (paragraph 34), indicate that interactions are largely devoid of conflict over authority and responsibility. Paragraphs 9, 12, 17 and 19 indicate that first-line supervisor-superior interactions involve the communication of instructions as hypothesized. The "informal" interactions noted in paragraph 35 suggest that advice and information may also be communicated.

Horizontal interactions (III-B-1-c). It was hypothesized that the first-line supervisor would enter into interactions with fellow supervisors either along the work-flow, or in the maintenance units of the enterprise. Furthermore, it was predicted that such interactions would be task-oriented and generally devoid of conflict over authority and responsibility.

Paragraph 19 highlights the importance of supervisor interaction along the work-flow in order to effect co-ordination of the overall production process. Paragraph 22 suggests the importance of interactions with maintenance engineers and their workers. Such interactions are clearly task-oriented. There is no evidence that this class of interactions is characteristically conflictful.

Further to this class of interactions, it was hypothesized originally that interactions between the first-line supervisor and staff specialists would be of limited importance. Because the technology described in this case is relatively primitive (paragraph 28), and production control is still in the hands of the supervisor (paragraphs 17, 20), interactions between the supervisor and the laboratory technician appear to be important. As hypothesized, however, one finds no evidence that such interactions are a source of conflict.

Frequency of interactions

The quality of the data is insufficient to permit testing of the specific hypotheses of this section.

Supervisory Sentiments

Toward subordinates (III-C-1). The data is insufficient to test the specific hypotheses under this subsection.

Toward superiors (III-C-2). Originally it was predicted that the sentiments of first-line supervisors vis-à-vis their superiors would be neutral to friendly in tone and somewhat unstable over time due to the occurrence of production crises. The data contain no references to the sentiments of personnel given the occurrence of production crises. Paragraphs 34 and 35 appear to confirm the first part of the hypothesis.

Toward parties in horizontal interactions (III-C-3). As noted above, horizontal interactions involving the supervisor appear to be devoid of conflict over authority and responsibility. By inference, the sentiments of supervisors toward fellow first-line supervisors and staff specialists are friendly to neutral in tone. The data do not permit one to ascertain whether or not such sentiments are affected by production crises.

Interpretation of Case 6

Classification as Category III technology

The technological processes described in Case 6 are explicitly those of continuous-process technology. In comparison with the technology and technological correlates delineated in Case 5, Case 6 appears to fit more accurately the median or ideal characteristics noted by Woodward.

Echoing Woodward (Chart IV), Blauner notes the extremely "complex" nature of continuous process technology (paragraph 2). Paragraphs 5 and 38 of Case 6 confirm Woodward's observation regarding the source of technical competence of managerial personnel as well as the relatively high degree of required supervisory and managerial technical competence.

Paragraphs 7, 8 and 21 are consistent with Woodward's observation (Chart IV) regarding the presence of small primary work groups in continuous-process technology. In paragraph 8, for example, we note the three-man work team.

The levels of management in the organizational hierarchy is six (paragraph 13), which equals the median number noted by Woodward. In other words, the management communication line is fairly long.

Given the small primary work groups noted above, the median first-line supervisory span of control in the enterprises described in Case 6 appears to be considerably smaller than the range of 11-18 noted in Woodward's study.

As noted by Woodward, production workers may potentially exercise a high degree of control over production (paragraph 15).

Paragraphs 1 and 6 confirm the built-in, virtually automatic nature of production control procedures or systems.

Woodward observes (Chart IV) that under continuous-process technology staff specialists tend to be few in number and not easily distinguishable from the line supervisor (e.g. in terms of knowledge and skill). She observes that "ideological conflict" between the supervisor and the staff specialist is rare. Paragraphs 28 and 33 appear to confirm these observations. For example, in paragraph 28 one notes the supervisor engaged with a staff specialist in what is an atypical situation. Paragraph 33 indicates that their relationship is basically one of mutual confidence.

Paragraphs 19 and 20 confirm in a very explicit way the low sense of urgency of production which Woodward noted. Paragraph 20 suggests that continuous-process technology is indeed characterized by a high ratio of direct to indirect workers.

The fact that plants utilizing a continuous-process technology are not large (paragraph 2); that decentralization within a given plant is characteristic (paragraph 3); that security of employment is high (as noted by Woodward) (paragraph 4); and that line-staff relationships are basically non-conflictful--these observations suggest that Woodward's claim regarding the rareness of organizational problems may be confirmed by the data of Case 6.

In other wrods, the organizational correlates of continuous-process technology recorded by Joan Woodward (Chart IV) are well substantiated by the data of Case 6.

Organic Management Processes

The testing of the specific hypotheses regarding the dimensions of supervisory behavior under varying technologies has rested heavily upon the ability to demonstrate the presence of either mechanistic or organic management processes. Does the preceding case provide evidence for the existence of organic processes of management in continuous-process technology?

One of the dimensions of organic processes of management is the contributive nature of special knowledge and experience to the common tasks of the enterprise. The status and skill hierarchies of the small work teams (paragraphs 21 and 22) suggest the presence of this characteristic of organic management processes. Further evidence is provided by the fact that the operator does engage in interactions of consultative nature with his supervisor and staff specialists (paragraph 26). In fact, such consultations appear to be an integral feature of employment in continuous-process technology (paragraph 26).

Paragraph 28 demonstrates the staff specialist engaged in direct production activities in an instance where his special knowledge and experience are thought to be relevant.

The setting of individual tasks according to the total situation of the enterprise is an additional dimension of organic management. Paragraphs 9 and 10 illustrate that the nature of the operator's activities depend heavily upon the state of the process. The nature of the activities or tasks of supervisors and staff specialists similarly is determined by the state of the continuous process (paragraphs 28-34).

The references cited in the previous paragraph illustrate that in continuous-process technology there tends to be adjustment and redefinition of individual tasks through interactions with others. The interdependence of team activities (paragraph 21) is an additional illustration of this attribute of organic management processes.

Ad hoc location of control authority based upon expertise is well documented in the case study. The supervisor's use of production control reports (paragraph 24) is one example. The well-developed practice of technical consultation noted in paragraph 26 is an additional example. Finally, paragraphs 28-34 illustrate this characteristic of organic processes of management.

The decentralization within the enterprise (paragraph 3) and the lack of constant job pressure (paragraph 15) and close supervision (paragraphs 16 and 23), suggests that communications within the work team tend to be lateral rather than vertical. Paragraphs 28 to 34 suggest that the supervisor communicates more frequently and for longer durations with staff specialists than with his line superiors.

The final characteristic of organic management processes--namely, the communication of advice and information rather than mainly instructions and decisions--is demonstrated in the continuous-process technology described in the case study by paragraphs 22, 24, 26, and 28-34.

It is evident, therefore, that the continuous-process technology dealt with in Case 6 is characterized by the practice of organic management processes.

Support of Specific Hypotheses

Supervisory activities (III-A-1)

(1) Application of technical knowledge and the exercise of technical skill

The basically ideal nature of the specific hypotheses under this sub-section is well illustrated by reference to Case 6. The specific hypotheses appear to be more completely supported by Case No. 5. That is, the data of Case 6 indicate the need for recognizing the effects of more highly developed technology within Category III. The case data do not provide support for the specific hypotheses pertaining to the supervisor giving technical advice to subordinates. Rather paragraphs 19,26, 30 and 42 illustrate the active listening role of the supervisor. In effect the first-line supervisor uses his subordinates as sources of technical information and relies upon their judgement, experience and discretion.

Paragraphs 28-34 provide support for that portion of the hypothesis regarding the supervisor seeking the technical advice of staff specialists.

(2) Originally it was hypothesized that the first-line supervisor would not typically perform the administrative activities outlined in Chapter III. It was hypothesized that at most he would review periodic production reports as a means of monitoring the performance of his subordinates and the processes they control. The data of the case do not appear to support the hypothesis.

The responsibilities of the head shift operator (presumably the first-line supervisor) as described in paragraph 14 clearly include extensive administrative activities. Furthermore, the role of the supervisor as described in paragraphs 28-34 appears to involve administrative activities of the kind outlined in Chapter III.

(3) Paragraphs 14, 19, 22, 26 and 28-34 provide confirmation of the specific hypothesis to the effect that interactions with subordinates would comprise an important

element of the supervisor's activities. Paragraphs 19, 26, 30 and 42 underscore the requirement to reformulate the specific hypotheses of this sub-section to include an active listening role as the supervisor seeks the technical views of subordinates.

Frequency of activities (III-A-2)

The data lack the quality necessary to permit confirmation of the specific hypotheses of this sub-section.

Nature of interactions

With subordinates (III-B-1-a). Paragraphs 14, 19, and 26 support the specific hypotheses of this sub-section. The data confirm the face-to-face, generally informal (consultative) interactions which apparently are devoid of conflict over authority and responsibility. The latent conflict implied in paragraphs 28-34 appears to concern pride in expertise rather than authority and responsibility as such.

With superiors (III-B-1-b). The data contain no significant references to interactions between the first-line supervisor and his superiors.

Horizontal interactions (III-B-1-c). While interactions between the first-line supervisor and maintenance supervisors occur as hypothesized (paragraph 14), it is not possible to evaluate the nature of these interactions given the limitations of the data. Horizontal interactions based on work flow do not appear as part of the case description. Paragraph 14 raises a question regarding the validity of the specific hypothesis to the effect that interactions with staff specialists would be of limited importance, excluding crises situations. Apparently the supervisor does interact with staff specialists in arranging for the transport of materials and products to and from the plant (paragraph 14).

Paragraphs 28-34 appear to confirm the hypothesis that interactions with staff specialists will be devoid of conflict over authority and responsibility, and that they will be characterized by the mutual communication of advice and information.

Frequency of interactions

As with Case 5 it is not possible to either confirm or refute the specific hypotheses of this section given the limitations of the data.

Supervisory sentiments

Toward subordinates (III-C-1). It was hypothesized that supervisory sentiments toward subordinates would tend to be neutral to friendly in tone. Although the data are devoid of explicit references to this matter inferences may be warranted. Because (1) the work pace and atmosphere are relaxed during smooth operations (paragraph 16) (2) the operators control their own work pace (paragraph 16) (3) workers are relatively free to determine their work techniques (paragraph 19) (4) mobility within the plant area is considerable (paragraph 20) and the perceived burden of supervision is light (paragraph 23) (5) work teams tend to be cohesive and sources of identity for operators (paragraph 22), and (6) two-way supervisor-subordinate communications are more prevalent in continuous-process than other technologies (paragraph 23)--because of these conditions of the work environment in continuous-process technology it is inferred that sentiments between the first-line supervisor and his subordinates are, as hypothesized, neutral to friendly in tone.

Given the alternation between routine and crises that is characteristic of continuous-process technology, it is inferred that sentiments will exhibit a certain degree of instability over time (e.g. see paragraphs 36, 39 and 40).

Toward superiors (III-C-2). The case data are of insufficient quality to permit testing of the specific hypotheses of this sub-section.

Toward parties in horizontal interactions (III-C-3). The data are insufficient to permit testing of the specific hypothesis pertaining to the sentiments of first-line supervisors toward maintenance personnel and fellow first-line supervisors. If one accepts the conclusion that paragraphs 28-34 confirm the hypothesis that interactions with staff specialists tend to be devoid of conflict over authority and responsibility, then one may conclude that sentiments between first-line supervisors and staff specialists are friendly to neutral in tone. There is no evidence in the data to support the prediction that such sentiments will tend to be unstable over time due to the occurrence of production crises.

Analysis of Additional Empirical Data

The following paragraphs, which bring Chapter VII to a close, provide an analysis of the data of Appendices IV and V.

Structural correlates of continuous-process technology

In the preceding case analyses the technological classification of the case studies has been in terms of the degree of fit with the structural correlates of technology (Charts II, III and IV). The data of the appendices pertain to two structural correlates of continuous-process technology.

According to Chart IV, the presence of small primary work groups is a characteristic of continuous-process technology. The data of the appendices question the universal validity of the observation. Thus, on the one hand, one notes nine operators of a continuous seamless pipe mill scattered over some 45,000 square yards (IV,A,3 and IV,B,2). On the other hand one notes two operators manning the controls in a power palnt where physical isolation has virtually been eliminated due to the integration and centralization of controls (IV,B,3). These conflicting data indicate the need for additional research designed to delineate the composition, structure and behavior of work groups under continuous-process technology.

According to Charts II, III and IV, one expects to observe a progressive increase in the number of levels of management from Category I to Category III production technology. However, the additional empirical data (V,C,3) indicates that within enterprises under continuous-process technology a development toward increased automatic controls may result in the reduction of the number of levels of management within the enterprise. Additional research will be needed to clarify the behavior of this structural correlate of production technology both within and among the major categories of technology.

Organic processes of management

In general, the data of the appendices both support and challenge the hypotheses regarding the characteristic dimensions of organic management processes within continuous-process technology. For example, organic management processes are characterized by the setting of individual tasks according to the total situation of the firm. The appendix data suggest on the one hand, that responsbilities are heavy and few duties specifically assigned (IV,7). On the other hand primary tasks may be clearly defined and accepted as such (IV,10(a)). The contradiction between these two references is apparent. An explanation of this apparent contradiction may include the realization that datum (IV,10(a)) is based upon Woodward's study of a rather large sample of continuous-process enterprises, and, hence, represents an average condition. On the other hand, datum (IV,7) is probably based upon a smaller sample, and hence, represents a more unique condition.

An additional feature of organic management processes pertains to the ad hoc location of control authority based upon expertise. Two references (IV,10(b)) and (V,A,4) support this premise plus the fact that it is associated with continuous-process technology.

A characteristic of organic management processes which, it was argued, would be associated with continuous-process technology concerns the predominance of lateral over vertical communications. If in fact supervisors tend to concentrate upon inspection and control functions (IV,2) then, the observation might be challenged. On the other hand, if team work by all crew members is important at all times (V,A,3) then, the observation may be confirmed in part.

Therefore, notwithstanding the apparent existence of organic processes of management in the enterprises described in Cases 5 and 6, the pervasiveness and detailed characteristics of this type of management process under Category III technology requires additional elucidation.

Support for Specific Hypotheses

Supervisory activities (III-A-1)

(1) Application of technical knowledge and the exercise of technical skill

In general, the data of the appendices confirm the reformulation of our specific hypotheses under this section as found in the interpretation of Case No. 6. The technical advisory role of the supervisor is implied in items (IV,4), (V,B,2) and (V,B,4).

(2) Administrative activities

The observation that supervisors tend to concentrate upon inspection and control functions (IV,2) lends support to the reformulation of the specific hypothesis of this subsection to conform more closely with the hypothesis regarding administrative activities under Category I technology. Reference (IV,B,1) represents additional confirmation.

(3) In the interpretation of Case 6 the apparent need to reformulate the specific hypotheses pertaining to supervisory activities whose nature consists of interactions primarily with subordinates was demonstrated. Specifically, the requirement to extend the hypotheses to include an active listening role on the part of the front-line supervisor as he seeks the technical views of his subordinates was noted. The additional empirical data offer confirmation of the validity of this reforumlated hypothesis (V,A,7)

and (V,A,4).

Frequency of activities (III-A-2)

The data of Appendices IV and V shed no light on the validity, or otherwise, of the specific hypotheses of this sub-section.

Nature of interactions

With subordinates (III-B-1-a). Analysis of the additional empirical data fails to produce evidence contradicting the specific hypotheses of this sub-section. The free interaction of workers roughly equal in status with their superiors (IV,8); the slight pressure to get out production (IV,9); the clear and accepted definition of primary tasks (IV,10(a)); the listening behavior of the supervisor (V,A,4), (V,A,6)--these observations appear to support the hypotheses that interactions between the first-line supervisor and his subordinates will be face-to-face, informal (i.e., consultative in nature), and devoid of conflict over authority and responsibility.

With superiors (III-B-1-b). The additional empirical data of the appendices do not permit testing the specific hypotheses of this sub-section.

Horizontal interactions (III-B-1-c). Additional validation of the specific hypotheses concerning the nature of horizontal interactions is not possible given the quality of the data.

Frequency of interactions

With subordinates (III-B-2-a). An average of 5 contacts per day between workers and their supervisors is noted (V,A,4). Although the data of the appendices do not permit evaluation of the specific hypotheses regarding the relative frequencies of interactions between the supervisor on the one hand, and subordinates, superiors and parties to horizontal interactions on the other hand, the hypotheses regarding the relative frequency of subordinate-supervisor interactions within the three categories of production technology is partially varifiable. Thus, it was hypothesized that the frequency of interactions between supervisors and their subordinates would be greater in Category III technology than in Category II technology.

It appears that the median frequency of such interactions in Category II technology varies between once per day and "at least twice per day but less than once per hour" (III,39). It is possible, therefore, that the observation at (V,A,4) confirms this hypothesis.

The data of the appendices do not permit additional testing of the specific hypotheses regarding the frequency of either interactions with superiors, or horizontal interactions.

Supervisory sentiments

Toward subordinates (III-C-1). The specific hypothesis that sentiments of supervisors toward workers would tend to be neutral to friendly in tone would appear to be supported by the observation that hostility between the supervisor and his crew was almost non-existent (V,A,6).

The quality of data in Appendices IV and V does not permit additional testing of the specific hypotheses pertaining to the nature of supervisory sentiments toward superiors, or toward parties in horizontal interactions.

Chapter Summary

The preceding analysis has sought to test the validity of the specific hypotheses regarding supervisory behavior under the three categories of industrial production technology. The quality and comprehensiveness of the data posed serious limitations upon the extent and objectivity of the testing. In the following chapter the conclusions to be drawn from the foregoing analysis will be stated.

FOOTNOTES ON CHAPTER VII

[1]F.L.W. Richardson, Talk, Work and Action (Ithaca, New York: The Society for Applied Anthropology, Cornell University, New York State School of Industrial and Labor Relations, 1961), p. 54.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Introduction

The purposes of this final chapter are three-fold: (1) to present the conclusions of the preceding analyses in a manner which illustrates the apparent consequences of industrial production technology upon those dimensions of first-line supervisory behavior dealt with in the study (2) to offer a few observations regarding the implications of the study for organization theory, and (3) to enumerate the main avenues of possible subsequent research suggested by the analysis.

Conclusions

The analysis undertaken in this study started from the premise that

> Technology, because it influences the roles defined by formal organization, must therefore influence industrial behaviour, for how a person reacts depends as much on the demands of his role and the circumstances in which he finds himself, as on his personality.[1]

An attempt has been made in the analysis to test the specific hypotheses developed in Chapter III regarding the demands of the supervisor's role and the circumstances in which he finds himself in each of the three categories of industrial production technology. What conclusions may be drawn from the analysis?

Structural Correlates of Technology

In varying degrees, depending upon the distinctive characteristics of technology and organization found in each of the six case studies, it was possible to illustrate the presence of the structural correlates of production technology noted by Woodward. In particular, the manner in which organic and mechanistic management processes occurred in the enterprises described in the case studies was demonstrated.

The analysis appears to point to the conclusion that organic management processes are more or less identifiable characteristics of most Category I and Category III production technologies. However, it is noted from the analysis of Chapter VII that the theory of mechanistic management characteristic of enterprises under Category II technology tends to break down somewhat in practice. Thus, although certain features of mechanistic management appear to be present in Category II technology, their impact on first-line supervisory behavior does not conform to the theory. In particular, the first-line supervisor finds himself without a "precise definition of duties, responsibilities and power. . . ." Similarly, as enterprises under Category I technology increasingly assume the organizational characteristics associated with Category II technology, residues of mechanistic processes of management tend to develop. For example, the Case 2 supervisory role demands regarding technical matters tend to approach those hypothesized to be found under Category II technology. In addition, the quality of supervisory sentiments toward immediate superiors revealed in Case 2 exhibit a shift in the direction of those regarded as correlates of Category II technology.

A second qualification of the observations regarding mechanistic management processes relates to the "very limited area of discretion" possessed by the first-line supervisor concerning the activities he performs and the nature of his interactions with others. While the broad parameters of these interactions appear to be determined by technology and its structural correlates (see Figures VI and VII), the first-line supervisor in enterprises under Category II technology in fact exercises some discretion in deciding with whom and how frequently he interacts, particularly with subordinates. For example, although he has a relatively large span of control, he interacts mainly with his favorite group leaders. In effect, he selects the subordinate through whom he attempts to realize production objectives. On the whole, however, the nature of the technology does appear to determine the object of supervisor-subordinate interactions. In addition, technological and role demands appear to determine the object, or raison d'etre of interactions with staff specialists and supervisors. Finally, although the first-line supervisor in enterprises under Category II technology apparently has little discretion over the frequency or direction of initiation of interactions with superiors, there seems to be an area of discretion in terms of frequency and direction of initiation of interactions between the supervisor and staff specialists.

By utilizing the data of the case studies an effort was made to validate the specific hypotheses regarding the dimensions of supervisory behavior enunciated in Chapter III. Where the analysis indicated that the hypotheses could not be defended in their original form they were reformulated. What results emerge from the analysis? That is, what conclusions might be drawn regarding the relationship between industrial production technology and first-line supervisory behavior? More generally, what are the implications for organization theory suggested by the analysis?

First-line Supervisory Behavior and Industrial Production Technology

The analysis indicates that first-line supervisors in Category I technology review production orders and their attendant specifications. On the basis of these data the supervisor typically makes a fairly broad range of technical production decisions, or gives technical advice to his subordinates regarding (a) choice of work tools, methods and work sequence (b) the content of individual worker's tasks, and (c) the pace of work and the quality of production required (mainly when unforeseen difficulties arise). The first-line supervisor may become personally involved in contributing his technical knowledge and experience to the direct production activities of his subordinates if unforeseen production problems or excessive work loads develop.

In comparison with the requirement for and scope available to the first-line supervisor in Category I technology regarding the exercise of technical knowledge and skill, the supervisor in Category II technology is restricted. He typically neither possesses, nor is required to possess, a significant body of technical knowledge or set of technical skills. In enterprises characterized by Category II production technology it is the staff specialist rather than the first-line production supervisor who executes activities and decisions demanding relatively advanced technical knowledge and skill. With the exception of those activities designed to influence the pace, volume and quality of production--activities which involve interactions with staff specialists as well as subordinates--the technically oriented activities of the first-line supervisor under Category II technology are very limited.

Like the role demands of the supervisor under Category I technology and in contrast to the role of the supervisor under Category II technology, the role demands of the first-line supervisor in enterprises utilizing continuous-process technology include an important technical element. The continuous-process supervisor responds to fairly long-range production schedules (e.g., one week in advance) by executing relatively complex technical decisions regarding production specifications. Depending upon the degree of adjustments required in the process, the supervisor advises subordinates, although the latter exercise a considerable degree of discretion in making technical adjustments to the process, particularly in the more advanced forms of continuous-process technoloty. When production crises or non-routine situations emerge the first-line supervisor frequently seeks the advice of both staff specialists and subordinates. He also communicates technical advice to subordinates in such situations.

Certain hypothesized administrative activities do not appear to figure predominantly in the behavior of the first-line supervisor in CategoryItechnology. For example, activities such as coordinating work flow between successive work units and negotiating with fellow first-line supervisors along the work-flow for access to scarce organizational resources, do not appear to be major activities of the first-line supervisor in unit and small-batch production technology. However, administrative activities such as preparing personnel attendance and production reports, and coordinating and monitoring the work-flow through his unit do seem to be significant elements within the first-line supervisor's set of characteristic activities in Category I technology.

In Category II technology, supervisory administrative activities include coordinating and monitoring the work-flow through his unit, as in Category I technology. More generally, the great bulk of first-line supervisory activities under Category II technology appear to consist almost exclusively of verbal interactions with subordinates, superiors and staff specialists.

Whereas under Category I technology work-flow interactions among first-line supervisors do not appear to be technologically required, this class of interactions appears to be an indeterminate phenomenon in enterprises under Category II technology. On the one hand, work-flow interactions do not seem to figure predominantly in the role demands of the first-line supervisor under Category II technology. For example, neither Figure VI nor Figure VII suggest the importance of such interactions. However, as will be developed in more detail below, such interactions in fact range from being insignificant at one extreme to being inherent in the activities of the supervisor at the other extreme.

The primary objectives of supervisory interactions under Category II technology are (1) to effect the directives transmitted to the supervisor by his line superiors and the staff specialists (2) to achieve the collaboration of subordinates and staff specialists (3) to monitor the performance of his subordinates' activities (4) to coordinate the activities of his subordinates, and (5) to mediate conflicts between himself, and subordinates and staff specialists on the one hand, and subordinates and staff specialists on the other. That is, his interactions with others are both immediately task-oriented (items 1 and 4 above) and partially non-task oriented (item 5).

Administrative activities of first-line supervisors in continuous-process technology appear to be more important than in Category II technology and equal in importance to that found in enterprises employing Category I technology. Thus, in contrast with the situation under Category I technology, and like certain forms of Category II technology (see below), the continuous-process supervisor may coordinate the flow of work between his and succeeding work units, particularly when automatic or semi-automatic controls are absent. He frequently utilizes production control reports to monitor the performance of his subordinates and the production processes which they control, particularly in the more advanced stages of continuous-process technology, that is, where the process controls are comprehensive and automatic. Other administrative activities may include arranging maintenance priorities and programs as well as the transport of products and materials to and from the production site.

In contrast with the behavior of first-line supervisors under either Category I or Category II technology, the continuous-process supervisor appears to concentrate upon inspection and control functions designed to assure the safety of his workers and the process itself, as well as to achieve production objectives.

Face-to-face interactions mainly with subordinates appear to figure predominantly in the activities of the continuous-process first-line supervisor. In Category II technology such interactions are mainly with non-workers, as indicated above.

In contrast with the behavior of supervisors in Category I and II technology, the supervisor in continuous-process forms of technology appears to listen actively to his subordinates and to seek their technical advice regarding the state of the process and problems associated with it. His role as a link between workers and management seems to be more highly developed in continuous-process technology than in either of Category I or Category II technology.

Relative Frequencies of Activities Performed by the Supervisor

Throughout the analysis it was necessary to be conscious of the limitations to hypotheses testing imposed by the quality of the data. This situation makes itself particularly felt in regard to the hypotheses pertaining to the relative frequencies with which activities are performed and interactions occur. Because the specific hypotheses regarding the relative frequencies at which supervisory activities are performed remain untested, conclusions are unwarranted. Restatement of the specific hypotheses at this point would not be consistent with the purposes of this chapter.

The Nature of Interactions Involving the First-Line Supervisor

Although the limitations of the data posed problems in testing the specific hypotheses of this section, a series of inferences from the data indicate that the following observations have some validity.

In general, interactions between the first-line supervisor and fellow supervisors along the work-flow appear to be minimally required in Category I technology. To the extent to which they occur, this class of interactions appears to be relaxed. That is, interactions between fellow first-line supervisors in Category I technology appear to be task-oriented and devoid of conflict over authority and responsibility.

As indicated above, under Category II technology interactions between first-line supervisors along the work-flow range from a very minimal requirement as reported in Cases 3 and 4 (where the technology is that of the manufacture of electrical components), to being virtually inherent in the nature of supervisory activities (e.g., in the production of automobiles (III,31)). To the extent that such interactions are required and occur, they tend to be verbal and task-oriented.

The data pertaining to interactions between first-line supervisors and staff specialists under Category II technology is more extensive. The analysis points to the conclusion that interactions between staff specialists and first-line supervisors in Category II technology tend to be fact-to-face, task-oriented, and frequently hostile in tone. The latter characteristic appears to find its source in the practices of mutual "buck passing" and the by-passing of the supervisor by the staff specialist. It is interesting to note that, in contrast, Category I technology staff specialists appear to take explicit cognizance of the supervisor's sphere of authority and responsibility, that is, avoid by-passing. Consequently, the quality of interactions between first-line supervisors and staff specialists appears to be greater in Category I technology than in Category II technology.

Although the data in regard to interaction patterns in continuous-process technology is of limited scope and quality, certain tentative conclusions appear warranted.

Within continuous-process technology the requirement for interactions between supervisors related to each other by the work flow appears to diminish as the extent of automatic controls over the process increases. Similarly, the importance of interactions between the first-line supervisors and scientific staff specialists (e.g., testing laboratory technicians) varies with the sophistication of production controls. Where such controls are few and rudimentary, interactions between the supervisor and this class of staff specialists assumes greater significance. Where production control is complete and virtually automatic, such interactions appear not to be technologically required, except in non-routine or crisis situations. The analysis indicates that interactions between the first-line supervisor and staff specialists (e.g., development scientists) tend to be task-oriented, face-to-face, and devoid of conflicts over authority and responsibility. The latter characteristic appears to be typical of both Category I and Category III technology but atypical of Category II technology. The communication of advice and information, rather than primarily decisions and instructions, appears to be a characteristic of interactions between first-line supervisors and staff specialists under Category III technology. The latter feature of horizontal interactions appears to be atypical of Category II technology.

While, in general, interactions between supervisors and their line superiors under Category I technology, tend to be face-to-face, they may also be mediated by the reports of staff specialists. Also, while such interactions are generally devoid of conflict over authority and responsibility, certain ambiguities regarding the limits of the first-line supervisor's authority and responsibility may be present. The latter phenomenon is perhaps a manifestation of a mechanistic residue existent in the organic management processes.

The analysis indicates that interactions between the first-line supervisor and his line superiors in Category II technology tend to be characterized by hostility. They appear to be concerned exclusively with production quantity and quality. In addition, the subject of supervisor-line superior interactions may be concerned with the highly variable strength and disposition of the first-line supervisor's work force. Interactions are both face-to-face as well as mediated by the reports of staff specialists, the latter characteristic being more pronounced in Category II technology than in Category I technology.

The data pertaining to interactions between the first-line supervisor and his line superiors in Category III technology is limited. The analysis does suggest that this class of interactions is generally devoid of conflicts over authority and responsibility. In addition, it appears that such interactions are based to a significant degree upon the communication of advice and information as well as decisions and directives. None of the foregoing characteristics of interactions between the first-line supervisor and his superiors appear to be typical of the corresponding interactions in Category II technology.

To what extent does the nature of interactions between supervisors and subordinates vary across the three categories of industrial production technology?

For enterprises under Category I technology, the analysis points to the conclusion that interactions between the supervisor and his subordinates tend to be face-to-face, and concerned with production methods, pace, quality, the adherence to schedules, and special problems associated with non-routine jobs or tasks. It appears that such interactions are generally devoid of conflict over authority and responsibility. It is questionable whether interactions between the first-line supervisor in Category I technology and his subordinates typically allow for the mutual evaluation of issues based upon the technical expertise of both parties. Similarly, it is doubtful whether supervisor-subordinate communications are typically characterized by the exchange of advice and information rather than instructions and directives being transmitted to the subordinate.

Interactions between subordinates and their immediate supervisors in Category II technology are face-to-face in nature and apparently are perceived by the subordinates as being rather hostile. In addition, these interactions are primarily task-oriented, that is, concerned with giving effect to the directives and instructions transmitted to the supervisor by his line superiors or the staff specialists.

Although primarily task-oriented in nature, interactions between workers and first-line supervisors are not exclusively so. The mediation of conflict, plus a limited amount of casual socializing, seem to be characteristics of such non-task-oriented interactions.

In continuous-process technology interactions between the supervisor and his subordinates tend to be face-to-face and not mainly task-oriented as in Category II technology. On the whole, such interactions tend to be devoid of conflict over authority and responsibility. In a previous section it was questioned whether interactions between the first-line supervisor and his subordinates in Category I technology allowed for the mutual evaluation of issues based upon the technical expertise of both parties. Also the doubt was expressed whether supervisor-subordinate communications were typically characterized in Category I technology by the exchange of advice and information rather than instructions and directives. That such characteristics of organic management processes are not representative of the situation in Category II technology is evident from the analysis. However, it appears that in continuous-process technology interactions between the first-line supervisor and his subordinates are of a consultative nature, and permit the free interaction of workers roughly equal in status to their immediate supervisors. The communication of advice and information, rather than mainly decisions and instructions, does appear to characterize such interactions. The latter two characteristics of subordinate-supervisor interactions become increasingly representative of continuous-process technology as the degree of sophistication of production controls increases.

Frequency of Interactions

The scope for offering reasonably well-substantiated conclusions regarding the frequency of supervisory interactions in Category I technology is very limited due to the quality of the data. Therefore, a very tentative conclusion is offered to the effect that the supervisor's technical and administrative activities tend to limit the frequency of interactions with subordinates. It appears as though the technology of unit and small batch production may place very minimal requirements for such interactions. The analysis indicates that the frequency of interactions between subordinates and first-line supervisors is less in Category I technology than in Category III technology. It is not possible to present any conclusions regarding the frequency of either horizontal interactions or interactions between supervisors and their line superiors in enterprises characterized by unit and small-batch production technology.

The analysis of supervisory behavior under Category II technology indicates that the frequency of interactions between supervisors and staff specialists is relatively high.

The quality of the data does not permit an accurate assessment of the relative frequencies of interactions between staff specialists and first-line supervisors on the one hand, and supervisors, subordinates, or line superiors on the other hand. It appears that interactions between staff specialists and first-line supervisors occur more frequently than interactions with either line-superiors or subordinates as a group.

Interactions between first-line supervisors and their line superiors are both technologically determined and affected by the personalities of individuals. In comparison to the frequency of interactions between the supervisor and either staff specialists or subordinates, the frequency of interactions with line superiors is relatively low in Category II technology.

The analysis of the case studies and additional empirical data pertaining to Category II technology indicates that the frequency of interaction between the supervisor and his subordinates as a group is less than the frequency of the other classes of interactions. Most supervisory interactions involve non-workers. The pattern is complicated by the tendency for mechanistic management theory to break down in practice as noted above. One of the effects of this phenomenon seems to be a measure of discretion open to the supervisor in regard to which of his subordinates he interacts with and how frequently.

Although interactions with subordinates tend to occur relatively infrequently, the soothing of ruffled dispositions of female subordinates appears to be an important activity (hence a frequent activity) of the first-line supervisor in Category II technology.

The data pertaining to interaction frequencies in Category III technology are indeed scanty. However, as was concluded in Chapter VII, an average interaction frequency of five contacts per day between subordinates and the first-line supervisor appears to exceed that found in enterprises under Category II technology. It is concluded that continuous-process supervisors interact more frequently with their subordinates than do first-line supervisors in Category II technology.

Supervisory Sentiments

In testing the validity of the specific hypotheses concerning supervisory sentiments in Category I technology it was necessary to draw cautious and carefully considered inferences from limited data. It appears that sentiments of the supervisor in Category I technology toward subordinates, superiors, and staff specialists tend to be neutral to friendly in tone, fairly constant over time, and to be based in part upon a mutual respect for others' technical knowledge and experience.

Compare the foregoing situation with that found under

Category II technology. The data pertaining to Category II technology contain numerous direct and indirect references regarding supervisory sentiments. The analysis points to the conclusion that supervisory sentiments toward subordinates and *vice versa* may be characterized as variable or unstable due to (1) the high sense of urgency of production (2) the relatively short time perspective of first-line supervisors (3) the irregular demands of production technology and staff specialists, and (4) the more or less constant production-centered demands of supervisors on subordinates. Such sentiments appear to range from empathy to hostility.

In Category II technology the sentiments of first-line supervisors toward their line superiors tend to be characteristically those of defense and hostility, perhaps because of the breakdown of mechanistic management practices as manifested in (1) the apparent ambiguity experienced by the supervisor in regard to his authority and responsibility for production, and (2) the frequent bypassing of the first-line supervisor by staff specialists. Sentiments felt by the supervisor toward his line superiors tend to be variable or unstable over time. The explanation of the latter characteristic may lie in the relatively low frequency of such interactions and the frequent minor production crises associated with Category II technology.

Sentiments of the first-line supervisor toward staff specialists in Category II technology appear to be neutral to hostile and generally stable over time, possibly due to the relatively high frequency of their interactions. The negative characteristics of this class of sentiments might be due to the breakdown of mechanistic management theory noted in the preceding paragraph.

One notes, therefore, a rather marked shift in the quality and stability of supervisory sentiments as the level and nature of the mechanization of productive activities changes from Category I to Category II technology. As indicated in the following paragraph, the quality of supervisory sentiments in enterprises under Category I and Category III technology appears to be similar.

Direct expressions of the sentiments of supervisors toward others were absent from our data bearing upon continuous-process technology. An analysis of the available data leads to the inference that supervisory sentiments toward subordinates, superiors and staff specialists tend to be neutral to friendly in tone. In periods of crisis, or in non-routine situations which subordinates regard as being dealt with ineffectively by the first-line supervisor, sentiments may exhibit a slight amount of instability, that is, become mildly negative.

Implications for Organization Theory

The preceding section outlined the conclusions emerging from this exploratory study of the relationships between modes of industrial production technology and first-line supervisory behavior. What general conclusions may be drawn which are relevant to organization theory?

First, it appears that industrial production technologies may be viewed to advantage as "independent variables" giving an industry or enterprise distinctive and partially predictable organizational structure and process characteristics. The characteristics of an industrial enterprise which are in part shaped by the dominant mode of production technology include (1) the structure, composition and scope of the management organization (2) the skill, status, and authority distributions within and between managerial cadres and production workers (3) the social organization as expressed by organic or mechanistic processes of management (4) the nature, extent and relative ease of production planning and control (5) the room for maneuvre by first-line supervisors allowed by the procedures of production planning and control (6) the characteristic activities, interaction patterns and sentiments of members of the managerial cadres, and (7) required interdependence among organizational units and the problems peculiar to such required interdependence.

Second, it appears as though the foregoing organizational correlates of industrial production technologies may be conceived of as "intervening variables" which partially account for the observed relationships between the independent variables of dominant modes of production technology and various "dependent variables" such as the dimensions of first-line supervisory behavior or role demands.

That is, organization theory must acknowledge that modes of industrial production technology tend to be associated with specific and generally predictable correlates such as those specified above. The combined influence of technological demands on supervisory behavior and the organizational structure and process correlates of technology significantly help to shape a characteristic set of supervisory technical and administrative activities. The latter in turn require of the first-line supervisor a pattern of interactions involving himself and subordinates, superiors, staff specialists, and fellow supervisors along the work-flow.

Finally, as a consequence of these partially technologically required interactions, characteristic sentiments tend to develop and to exhibit rather predictable qualities and degrees of stability over time.

Figure IX below is a schematic portrayal of the apparent implications of this study for organization theory. The figure is meant to illustrate the interdependent effects of each of the six model elements.

The Need for Additional Research

Although for the purposes of analysis a degree of causality or determinism has been assumed to hold among the

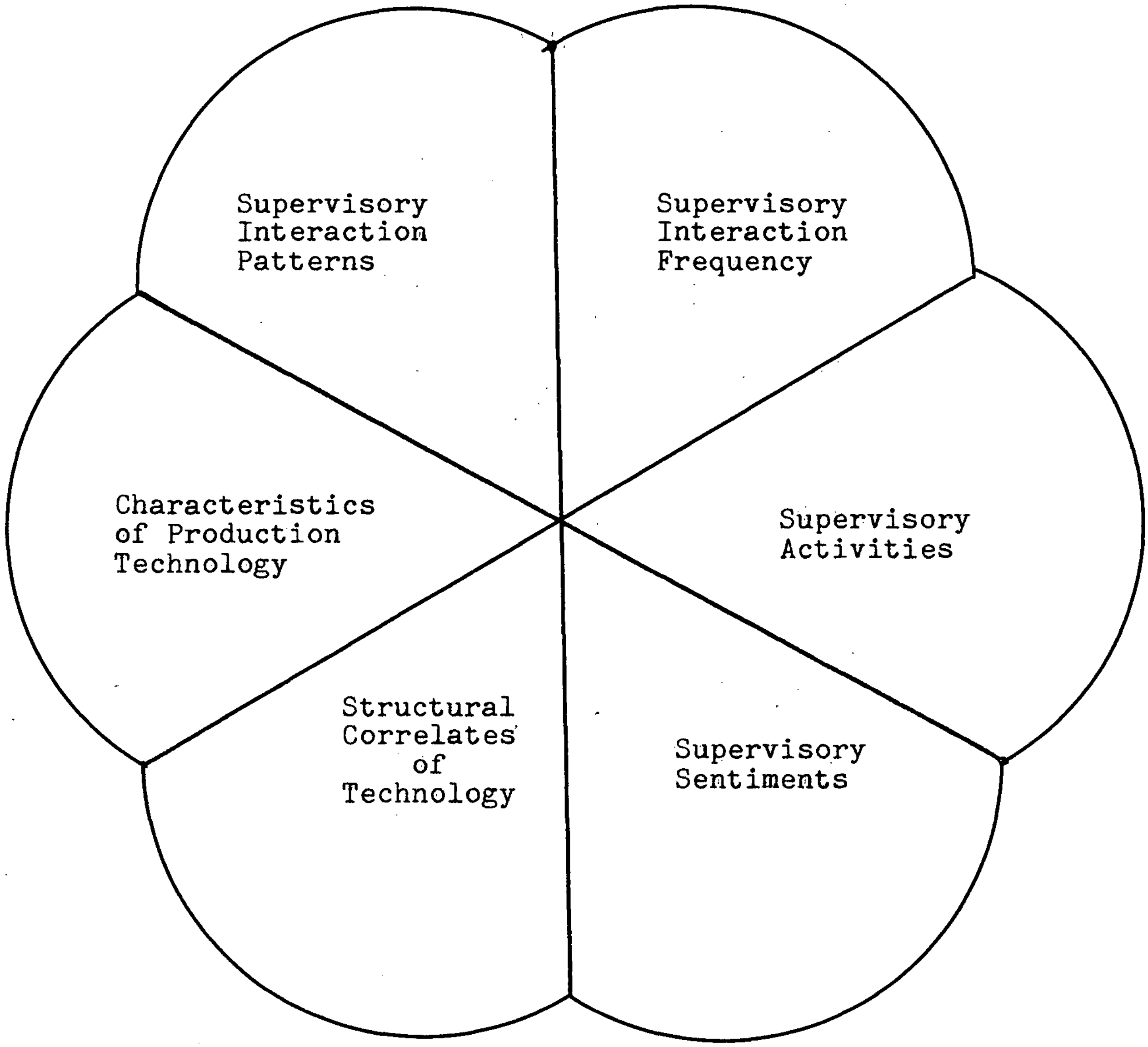


FIGURE IX

MODEL OF THE ELEMENTS INVOLVED IN THE RELATIONSHIPS BETWEEN PRODUCTION TECHNOLOGY AND SUPERVISORY BEHAVIOR "independent," "intervening" and "dependent" variables, the relationships among these elements are undoubtedly more subtle and complex than this study might suggest. Figure IX above is meant to convey a sense of the complex associations which likely exist among the main categories of the analysis. Hopefully, it will avoid any suggestion of a crude technological determinism which may have crept into the analysis. Also, it is fully acknowledged that technology is but one significant independent variable affecting the structure and processes of complex organizations, and, hence, the behavior of supervisors. Undoubtedly, the effects of time and territory,[2] economic factors, managerial ideology, socio-cultural values, and personalities of members of organizational elites are at least as significant as technology in shaping the behavior of first-line supervisors.

The most conspicuous and fundamental research problems indicated by this exploratory study are the need to elucidate in greater detail and with greater precision, the complex of interconnections which may exist among (1) the characteristics of technology and its demands on organizational actors, (2) the structural correlates of a given mode of production technology, and (3) the dimensions of first-line supervisory behavior.

In order to effect such additional research a number of basic problems grappled with in the present study must be dealt with. For each identifiable category of industrial production technology, additional research in the following areas is required if the insights gained in the present study are to prove of value in organization theory.

1. Delineating the significance for supervisory behavior of management by committee or its absence. Practice of management by committee will have implications for the nature and frequency of interactions, and, hence, affect sentiments. In addition, it may have implications for the nature and quality of management communications with rank-and-file operatives.

2. Specifying the technical qualifications of managerial and first-line supervisory personnel.

3. Stating in behavioral terms the activities and interaction patterns of first-line supervisors.

4. Quantifying the time and territory parameters relevant to supervisory planning and control activities, and specifying the effects of such parameters upon the behavior of first-line supervisors.

5. Expressing in behavioral terms the implications of "organization problems" affecting the supervisor,

6. Clarifying and standardizing the criteria for classifying an enterprise within a category of industrial production technology.

7. Monitoring communication networks involving the first-line supervisor in order to (a) ascertain interaction

patterns, frequencies and durations, and (b) indicate the content or subject of verbal communications.

8. Developing, testing and validating instruments designed to determine the nature and stability over time of supervisory sentiments toward subordinates, superiors, staff specialists, and fellow supervisors along the work-flow.

9. Ascertaining the relative proportions of time spent by the first-line supervisor in his main activities.

10. Correlating the relationships which may exist between the technologically required and permitted behavior of production workers on the one hand, and the behavior of the first-line supervisor on the other hand.

11. Identifying the effects of organic and mechanistic management processes upon the behavior of first-line supervisors.

12. Identifying the effects upon the number of levels of management in an enterprise due to the relative ease, accuracy and completeness of production control processes.

This exploratory study demonstrates that certain relationships among industrial production technology, organization structure and management practices, and first-line supervisory behavior may be predicted at a fairly high level of generalization. Subsequent confirmatory studies based upon the conclusions of this study and focusing on the above research problems, may contribute additional understanding of the organizational phenomena explored here. If subsequent research is successful in this regard, adaptation to technological change within the enterprise may be more readily achieved. Finally, the integration into the body of organization theory of the structural and behavioral correlates of various modes of industrial production technology may well enhance the predictive capability of that theory, and, hence, begin to meet the challenge offered decades ago by Elton Mayo:[3] to provide the industiral administrator with useful social skills.

FOOTNOTES ON CHAPTER VIII

[1]Joan Woodward, Industrial Organization: Theory and Practice, (London: Oxford University Press, 1965), p. 79.

[2]Eric J. Miller, "Technology, Territory and Time," Human Relations, Vol. XII, No. 2, (1959), pp. 243-272.

[3]Elton Mayo, The Social Problems of an Industrial Civilization (Boston: Graduate School of Business Administration, Harvard University, 1945).

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APPENDICES

ADDITIONAL EMPIRICAL DATA

APPENDIX I

CATEGORY I TECHNOLOGY: MISCELLANEOUS OBSERVATIONS

1. Unit production time is relatively long.[1]

2. Control of actual output and quality can be maintained at the worker-operator level.[2]

3. The need for supervision is reduced.[3]

4. Worker commitment required is relatively high.[4]

5. Worker autonomy may be relevant here.[5]

6. Sensitivity to the individual characteristics of the worker seems to be one of the traits which supervisors may use to obtain a high level of productivity from the worker.[6]

7. There is a curvilinear relation between worker participation and such consequences as output.[7]

8. Successful supervision requires the ability to play multiple, differentiated roles.[8]

9. Successful supervisors tend to delegate more authority, to be supportive in their relationships with subordinates, and to give more attention to creating employee morale than do unsuccessful supervisors.[9]

10. More cohesive groups tend to be more effective.[10]

11. High producers tend to be deviants [and isolates] from the group's productivity norms. Efforts at group social control seems to encourage deviant high producers.[11]

12. High group cohesion tends to accompany reduced member anxiety.[12]

13. There tends to be less variability in actual productivity <u>within</u> highly cohesive groups than within low cohesive groups.[13]

14. If work groups are allowed to select their own members turnover, labor and materials costs tend to decline.[14]

15. Lateral and vertical (status) work flow relations dominate the work situation for employees.[15]

16. For experienced workers, relations with the supervisor are relatively rare.[16]

17. The supervisor's skill in easing distresses in the work flow carry major weight in determining the worker's sentiment toward the supervisor.[17]

18. A basic skill required of workers is the ability to initiate interactions and activities for others.[18]

19. Work group social relations are of primary importance.[19]

20. Integration and coordination of the multiple skill-status levels of the primary work group is re-required.[20]

21. Work pace is largely influenced by the nature of the item being produced.[21]

22. Accurate worker coordination and worker skill is required (essential) for work rhythms and a minimum of emotional strain.[22]

23. The supervisor's initiation of activities will vary depending upon a combination of tasks to be done, the skill and personality of workers.[23]

24. Management control of production is minimal because it is so difficult.[24]

25. Agreement regarding production standards is difficult to attain.[25]

26. Determination of individual merit (as the basis for salary increases and promotions) is frequently very difficult.[26]

27. The foreman's influence on production is dubious.[27]

28. The foreman's knowledge of his workers and his ability to correct critical points is crucial.[28]

29. Workers value steady work pace and coordination.[29]

30. Technology and work flow tend to allow more latitude for free interactions than in Category II.[30]

31. The work situation tends to place upon the workers themselves the burden for organizing their social relations.[31]

32. In the hand got method of coal-getting we find [32]
    (a) small (2-3 men), self-selected, self-contained crews performing all underground operations (no division of labor between groups)
    (b) the work group determining its own pace (no direct supervision over the colliers)
    (c) isolated teams engaged in constant work with extensive free interactions among crew members
    (d) each worker capable of performing all work tasks.

33. In unit and small batch manufacturing we note:[33]
    (a) responsibility for planning, control and execution at all supervisory levels
    (b) foremen initiating interactions to workers re: production specifications, methods and sequence
    (c) <u>detailed</u> organization, planning and control of work left almost entirely to first-line supervisors
    (d) a high degree of supervisory involvement in the affairs of the company, plus a highly developed sense of supervisory responsibility.

APPENDIX II

CATEGORY I TECHNOLOGY

OBSERVATIONS ON CRAFT TECHNOLOGY IN PRINTING THE IMPLICATIONS FOR SUPERVISORY BEHAVIOR[34]

Background facts on printing

1. Skilled craftsmen comprise about 70 per cent of the direct labor in the printing trades.[35]

2. The typical shop is small. In 1955 the average printing establishment had 25 employees compared with 69 employees in chemicals, 134 in textiles and 334 in automobiles.[36] About 42 per cent of all printers work in shops with fewer than 100 employees compared to 26 per cent of all factory workers and 23 per cent, 15 per cent and 4 per cent respectively in chemical, textile and transportation equipment industries.

Organizational characteristics

3. "The essential feature of a craft technology is its lack of standardization of the product."[37]

4. "In the small or middle-sized plants characteristic of the industry, there is much . . . functional rationality . . ."[38]

Supervision in the printing craft

5. "The freedom to determine techniques of work, to choose one's tools, and to vary the sequence of operations, is part of the nature and traditions of craftmanship. Because each job is somewhat different from previous jobs, problems continually arise which require a craftsman to make decisions. Traditional skill thus involves

the frequent use of judgement and initative, aspects of a job which give the worker a feeling of control over his environment."39

6. "The craftsman's high degree of personal control implies a complementary freedom from external supervisory control. Craftsmen, with their strong sense of independence and dignity, resent close supervision and are likely to resist it more militantly and successfully than other manual workers. They have little need for external controls, since they have internalized standards of responsibility, output, and workship. Their discipline is self-discipline, supported by the group discipline of their professional craft, which enforce collective standards of excellence and behavior. Craftsmen generally consider themselves as good as their supervisors in social status as well as professional competence. In craft industries, the foreman is often the oldest and most experienced journeyman. He may be more respected, but he is not basically different from the others."40

7. "Technical consultation with superiors does take place in craft industries, but since craftsmen have a more independent domain, it is built into the system less than in continuous process technology."41

8. "Printers have extended the freedom from supervision natural to craft production to a point perhaps unrivaled in modern industry. Foremen are required to be union members, and thus their actions may be controlled by the workers themselves, who can invoke union rules to check them."42
To a large extent the workers themselves run the composing room.43

9. "Although the printer's freedom and control is largely due to the nature of craft technology, it is reinforced and strengthened by special economic conditions and by social institutions of the industry which have a long history. The unusual power of the union and the reduced authority of the supervisors are two such unique features of the industry."44

APPENDIX III

CATEGORY II TECHNOLOGY: MISCELLANEOUS OBSERVATIONS

1. Efficiency and effectiveness of work groups appear to be positively related to low "consideration" and much "structuring" of the work situation.[45]

2. For production operations of category II, absenteeism and number of grievances filed tend to be positively related to "initiating structure" and negatively related to consideration.[46]

3. Superior-supervisor relations are most important; orientation to the feelings of subordinates is thus jeopardized.[47]

4. Staff specialists originate production standards which the foreman must uphold. Crucial control information by-passes the foreman and goes directly to his boss.[48]

5. Foremen-foremen (peer) relationships are inherent in category II technology; are largely informal and a source of complication in the foremen-superior relationships.[49]

6. Work flow relationships within the work unit tend to be important.[50]

7. Conflicts over production may be a source of low morale and workers withholding production.[51]

8. On short production runs supervisory planning skills become important.[52]

9. Workers tend to see the foreman's role as difficult and undesirable.[53]

10. Supervisors' interactions tend to be short, frequent and mainly with non-workers.[54]

11. Workers initiate interactions with their foreman more frequently than <u>vice versa</u>.[55]

12. The foreman's "leadership climate" appears to be the primary determinant of his attitudes and behavior.[56]

13. Industrial workers in category II technology seem to prefer working under foremen who are high in "consideration" and to dislike working under foremen high in "initiating structure."[57]

14. Category II technology presents management with very difficult technical questions of "balancing the line" --a matter of concern to the workers.[58]

15. The technical environment is overwhelming. To the extent that the supervisor can modify the degree of impact of this environment, he can build favorable sentiments toward himself.[59]

16. Workers tend to despise their jobs because (a) they cannot control the work pace (b) work is highly repetitive (c) minimum skill is required (d) methods and tools are completely specified (e) only "surface attention," not involvement, is needed (f) social interaction is limited.[60]

17. Interaction between workers is limited by supervisors as well as technology. Primary group identification is thus difficult.[61]

18. Under the long-wall method of coal-getting coordination between and within shifts is required. "Shift deputies" are responsible to management for the shift's production.[62]

19. Physical habitat and large span of shift deputy's control make effective communications difficult.[63]

20. For the long-wall method of coal-getting, task interdependence within and between shifts is considerable. One hundred percent performance is required at each step if the system is to operate effectively.[64]

21. The main burden of keeping down the number of cycle stoppages falls on the shift deputy. He alone has cycle, as distinct from task, responsibility. Close supervision is virtually impossible.[65]

22. In an automobile assembly line: 5 levels of the management hierarchy; supervisor's span of control covers 25-35 workers; workers' tasks completely prescribed, with the average time cycle for each operator's job being about 1 1/2 min. Interaction among workers is minimal; it is not functionally required.[66]

23. Automobile assembly line operations require an enormous amount of planning and coordination by special-

ized technical service groups (2 1/2 direct workers to 1 staff or service position).67

24. "At point after point, machines or technical experts have absorbed many of the duties normally associated with front-line supervision." Materials control and handling experts monitor the movement, amount and placement of worker; the conveyor controls pace of production. The time of each job element is fully prescribed.68

25. Foremen are unanimous in agreeding that relations with subordinates are the most important part of their job; the key to their success. 69

26. Absenteeism and production quality are the supervisor's two largest problems.70

27. Important supervisory skills: the ability to absorb management pressure; protection of workers' interests and consultation with them.71

28. Good human relations are especially important.[72]

29. The foreman is strategic in the swift adjustment of the new recruit to the unique experience of a mobile work environment.73

30. Human relations problems with multiplicity of staff-service groups are minimal.74

31. Foremen interactions are based upon work-flow problems. Fellow foremen are generally seen as helpful. Foreman cooperation along the work-flow is important.75

32. Strict adherence to the formal chain of command (re: orders and communications) is heavily emphasized but frequently violated due to pressures of production.[76]

33. Major supervisory duties include: training, checking quality and dealing with the personal problems of workers (e.g. workers' attitudes toward quality). 77

34. The foreman's technologically based problems include:
    (a) condition of tools and materials
    (b) supply of materials and parts to the unit
    (c) interdependence of operations from one unit to the next along the moving conveyor
    (d) the fluctuation of line speeds and its effects
    (e) the "balance" of work between each of the operators at the various stations along the line.78

35. Management and foremen recognize that quality production flows from a self-disciplined group possessing a sense of responsibility for doing a good job--and doing it for a foreman who is the group's leader in fact as well as title.[79]

36. Emergencies are normal: a function of departures from routines.[80]

37. The essence of the foreman's job is doing something different every minute (400-600 separate episodes/day.[81]

38. It can be concluded that in this particular working environment a foreman-worker relationship contains a higher degree of positive sentiment when there is more frequent interaction, provided that such interaction is not confined solely to matters related to the job, but is perceived as including informal, friendly contacts in addition to those required in the course of work. . . . Most of these workers disliked their immediate job. The technology of the moving line produced in the majority a feeling of pressure and impersonality. . . . Under these circumstances one would expect that the content and nature of interaction with foremen would be more important than its frequency alone.[82]

39. "Frequency of Interaction (Talking) with Foremen.[83]
(Percentage of Total Sample)"

Talk with Foremen	Plant Y	Plant X
Often (at least once per hour)	23.3	33.3
Occasionally (at least twice per day)	39.1	46.1
Rarely (once per day or less)	31.2	20.6
Indeterminate or no answer	6.4	--
	100	100

APPENDIX IV

CATEGORY III TECHNOLOGY: MISCELLANEOUS OBSERVATIONS

1. There is reason to believe that worker autonomy (i.e. general supervision) is not probably relevant to continuous process technology.[84]

2. Given the potentiality of an error causing substantial loss in the process should it go unattended, managers and supervisors will tend to concentrate on inspection and control functions.[85]

3. Worker commitment required is probably minimal.[86]

4. Workers expect immediate supervisors to be technically competent. For more senior levels of supervisor workers look for greater human relations skills.[87]

5. In new power plants, foremen expect their supervisors to be administratively skilled. Technical and human relations skills are felt to be less significant. In older plants [levels of automation lower], human relations skills are rated higher than technical or administrative skills.[88]

6. Workers tend to be tied to remote control panels. Activities are geared to conditions of the process. Interactions are required when changes are being made.[89]

7. Responsibility is heavy: few duties are specifically assigned.[90]

8. Free interaction is permitted. Workers (operators) are roughly equal in status to their boss. Supervisory support of top management is minimal.[91]

9. There is little pressure to get out the work. The job is neither nervously nor physically fatiguing.[92]

10. Woodward notes two important characteristics of category III technology which are common to category I technology.[93]
    (a) the definition of the primary task not only is clear-cut, but is acceptable to those concerned [note contradiction with 7 above]
    (b) a close association of the planning, execution and control elements in the production function

She remarks that the social organization is similar in categories I and III.94

11. In category III technology "the extreme mechanization has brought the character of the worker's technological work environment full cycle back toward that of a highly skilled craftsman. The semi-skilled or unskilled machine tenders, the 'proletariat,' have been eliminated, and engineers and their maintenance crews composed of skilled mechanics are all that remain."95

APPENDIX V

CATEGORY III TECHNOLOGY

<u>Notes on automated technology</u>

A. The following brief notes have been drawn from Charles R. Walker's study[96] of the first continuous seamless pipe mill in the United States.

1. 1. The technological innovation described in this study "pushed the mechanical process . . . [of pipe-making] a long step toward the automatic. . . . It made possible increased production with fewer people. . . . It decreased the need for muscle and increased the demand for mental skills."[97]

2. The work flow in the seamless mill is continuous. The steel billet moves successively through five processes, each of which is associated with a particular unit of machinery. The five units are connected with each other by conveyors.[98]

3. There are 9 operators in the hot mill crew, eight in regular positions and one man who "spells" all the others. Senior operating responsibility for adjustments on the most important unit in the sequence, and for overall coordination of the operations, resides with the foreman.[99] The nine crew men are functionally related to each other and to the machinery they operate

as a team or crew.[100] Jobs are either wholly or partly automatic.[101] "Team work by all [crew] members . . . is important not only when 'the mill is rolling' but when 'changeovers' and readjustments of equipment are called for."[102]

4. The technological innovation described by Walker apparently resulted in increased contacts between workers and supervisors.[103] The majority of the crew rated their relations with supervisors as "better" than in the old mill.[104] In the new seamless mill there was less intervention by senior supervisory levels when trouble occurred.[105] The crew reported less supervisory "nagging" and more listening to workers in the new mill.[106] Once the problems associated with the technological innovation were overcome, contacts between workers and foremen became less frequent. An average of 5 contacts per day was recorded.[107]

5. The workers valued the possession of technical skill by supervisors.[108]

6. Once the new seamless mill was "rolling" at a satisfactory rate, and, hence, once both production and earnings were high, "pressure" on the workers lightened. There was "less interpersonal tension" between supervision and the crews; hostility had almost entirely disappeared.[109]

7. "The foreman group occupied an ambivalent and changing position between [the production] group and management.

Increasingly it . . . [became] recognized in theory and practice that to do his job effectively a foreman should not only transmit and interpret management's orders to the worker but interpret and transmit the workers' needs to management."[110]

B. The following observations pertain to Chalres R. Walker's study of the first continuous seamless pipe mill in the United States.[111]

The Foreman's Job (as reported by a foreman)

1. "[In the new seamless continuous mill the foreman's job is] partly, of course, what it always was, the direction and training of your work force in their proper jobs. There's keeping their time, looking after safety, and doing paper work. But in other ways a foreman's job on an automatic mill is quite different. To start with, on the older type [i.e. non-automatic] of mill he had a larger crew and each man had a specific work area; anything he had to do, he did mostly through manual control, through wheels and levers, for example. Now, on this mill there are many automatic guages. . .: slow-down switches, timers, raising and lowering mechanisms, etc., all mechanically or electrically started or stopped and designed to perform in a cycle sequence.

2. "So today instead of supervising workers so much, you actually supervise machines. . . . You have nine men

scattered over an area 150 yards wide and probably eight or nine hundred feet long. Most of that space is filled up with conveyors and other machinery. The timers must be corrected and the machinery kept operating properly. A good foreman instead of having a backlog of just practical mill knowledge must have a hell of a lot of mill experience plus electrical and mechanical training. . . .

3. "This new type of mill is a lot harder, I think, on the foreman. . . . you're depending on a lot of machines [not men] to do a lot of work, and if they don't do it, you've got to get in there and see that they do. . . .

4. "The foreman becomes a [technical] trouble shooter."

C. The following observations pertain to the individual and organizational correlates associated with the introduction of more extensive automatic controls in electric power plants.[112]

1. The introduction of additional automatic controls in the electric power plant resulted in the boiler, turbine-generator and its electrical switching system being physically integrated and operating as a single independent unit. "The new plant consists of four such units."[113]

2. The integration and centralizing of controls of the boiler-turbine-generator parts of the system paralleled

the integration of operations in the new plant. The major controls for the entire plant were centralized on one floor in three control stations.[114]

3. The more highly automated system of production has brought about "significant" changes in the occupational and organizational structure of the plant. Personnel requirements were cut in half, with most of the reduction occurring in the operating jobs. "Whereas nine men are used on the electrical switchboards in the older plant, only two are specifically responsbile for this operation in the new one."[115] The new technology appears to be associated with increased tension felt by the workers. Their responsbiilities have increased; they depend more upon each other for information about the system. Physical isolation of workers is virtually eliminated with the integration and centralization of controls. . . ."there is strong indication that the men feel a greater unity, more like a single group than they did previously."[116] A reorganization of the supervisory structure has also accompanied the technological change. "In the new plant, a single foreman . . . is responsible for operations in the plant, and is in charge of the total plant during the evening and night shifts."[117] (One level of supervision has been eliminated.) He does not directly supervise all of the men of his shift. Rather, he relies on the senior operator to supervise

the work of the other two operators.[118]

4. It appears that the requirements for effective supervision have also undergone change due to the technological innovation.

> Those supervisors who are seen as most satisfactory by their subordinates are also preceived as being the most capable on both the technical and on the human relations side of their jobs. Those supervisors considered unsatisfactory are rated low in proficiency on technical and human relations skills. Among those supervisors who were rated as intermediately satisfactory, those who were perceived as competent in human relations, but not in technical ability, more often were considered satisfactory by their subordinates than the supervisors who were seen as good on the technical side but poor in human relations. Using the satisfaction of subordinates with their supervisors as the criterion, then the good supervisor seems to combine both technical and human relations skills, with human relations ability being the most important. This seems to be equally true in the two plants.119

FOOTNOTES ON APPENDICES

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[47] Roethlisberger in Dubin, *Human Relations in Administration* (Englewood Cliffs, N.J.: Prentice Hall, 2d ed., 1961) p. 211.

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[51] *Loc. cit.*

[52] *Ibid.*, p. 145.

[53] *Loc. cit.*

[54] *Ibid.*, p. 191.

[55] *Loc. cit.*

[56] Fleishman *et al*, *op. cit.*, p. 7.

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