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ABSTRACT

This paper provides part of the theoretical underpinning for a series of studies on the environment for teaching. Addressed primarily to organizational researchers, it deals with the relation between educational innovation and the organizational structure of schools. Three assumptions made widely in previous studies relating technology to structure are questioned, and suggestions for their modification are made. The assumptions of homogeneity of technology and social structure, rationality of organizational participants, and concensus among participants on the task and the technology employed are questioned. However, the authors, while acknowledging the effect of technological factors on organizational structure, argue that such factors are both more complex and subtle in their operation than previous analyses have suggested. Specifically, it is argued that (1) not one but many technologies associated with many structures may be present in an organization; (2) organizational participants may hold differing conceptions of the nature of the technology employed; (3) different task conceptions can lead to different sets of preferences for work arrangements; and (4) nonrational factors may also enter into the formation of task conceptions and into the establishment of work arrangements. A 24-item bibliography is included. (Author/DN)

STANFORD CENTER
FOR RESEARCH AND DEVELOPMENT
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Research and Development Memorandum No. 97

TASK CONCEPTIONS AND WORK ARRANGEMENTS

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Introductory Statement

The Center's mission is to improve teaching in American schools. Too many teachers still employ a didactic style aimed at filling passive students with facts. The teacher's environment often prevents him from changing his style, and may indeed drive him out of the profession. And the children of the poor typically suffer from the worst teaching.

The Center uses the resources of the behavioral sciences in pursuing its objectives. Drawing primarily upon psychology and sociology, but also upon other behavioral science disciplines, the Center has formulated programs of research, development, demonstration, and dissemination in three areas. Program 1, Teaching Effectiveness, is now developing a Model Teacher Training System that can be used to train both beginning and experienced teachers in effective teaching skills. Program 2, The Environment for Teaching, is developing models of school organization and ways of evaluating teachers that will encourage teachers to become more professional and more committed. Program 3, Teaching Students from Low-Income Areas, is developing materials and procedures for motivating both students and teachers in low-income schools.

This paper presents part of the theory on which a number of studies in the Environment for Teaching program are based.

Abstract

Much recent work argues for the importance of technological variables as determinants of the social structure of organizations. Relating technology to social structure for the organization as a whole requires several assumptions, three of which are considered here. (a) The assumption of homogeneity holds that the technology employed by an organization is essentially similar across tasks or occupational groups and that the social structure of the organization is uniform across work units or departments. (b) The assumption of rationality holds that participants in organizations do in fact devise and establish the most effective and efficient arrangements for task performance. (c) The assumption of consensus holds that there is agreement among participants on the nature of the task performed and the technologies employed in organizations. All three assumptions are questioned, and suggestions for their modification are made.

It is argued that the problems raised by the assumption of homogeneity can be circumvented by an examination of the relation between particular tasks (rather than technology in general) and work arrangements (rather than social structure in general). To deal with the problems raised by assumptions two and three, it is proposed that the previous simplistic model relating characteristics of technology and social structure be replaced with a more complex model which recognizes that differing conceptions of tasks may be held by the participants, in particular by administrators on the one hand and performer groups on the other. It is predicted that when task conceptions vary among participant groups, power considerations determine whose views prevail and what sorts of work arrangements are in fact established.

Task conceptions and work arrangements are viewed as mutually interrelated: certain task conceptions imply the appropriateness of a given work arrangement, but a given work arrangement also shapes the participants' conceptions of their tasks. Task conceptions are also shaped by socializing institutions external to the employing organization, such as professional associations. If such conceptions run counter to those fostered by organizational administrators, there is likely to be organizational change.

TASK CONCEPTIONS AND WORK ARRANGEMENTS

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This paper provides part of the theoretical underpinning of a series of studies in the Environment for Teaching program dealing with the relation between educational innovation and the organizational structure of schools. It is addressed primarily to organizational researchers.

For well over half a century sociologists have been engaged in the study of organizations. But until the last few years relatively little systematic attention has been devoted to describing and analyzing the formal structure of organizations. Many sociologists took the structure of organizations as given, viewing it only as a context within which behavior occurred. Others devoted more attention to structure but neglected the formal structure to concentrate on the informal structure. As a result the analysis of formal structure remained the province of industrial engineers and other intellectual descendants of Frederick Taylor and Henri Fayol, rather than of sociologists.

Work on this project was partially supported by the Stanford Center for Research and Development in Teaching (Project No. 5-0252-0307). It was a continuation of a study begun under the auspices of the National Science Foundation, Grant G23990. In addition to the authors, project members included Karen Cook, Judy Hanks, and David Gonzales. An earlier version of the paper was presented at the 66th Annual Meeting of the American Sociological Association, Denver, Colorado, August 30, 1971.

This situation changed in the late 1950's and early 1960's when a number of sociologists began to take seriously Weber's model of bureaucracy as a set of interrelated variables and to go beyond Weber to examine these interrelations empirically. Research of this type by Udy (1959), Hall, (1963), Pugh et al. (1968, 1969), and others has revealed that there are significant variations in formal structure among organizations. Such variations, in addition to serving as independent variables helping to account for differences in the behavior of participants, have increasingly been viewed as dependent variables--as phenomena to be explained.

A number of variables have been suggested to account for variations in the structure of organizations, but none has received as much attention in the past few years from sociologists as the variable "technology." A central premise underlying much recent work on organizations is that organizational structure depends fundamentally on the type of technology employed.

It is generally recognized that the concepts "technology" and "organizational structure" each incorporate a cluster of variables. But at the present time there is little agreement about which variables should be emphasized. In the case of technology Hickson et al. (1969) suggest that at least three different facets of this cluster have been identified and operationalized. (1) Operations technology deals with techniques used to carry on workflow activities. Variables or dimensions that have been employed to characterize one or another aspect of these techniques include types of production systems, such as unit and small batch, large batch and mass, and process production (Woodward, 1965); diffuseness (vs. specificity), or the degree to which a firm uses a number of technical processes to yield

a wide range of products (Harvey, 1968); and routinization, or the extent to which work processes entail highly similar activities that are repeated over time (Haye & Aiken, 1969). (2) Materials technology deals with the characteristics of the task objects--the materials being processed. Variables proposed as useful in characterizing task objects include variability, or the uniformity and stability of the raw materials (Perrow, 1970); activity (vs. inertness), or the extent to which the resistance encountered in the performance of a task is unpredictable (Scott et al., 1967); and the relative hardness of the materials processed (Rushing, 1968). (3) Knowledge technology deals with the characteristics of the knowledge employed in the workflow. Thus Perrow (1967) emphasizes the degree to which the search process undertaken when unusual or exceptional cases are encountered is systematic and analytical; and Thompson (1967) proposes to classify tasks by the extent to which knowledge of cause-effect relations is complete.

Turning to organizational structure, among the dimensions that have been investigated are the degree of division of labor, the degree of formalization, the ratio of managers and supervisors to total personnel, the supervisory ratio for production groups, the relative power of departments or work groups, the degree of work group interdependence, and the extensiveness and types of coordination mechanisms. Again, it appears that there is little agreement about which components are to be examined or precisely which variables are to be used.

Since this type of research is relatively new, it is too early to draw any firm conclusions about the relation between technology and structure. On the one hand, several empirical studies have reported

fairly consistent results to the effect that uniform inputs and routinized workflows tend to be associated with "tighter"--more centralized, formalized, and specialized--structures (see Hage & Aiken, 1969; Harvey, 1968; Woodward, 1965). On the other hand, Hickson and his colleagues (1969), focusing exclusively on operations technology, conclude that technological variables are not nearly as decisive as others (such as size and dependence on other organizations) in determining the nature of organizational structure. Hickson's results, though not strictly speaking inconsistent with previous findings, do cast a pall over earlier, more confident assertions. Thus the time seems ripe for a more careful analysis of the arguments relating technology to structure. That task cannot be completed here, but it can be begun. We will point to three questionable assumptions made in previous studies of this relationship and make some modest suggestions for dealing with them.

Assumptions Made in Relating Technology to Structure

The Assumption of Homogeneity

Previous analysts have assumed that the technology employed by an organization is essentially similar across tasks and occupational groups and that the social structure of the organization is uniform in its characteristics across work units. But technologies--whether defined in terms of materials, operations, or knowledge--vary greatly within as well as between organizations. As Hickson and his colleagues note in commenting on Woodward's typology of production systems: "To describe the general technology of a factory as 'mass,' when this characterizes only some departments and other departments are engaged in small batch and process operation, is an oversimplification [Hickson et al., 1969, p. 395]."

More complex organizations, such as hospitals and research and development firms, have technologies that vary not only across departments but also across occupational groups within departments and across types of tasks performed within occupations. Consider, for example, the many types of occupational groups in a hospital: doctors, nurses, social workers, aides, laboratory workers, office personnel, and so on. Each group performs very different kinds of tasks. Even within a given occupational group, e.g., physicians, there may be significant differences among the various specialty groups in the tasks performed, the methodology and techniques employed, the uniformity or predictability of problems encountered, and the extent to which current knowledge is adequate to cope with these problems. Further, when we examine the work practices of a single physician, we discover that he carries out not one but many types of tasks involving quite diverse technologies. Which of the many technologies employed by individual workers, by occupational groups, and by departments determines the nature of the organization's structure?

It may be that one technology predominates over all others. Hughes (1958, pp. 121-22) has suggested that there is a "core" set of tasks that comes to define the "symbolic work" of an occupational group. Perhaps this set of tasks determines the nature of the organizational structure--or perhaps it is only the assumption that one can meaningfully speak of the organizational structure that forces us to search for a single technology. If we admit the possibility of multiple structures with varying characteristics within a single organization--and after all, organizations are supposed to be highly differentiated--we can more easily allow for multiple technologies of differing types.

The Assumption of Rationality

In attempting to explain the relation between technology and structure, one could adopt a kind of technological determinism: the technical requirements of the tasks to be performed force organizational participants to behave in certain ways. However, few if any sociologists are willing to embrace a deterministic framework; indeed, one leading advocate of the technology approach, Joan Woodward, has explicitly rejected it as inappropriate (1970). Instead, most analysts in this tradition prefer to assume that arguments relating technology to structure hold under the assumption of rationality. We are asked to assume that participants in organizations will be motivated to devise and establish the most effective and efficient arrangements for performing their tasks. Thus, in the midst of developing his arguments relating technology to structure, Perrow (1970, p. 80) reminds us: "We must assume here that, in the interest of efficiency, organizations wittingly or unwittingly attempt to maximize the congruence between their technology and their structure." And Thompson (1967) prefaces all of his specific propositions linking technological and structural variables with the elusive phrase "under norms of rationality."

However, we have known since the work of Roethlisberger and Dickson (1939), if not long before, that the logic of efficiency is not the only logic used by organizational participants. Constraints on rationality are pervasive themes in the work of analysts like Selznick (1943, 1948, 1949) and Dalton (1959), who emphasize such motivational factors as self-interest, identification with subunits, and commitments that bind actors to a particular set of skills or work arrangements. Even a

"neoclassicist" like Herbert Simon (1957) reminds us that the rationality exercised in organizations may be constrained by selective routing of information and selective attention to information received. In sum, most sociologists would readily agree that assumptions about the rationality of human action should be embraced reluctantly, and relaxed or discarded whenever possible.

The Assumption of Consensus

Past research relating technology and social structure assumed that organizational participants agree on the characteristics of the technology--on the basic nature of the materials processed, the techniques to be employed, and the utility of the available technical knowledge. Presumably such consensus exists because these technological traits are "real, solid, and substantial"--that is, objective in character. By contrast, we would propose that these technological characteristics are not nearly as solid as they at first appear--that they are to a significant degree subjective and hence subject to dispute. Given the same set of task objects, participants may emphasize either their similarities or their differences. For example, Perrow's (1965) historical survey of the treatment of the mentally ill demonstrates that conceptions of the raw material--in this case, mental patients--have varied enormously over time. Such variations in conception are particularly apt to occur when the materials being processed are human subjects, but disagreements may also occur over the perceived characteristics of inanimate objects. Similarly, participants may disagree on the characteristics of the techniques employed: where one sees repetitive activities another may see ingenuity and artful adaptation. In recognition of the

fact that participants may not agree on the nature of the technology being employed, we propose to speak not of technology per se but of "conceptions" or social definitions of technology. Such an approach, in our view, is not only more accurate but should make the study of technology even more interesting to social scientists: in positing a relation between technology and work arrangements, it is not only the dependent but also the independent variable that requires sociological formulation.

An Alternative Approach

Three assumptions currently supporting much of the research relating technology to social structure have been identified and challenged. What is the alternative?

We propose first that the assumption of homogeneity can best be circumvented by shifting the level of analysis from technology in general to the technology associated with a particular task or cluster of related tasks. This approach would allow us to examine the relation between particular technologies (rather than technology in general) and particular work arrangements (rather than the social structure of the entire organization). It also allows for the possibility that a given worker employing several different technologies may be operating within several kinds of work arrangements. And it is consistent with the empirical findings of Hickson et al. (1969), in which technological variables were not strongly related to characteristics of the wider administrative or hierarchical structure (except possibly in small firms), but were related to structural variables centered on the workflow, such as the

subordinate-supervisor ratio and job counts of employees on production-linked activities.

Those wishing to characterize the technology of an organization as a whole would, in our view, be better advised to assume that there are many technologies and attempt to develop measures that will summarize across them in some meaningful way--e.g., the proportion of technologies employed that are of a given type. Similarly, the overall structure of the organization might be viewed as a collection of substructures, or perhaps better as an overarching structure linking the various differentiated units into an integrated system.

In attacking the assumption of consensus we suggested that because technology is in part socially defined, we did not expect organizational participants to agree invariably on the characteristics of the technology employed. Disagreements may occur among various sets of organizational participants, but our preliminary thinking indicates that two groups are of critical importance. The first consists of those higher-level participants responsible for devising and establishing work arrangements within the organization. Such administrators must have some conception of the technology to be used in order to design appropriate structures. And here, if anywhere, one should find some concern for developing the most effective and efficient arrangements. Perhaps these administrative decisions "under norms of rationality" are the implicit mechanisms involved in the conventional arguments linking technology with structure.

The second important group consists of those who carry out the tasks. Performers can surely be expected to have conceptions of the

material, operations, and knowledge technology with which they work. Whether or not the conceptions of a given set of administrators and performers converge is a matter to be empirically determined, although there are apparently important systematic factors at work that help us predict the outcome.

We begin with the premise that there is always some tendency for task performers and administrators to disagree in their views of the technology employed by the performers. It appears from some initial empirical studies that the closer one is to the task performance itself, the more impressed one will be with the variability of the raw material, the imperfections of the standard operating procedures, and the inadequacy of technical knowledge in the work area. As one moves from the work location to administrative levels, perceived variability diminishes and the work process appears to be more predictable. In addition, performers and administrators often differ in their view of both the level and scope of the task definition. Performers are more apt to concentrate on individual cases, while administrators typically are more concerned with the fate of the set or cohort of task objects. For example, a classroom teacher may view the task of teaching as reacting appropriately to the differing needs of individual students. School administrators, however, are more likely to view teaching as a means of ensuring that all students perform sufficiently well to enable them to move from class to class and from school to school (Bidwell, 1965). Again, the performer tends to focus on variability--on factors that differentiate among task objects, while the administrator focuses on uniformity--the factors that task objects share as a class.

Variations in task conceptions are of interest because they should be associated with variations in preferred work arrangements. Most of the previous research relating technology and structure suggests that performers, emphasizing variability and lack of predictability, tend to prefer structures allowing them to exercise maximum discretion. By contrast, administrators, seeing performers working with fairly uniform and predictable tasks, tend to prefer more centralized and formalized structures. Assuming that most individuals prefer to make decisions, it appears that these differing task conceptions are not disinterested but work to the advantage of the perceiver. Performers and administrators each hold task conceptions consistent with their desire for greater decision-making control at their particular level.

Of course, the view that task conceptions are often biased owing to motives of self-interest argues against the third and final assumption discussed above, the assumption of rationality. We would argue in addition that given different task conceptions, might will prevail over right: the conceptions of the group with the greater power will win out. Thus, should organizational administrators enjoy greater power, their conceptions of the tasks performed will determine the nature of the work arrangements established. If the task conceptions of performers differ from those of administrators, we would expect performers to prefer a different set of arrangements than administrators, in keeping with their conceptions of the task. The greater the discrepancy between preferred and actual work arrangements, the more we would expect performers to object to the arrangements. Results from empirical studies of public school teachers are consistent with these predictions (see Magnani, 1970). On the other hand,

should the performers enjoy greater power, their conceptions of the task performed would be expected to determine the nature of the work arrangements. In such a case administrators would be forced to take the preferences of performers into account when designing work arrangements and might be expected to express considerable dissatisfaction concerning what they regarded as the uncontrolled and inefficient nature of the work arrangements.

We believe that such processes operate in all types of organizations. However, they are particularly visible, and hence more easily studied, in organizations with professional or semiprofessional employees. Such occupational groups are particularly likely to develop divergent task conceptions, these conceptions being transmitted by external socializing organizations and reinforced by peer group pressures. Because specific alternative task conceptions are collectively held by performing groups, these shared conceptions and expectations concerning appropriate work arrangements become important unifying forces for occupational groups across varying settings. Finally, a more or less tight monopoly over the performance of certain tasks, plus in some cases the ability to regulate the supply of performers, assures that professional groups will be in a relatively powerful position vis-à-vis organizational administrators.

Full-fledged professional groups are currently powerful enough to have a strong voice in devising work arrangements. Semiprofessional and professionalizing groups are in the process of attempting to gain similar power. As groups professionalize they challenge both administrative task conceptions and administrator-designed work arrangements. Such challenges, we believe, are among the most powerful sources of change in organizations.

Conclusion

In exposing and questioning the three assumptions of homogeneity, rationality, and consensus that underlie much current writing and research relating technology to the social structure of an organization, we do not deny the effect of technological factors on organizational structure. Rather, it seems to us that such factors are both more complex and subtler in their operation than previous analyses suggested. Specifically, we argue that (a) not one but many technologies associated with many structures may be present in an organization; (b) organizational participants may hold differing conceptions of the nature of the technology employed, and their conceptions will vary systematically according to such factors as distance from the task and, in the case of professionals, views advanced by socializing agencies and supported by occupational associations; (c) associated with these differing task conceptions are different sets of preferences for work arrangements, their realization depending on the distribution of power within the organization; and (d) nonrational as well as rational factors enter into the formation of task conceptions (e.g. self-interest) and into the establishment of work arrangements (e.g. power).

If an organization modifies important portions of its technology, it can be expected to change associated social structures. Similarly, we believe that changes in social structures may follow from changes in task conceptions, which may in turn be a product of changes in the distribution of power among participants within the organization.

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