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ABSTRACT

This paper is concerned with innovative behaviour in organizations and the role of structural factors in its cultivation. Innovative task and organic structural variables were measured in a field study involving a unit of analysis not hitherto considered in this context: the small face-to-face work group. A structural construct ("organicity") emerged, which correlates strongly with innovativeness of task.

Organicity emphasizes the sharing of roles, tasks and responsibilities, a democratic, team-oriented approach to the work at hand, and access of all members to the decision making processes of the group. Innovativeness of task was measured in terms of group members' expectations. An attempt to include "performance" in testing the task-organization structure contingency model met with limited success.

INTRODUCTION

Innovation, meaning the devising of new and different things to do, and new and different ways of doing things, is something of a necessity for organizations operating in the present era. It is characteristic of this era that social organizations of most kinds have to deal with a fast rate of change in the techniques they use, the needs and demands they cater to, and the resources they draw upon.

Business organizations in particular are under continual pressure to, on one hand adapt themselves to changing resources and constraints and, on the other hand, seek and respond to unpredictable opportunities. In short, they have to cope innovatively with a changeful and uncertain environment. Population growth, scarcity of resources and the physical and psychological hungers of mankind would appear to guarantee the continuance of this innovative pressure in the economy and in society for some time to come.

For a business organization to survive in a changeful and uncertain world, therefore, it must have a structure and a way of operating that can cope with innovation. This question of viability in an uncertain environment has drawn considerable attention from students of management and administration. In their book, "The Management of Innovation", Burns and Stalker (1961) described a number of firms, many of which in the aftermath of the war were faced with the necessity of adapting their business strategies, their organizations and their people to far-reaching changes in technology and markets. Some of these firms were singularly successful in adapting, and others were not.

Burns and Stalker extracted from their analysis two distinct sets of characteristics which typified the management systems of these firms. One set, which was typical of firms which adapted successfully and were innovative, was labelled "organic". The other set was associated with firms which operated in a comparatively routine and non-innovative manner, and were not successful in adapting to new conditions; it was called "mechanistic". The attributes which characterise the organic and mechanistic management systems are summarized in Table 1.

Of course, the management system of an actual firm need not be at one extreme or the other, but would normally be located at some intermediate position along this organic - mechanistic dimension. A firm which is relatively mechanistic, and which desires to become more innovative, would be well advised to "move" toward the organic end of the dimension.

It is the intention of this paper to examine some of the theoretical ideas underlying organic structure and the innovative process, and to present the findings of a field study in which these ideas were tested on a unit of analysis not hitherto considered: the small face-to-face work group.

Table 1 -- about here.

THEORETICAL FRAMEWORK

1. The Innovative Process

Innovation can be viewed as a behavioural response of a system to a challenge originating in its environment. The notion of "challenge" pre-supposes a dissatisfaction on the part of the system

TABLE I*

Mechanistic Systems

- a) The tasks facing the concern as a whole are broken down into functionally specialized, separate jobs.
- b) The separate jobs are performed by functionaries, as ends in themselves.
- c) Individual tasks are defined and coordinated by a formal hierarchy of superiors.
- d) Rights, obligations and methods for each job are precisely defined.
- e) Responsibility is determined by rights, obligations and methods
- f) There is a hierarchical structure of control, authority and communication.
- g) Knowledge about and control of the task are located towards the top of the hierarchy.
- h) Communication is vertical, rather than lateral.
- i) Operations and behaviour are governed by instructions and decisions from superiors.
- j) Loyalty and obedience are mandatory.
- k) Greater importance and prestige attached to "local" rather than "cosmopolitan" knowledge, experience and skill.

Organic Systems

- a) Individuals contribute their special knowledge and experience to the common task of the concern.
- b) The individual task is seen as set by the total situation of the concern.
- c) Individual tasks are adjusted and continually re-defined through interaction with others.
- d) Rights, obligations and methods are not precisely prescribed; problems may not be posted upwards, downwards or sideways, as being someone else's responsibility.
- e) Commitment to firm and task goes beyond any technical definition.
- f) There is a network structure of control, authority and communication.
- g) Knowledge about and control of the task may be located anywhere in the network.
- h) Communication is lateral, rather than vertical; consultation, rather than command.
- i) Superiors give information and advice rather than instructions and decisions.
- j) Commitment to the "technological ethos" is more highly valued than loyalty and obedience.
- k) Importance and prestige attach to affiliation and expertise related to the industry, skill or profession, rather than to the firm

(* The items are condensed and paraphrased from the original items in Burns & Stalker (1961).)

with its situation, and an opportunity to improve that situation. An innovation can be said to progress through three main phases: the generation of new ideas, the proposal and acceptance of these ideas, and, finally, their implementation. In an organization, such a process will be moderated by the information and authority sub-systems of the organization. (e.g. Thompson, 1965; Wilson 1966).

The information system is concerned with the interchange of ideas and the patterns of interaction and communication. If innovative behaviour is motivated by dissatisfaction with the status quo, and conveyed by an opportunity, information processes must be called into play in order that the dissatisfaction be felt and the opportunity perceived and evaluated. Messages must be sent and received, problems researched and analysed, and decisions made. It is through these information processes that, within an organization, individuals and groups acquire much of the knowledge, ideas, preferences and goals which determine their creative and co-operative responses.

The authority system is involved with the control of incentives, the selective control of information and the general attitude of the organization toward change. Innovative behaviour can be increased by reducing the risks and increasing the rewards associated with change for individuals and groups (Slevin, 1971). These penalty - reward factors are normally linked with and controlled by the formal power structure of an organization. On the other hand, to the extent that a really basic innovation or "re-orientation" could alter the actual authority structure of an organization, the power system itself might be expected to resist the proposed change (Normann, 1971).

The apparent relationships between this process model of innovation and the organic and mechanistic characteristics described by Burns and

Stalker have been formally evaluated elsewhere, (Meadows, 1975). In general, the evaluation shows the organic structure mode to be favourable to the innovative process in many, but not all, respects. Specifically, the mechanistic mode has the advantage in maintaining stability, (i.e. avoiding over-reaction or "hunting"); and in the manipulation of rewards and incentives. These factors have some importance in getting new ideas accepted and implemented. Several researchers have seen evidence of this structural dilemma (Wilson, 1966; Sapolsky, 1967; Carroll, 1967), and it has led some to advocate the operation of both modes within the innovative organization (Evan & Black, 1967; Shepard, 1967). However, on balance, the organic mode does seem to be substantially more favourable to the innovative process than does the mechanistic mode.

2. Organic Structure

Weber's model of bureaucracy has long served the industrial era as a structural framework for organization theory. Classical organization theory used the model as a way of linking individual effort to organizational goals - a sort of administrative technology. In reaction, the Human Relations movement has emphasised the individual and has tended to treat the organization and the environment as external systems with which the individual has to cope. With the revival of "structuralism", closer attention has been paid to those levels of organized behaviour that intervene between the individual personality and the corporate system of the organization. As the Weberian model has been challenged and refined, it has become increasingly clear that this organizational "tissue" contains a rich variety of patterns. Some are formal and contrived, while others are informal and spontaneous.

Work collectivities are, as Selznick says, "cooperative systems...constituted of individuals interacting as wholes in relation to a formal system of coordination." The concrete structure of an organization is a resultant of various interacting subsystems, both formally and informally conceived (Selznick, 1948). Social science is in need of concepts that express and interpret the various ways that collectivities can work together. The concept of "organic structure," with its emphasis on interpersonal, rather than interpositional structure, is one approach to this problem.

The "organic" or "organismic" analogy of human organizations to biological systems has long been current among social philosophers. The idea was particularly popular in the nineteenth century (e.g., Spencer). Durkheim, at the turn of the century, put the idea into a specific sociological framework in his dissertation on the Division of Labour in Society (Durkheim, 1902). The ideal types of "organic and mechanical solidarity" emerged as explanatory factors in social cohesion at the interpersonal level. Durkheim argued that the dividing of an activity among several individuals, each performing a special and different part according to his special abilities and disposition, creates interdependence among them. The shared task cements, as it were, their social group. This type of integration is "organic solidarity." The other type, "mechanical solidarity," is found in the more primitive integration of societies whose members play more or less identical, interchangeable roles, and where cohesion springs from adherence to a common system of values and beliefs ("la conscience collective").

In a modern industrial context, these factors emerge in a practical way in a group of studies by Trist and others of social process "at the coal face." In one of these studies, the contrast is drawn between the structure and process of two occupational groups of coal miners, the "gummers" and the "rippers." The gummers have to clear away the loose coal cut away from the bottom of the coal-face, so that a clear space is left for the coal to drop into when the face is blasted. The rippers have the relatively complex task of constructing the permanent "gates," or reinforced passageways, as the coal-face advances. The rippers' work requires team-work and a variety of skills. They are summed up as a cohesive, high-status group, doing a relatively complex job. They are bound together by a variety of functions which fit together into a finished product which is lasting and visible to all. The gummers, on the other hand, are a loose-knit, low-status group, doing a relatively simple job. They all do much the same thing in parallel, between two other operations (cutting and blasting), in which they are not really involved. (Trist and Bamforth, 1951.)

In a later paper, Emery and Trist (1960) draw on similar data to illustrate the interaction of technology with group structure. In this case, the contrast is between a group with complex formal structure and simple work roles, and a group with simple formal structure and complex work roles. The former is characterized by each man sticking to his narrowly defined job and having little to do with people outside it. In the latter, each man is drawn into a variety of tasks, and feels an overall commitment to the whole job. Productivity and general work effectiveness were considerably higher in the latter group.

These studies demonstrate the phenomenon of the organically cohesive group, whose strength lies in the integrated diversity of the roles it contains, as contrasted with more contrived and divisive forms of social organization. The division of labour can be seen to exist in two quite different modes: when it is able to shape itself within a group, as a mutual sharing of a whole task among members with different skills, and a sharing of responsibility for the whole task, it can produce a strong cohesive force. When, however, it is a restrictive and arbitrary system which limits responsibility, communication and influence to trivial proportions, it is antithetic to Durkheim's conception and produces no "organic solidarity."

Burns and Stalker, as noted earlier, arrive at the concept of organic structure from an empirical study of management systems in industry. They identify an organic type of management system, and contrast it formally with a mechanistic type of management system which is closer to the Weberian model of bureaucracy. The characteristics of these two ideal types are summarized, above, in Table 1. Importantly, Burns and Stalker linked the organic system closely to success in innovative activity (Burns and Stalker, 1961).

These three instances of the emergence of "organicness, firstly as a factor in social cohesiveness; secondly as a factor in organizational effectiveness; and thirdly as a factor in innovativeness; testify to its importance as an organizational variable. The concept is, moreover, demonstrably applicable to several levels of analysis: Burns and Stalker apply it at the level of the management system, in terms of organizational decision making and control. Trist and his colleagues observed it at the

level of the face-to-face work group. In subsequent research, the same or similar constructs have been applied to industrial departments (Lawrence and Lorsch, 1967), professional organizations (Hall, 1967, 1968), R&D organizations (Pelz and Andrews, 1966), and health and welfare agencies (Aiken and Hage, 1971). Some representative studies from this body of research are discussed in the next section.

3. Organic Structure and Innovation

Lawrence and Lorsch (1967) measured a structural variable, "formality of structure," which they based largely on R.H. Hall's (1962) "bureaucratization" measures. They found a positive correlation between a measure of environmental and task uncertainty and the formality of structure in the management of the industrial departments they examined.

Pelz and Andrews (1966) found a positive correlation between the inventive output of R&D groups and certain group behavioral characteristics, including frequency of communication, diversity of interests, motivation and coordination. Clagett Smith (1971) added to this list, "group heterogeneity," which includes diverse approaches to problem solving, time horizons and achievement orientations.

Harvey (1968) has shown that the degree of programming of roles, work flow and communication in a manufacturing organization correlates negatively with the breadth and rate of change of the product range. Harvey refers the structural measure specifically to Burns' organic-mechanistic typology.

Duncan (1971) constructed structural profiles of a number of

decision groups, using bureaucracy-type measures, after Hall (1962). He found correlations between non-bureaucratic features in these profiles and perceived task uncertainty in the groups.

Miller (1971) studied a sample of steel producing corporations in Europe and America. He found that the frequency of innovation (the adoption of new and risky technology) correlates positively with "organicity" of structure. The latter variable is based on the Burns and Stalker ideas.

Aiken and Hage (1971) also used the Burns and Stalker characteristics of organic systems to derive a set of structural variables: these include diversity of occupational specialties, involvement of members with professional associations, intensity and direction of communications, participation in decision making, and formalization of rules and procedures. They used these variables, and a measure of innovation (track record of the organization in adopting new programs) to compare 16 health and welfare organizations. The unit of analysis is the whole organization. They found substantial correlations between the innovative record and the diversity of occupations (positive), professional involvement (positive), formal rules and procedures (negative), and some elements of the communication variable -- particularly with frequency of committee meetings (positive) and with upward communication within departments (positive). Participation in decision making correlated only slightly with innovative record; the decision areas concerned were hirings, promotions, new policies, and new program adoptions.

Aiken and Hage also noted four factors which are not related conceptually to organic structure but which are positively corre-

lated, in their study, with the rate of new program adoption in an agency. These are, increase in financial resources, growth in size, number of joint programs with other organizations, and innovative record in previous periods.

In the above research, structural measures occupy the area between Burns' organic characteristics on one hand, and classic non-bureaucratic characteristics on the other. Some studies treat them as a composite dimension, and others as separate dimensions. The relationships among these structural factors have received little attention. The innovation measures are of two distinct kinds: either in terms of innovative output (inventions, patents, new programs, new technology adopted, etc.), or in terms of perceived uncertainty and innovative press. Those studies which emphasize perception by managers or group members of uncertainty and challenge in the task environment (e.g., Lawrence and Lorsch; Duncan) are only incidentally concerned with structural measures. Lawrence and Lorsch are concerned mainly with differentiation and integration among departments; Duncan's research is more concerned with the structure of the environment than of the organization or the group itself (Duncan, 1972).

The essential questions of interpersonal structure and process, relative to innovative behaviour in organizations, remain unanswered. The research needs to be extended into the area of organic dimensions of structure on an interpersonal, small group level; and of innovative behavior in the day-to-day process at this same interpersonal, group level.

4. The Small Work Group

The process of innovative activity in organizations, clearly

concerns all levels of structural analysis. Idea generation is an individual activity, often stimulated and facilitated by interpersonal transactions. The acceptance and development of new ideas engages interpersonal and intergroup levels; and issues of applied organizational policy arise with the acceptance and implementation of new ideas. Research has rightly been concerned with questions of overall organization structure and climate on one hand, and of individual creativity on the other (e.g., Roe, 1964). However, the small face-to-face work group has been somewhat neglected as a unit of analytical study with respect to innovation and structure.

Hare states that:

"There are...five characteristics which differentiate the group from a collection of individuals. The members of the group are in interaction with one another. They share a common goal and set of norms, which give limits and direction to their activity. They also develop a set of roles and a network of interpersonal attraction, which serve to differentiate them from other groups." (Hare, 1962:10)

In organizations of most kinds, it is common to find individuals working together in small collectivities, ranging in size from two or three members up to seven or eight, and sometimes more. The members share a common task, interact face-to-face, and in general meet Hare's qualifications for a true group.

Typically, the members of a small natural work group are engaged in a joint endeavour; they are united in a common overall purpose and share a common place of work. They see each other frequently, exchange information about the work, are part of a unified network

of authority and activity, and are aware of their separate existence from other groups. For instance, the members of a drawing office are all engaged in preparing specification drawings of telephone switchgear. Their common purpose is to provide this service for engineering research and development groups and individuals. They work at drawing boards in one large drawing office; the supervisor of the group sits in a glass-partitioned office at one end. The group members can consult one another whenever they need to, about technical or administrative matters. They all report to the same supervisor, and on up the same branch of the line organization. Each member knows the title of the group, its official identification number and the names of all its members.

This view of the small work group as a functional unit of organizations suggests two things: firstly, one might expect it to be a primary arena for the interpersonal transactions that are so important to innovative activity. Secondly, it clearly has structure, either imposed or self-generated, which defines its persisting interpersonal relations.

5. Summary and Conclusions

In considering the problem of organizational survival, the foregoing discussion has focussed on the concept of the structured system adapting to environmental changes. More specifically, innovation has been identified as a behavioral response, and organic structure as a means of cultivating and facilitating innovative behavior.

It is pointed out that the differentiation of individuals is a cohesive rather than a divisive force in social groups -- but

only if the differentiation process is of a certain kind. Durkheim's notions have been introduced to the discussion because it is his conception of "organic solidarity" which first came to grips with the problem. Trist and his colleagues have demonstrated different forms that the division of labour can take at the work group level. Burns and Stalker relate organicness to innovativeness, and this has been confirmed by several subsequent research studies. The Burns and Stalker descriptive characteristics of organic and mechanistic systems provide an empirical basis for a structural dimension of "organicness," although the consistency and homogeneity of this dimension has not been extensively tested.

Research on the organic-innovative relationship has so far been largely at the macro-level of organization analysis. It has used structural measures based mainly on the bureaucracy model (e.g., Hall, 1962), and to some extent on the Burns and Stalker typology. The importance of a smaller unit of analysis, the small work group, has been established in this context, both as a structured sub-system and as a vehicle of innovative process. A need is strongly indicated, to extend the research into an examination of the small organic work group and of perceived innovativeness in the group work process. Two practical questions present themselves:

- 1) Is the organic notion applicable to the structure of small groups?
- 2) Is innovative activity in small groups associated with the organicness of their structures?

The remainder of this paper describes an attempt to operationalize organic structure and innovativeness of task as small group variables, and to address the above questions through the measurement of these variables in a field study.

RESEARCH VARIABLES AND HYPOTHESES

The model used as a theoretical basis for this study is essentially that of a system adapting its structure to environmental and task demands in order to achieve its performance goals, i.e., Task → Structure → Performance. These general terms are rendered more specific in the framework of the foregoing theoretical discussion:

Innovative → Organic
Task Structure → Performance

The unit of analysis is the small, face-to-face work group, as defined earlier. In this section, the variables of the model are described in operational terms, and the hypotheses linking them are stated.

1. The Organic Structure Measure

This variable is conceived in terms of the Burns and Stalker organic characteristics, thinking about small work groups rather than management systems. The variable is constructed of five elements:

- a) The extent to which sub-dividing, fragmenting and arbitrary assigning of tasks is eschewed in favour of an integrative, team-oriented, situational approach.
- b) The extent to which the boundaries of responsibility, authority and influence are blurred, and dependent on the situation, rather than precisely defined and theoretical.
- c) The volume of interpersonal communication engaged in,

the dominance of lateral over vertical directions of communication, and of supportive over directive information content.

- d) Individual commitment to special skills or professional norms, rather than to the organization itself; i.e., cosmopolitan rather than local.
- e) Access of the individual to the decision making processes within the group.

A questionnaire instrument was constructed including three items for each element. The 15 items were designed to fit into a conversational interview format; scoring is on a 1 to 5 scale ranging from very mechanistic (1) to very organic (5) responses. Typical items are:

- a) "When a new job/program comes up for your group to do, do you get a piece of it to work on alone (M) or are you assigned to it as one of a team?" (0)
- b) "When you are working on a job, is it quite clear to you what you are not (responsible for)?" (Yes=M; No=0)
- c) "When you are working on a job, are most of your (dealings) with your own superiors and subordinates (M), or with other people (0)?"
- d) "Do you feel you could apply your own personal skills and abilities just as well in other firms or organizations as you do here?" (Yes=0; No=M)
- e) "When decisions are made in your group...do you play an influential part?" (Yes=0; No=M)

(The O and M symbols refer to the organic and mechanistic characteristics in the Burns and Stalker typology from which the items are conceptually derived.)

This instrument is designed for scoring individual group members; the scores have to be combined to generate group scores. The group variable is coded "O_G".

2. The Innovativeness Measures

The concept is that of a task attribute, not an outcome. That is, we are concerned with how innovative the task requires the group to be -- not with the actual level of innovation attained. Therefore, the measurement should be of management's expectations and of group members' perceptions. Two separate measures were designed: one aims to assess the innovativeness of the group as required or desired by a senior manager at one remove from the group (i.e., not the group leader, but his supervisor). An instrument was designed for the use of a researcher in a semi-structured interview with a manager. A five-point scale was used; typical bench marks are:

	<u>Score</u>
A group constituted solely for the purpose of generating and developing new ideas. Virtually no routine or service work.	5
A group expected to solve problems and develop new designs and methods within a well-known but developing technology. A proportion of time on support and service.	3
A group set up to perform a routine service, requiring only the most basic adaptations.	1

The instrument produces a score for the group. The variable is coded "N_{Req}".

A second instrument was designed, in the form of a questionnaire to be administered, along with the structural questionnaire, in conversational interviews with group members. The 15 items represent rate of environmental change (technology and client structure), task variety or routine, and general "press" to innovative behavior. Some typical items are:

- a) "How much new technology (materials, techniques) has become available to your group in the past 2 years?"
- b) "Can you predict who the group's (clients) will be 2 years from now?"
- c) "Does much of your work involve problems which require really fresh approaches and novel solutions?"
- d) "Do you think you are judged on your innovative contribution?"

Response to each item is scored on a five-point scale, according to whether it indicates a very low (1) or a very high (5) degree of change, variety of innovativeness. The individual scores are combined to generate group scores. The variable is coded "N_G".

3. The Performance Measure

The performance variable was operationalized in the form of an appraisal questionnaire, to be completed by supervisors who have responsibility for the various groups' activities, and who are in a position to judge their output. The instrument was, like the others, designed especially for the purpose; it includes ratings of general quality of performance, room for improvement, reliability, competence and being up-to-date, for the group as a whole. Each item is rated on a five-point scale, e.g.,

1 = unreliable
3 = moderately reliable
5 = outstanding

The items are combined into a total score on a 1-5 scale. The variable is coded "R_G".

Due to an internal policy in the larger of the two organizations in which the field study was carried out, performance data were forthcoming for only a small segment of the total population studied.

4. Hypotheses

The model linking these three variables implies (i) a direct correlational hypothesis with regard to "innovativeness" and "organicness", and (ii) a contingency hypothesis with regard to those two variables and "performance". Moreover, the tentative and exploratory nature of the "organic" and "innovative" constructs requires that they be tested for homogeneity. It has not been established that the organic-mechanistic construct is indeed a single, homogeneous dimension, and its application to small group structure is hypothetical in itself. Similarly, the perceived innovativeness measure must be tested for internal consistency and for mutual validity with the required innovativeness measure as criterion.

Therefore, the following list of hypotheses is proposed:

- 1) The separate items measuring perceived rate of change, variety and other innovative press, embodied in the innovativeness questionnaire, are sufficiently inter-correlated to constitute a single measure of perceived innovativeness.

- 2) The perceived innovativeness within a group (N_G) is associated closely with the task requirement for innovation as described by a senior manager.

$$N_G = f(N_{Req}). \quad \text{positive correlation.}$$

- 3) The items of the organic structure variable (O_G), based on the Burns and Stalker characteristics of organic management systems, can be used to define a single dimension of "organicness" in the structures of small groups, i.e., the fifteen items of O_G are inter-correlated.

- 4) Organicness of structure in small work groups is closely associated with innovativeness of task as perceived by the members of the group.

$$O_G = f(N_G). \quad \text{positive correlation.}$$

- 5) The quality of group task performance depends on the combination of organicness of structure and innovativeness of task. The proposed relationships are summarized in Table 2.

Table 2 -- about here.

THE RESEARCH SETTING

1. The Sites and Samples

The field study was conducted in two commercial organizations. The first is a very large corporation in the telecommunications industry in the United Kingdom. The work groups examined are all in the Research and Development departments, and are all involved directly or indirectly with the invention, design, development or use of electronic equipment of one kind or another. At the less

TABLE 2

Hypothesized levels of group performance
 (R_G) , as contingent upon organic structure
 (O_G) and innovativeness of task (N_G) .

		Innovativeness of task (N_G)		<u>Low</u>
		High R_G	Low R_G	
<u>Organicness of structure (O_G)</u>	<u>High</u>	-----	-----	
	<u>Low</u>	Low R_G	High R_G	

innovative end of the spectrum are routine drawing office groups; at the other extreme are groups engaged in inventive research (~~in inventive research~~) in new scientific fields. Between these extremes are groups whose tasks involve a wide range of degrees of uncertainty, variety and complexity.

For instance, groups which are charged with developing and approving telephone switching and signalling equipment must have expert knowledge and have to cope with complex problems in a volatile field of electronic engineering. Groups which design equipment and methods for the installation and maintenance of telephone lines and cables are also required to be expert and resourceful in a relatively stable engineering field. Research groups working on optical wave guides and laser-beam transmission of information are exploring at the frontiers of physical science. Groups which produce standard drawings of electrical circuits have quite routine work, although complexities arise in scheduling and coordinating this work.

The second organization is a manufacturing division of a medium sized chemical company in Canada. The groups sampled in this organization are engaged in technically oriented work in R&D, technical service, production control and marketing. While the industry is different (industrial coatings), the factors of technical expertise, task complexity and technological change are qualitatively similar. For instance, one group is engaged in developing new types of organic coatings under a radically new technology (powder coatings). Another group develops new qualities and colours of coatings for the automobile industry. A marketing group is engaged in planning and developing product lines in a

competitive and technically sophisticated industrial market. A clerical and stenographic group provides routine support for the R&D laboratory. Other groups provide conventional problem-solving services to production units and customers.

In the first organization, data were collected by interviewing 79 members of 20 groups, and 30 managers responsible for those groups. In the second organization, 28 members of 8 groups were interviewed and several managers.

2. Methods

The groups sampled were selected, in consultation with the management of each organization, with the aim of getting a suitable range of innovativeness of tasks.

Interviews for the variables innovativeness (N_G) and organic structure (O_G) were conducted individually and in private. No tape recordings were made; data were recorded directly on the questionnaire forms. The questionnaires were completed by the interviewer in the course of approximately thirty minutes of interview. (The total interview time averaged one hour, the rest of the time being used to collect data on attitudes and personality traits. These will be presented in a later paper.)

The measurement of the innovativeness criterion (N_{Req}) was done in private interviews with managers. The approach was informal; the researcher simply directed the conversation toward a discussion of the nature and purpose of a group's work and the demands of the "client" environment. The researcher then used this information to assess the group on the rating scale outlined above. This interview with the manager, and the O_G and N_G interviews with

group members took place several weeks apart and often at different locations; all reasonable efforts were made to avoid confounding the two ratings in the researcher's mind.

The performance (R_G) data were obtained through a questionnaire-type rating form, given to appropriate managers. The paucity of these data has been explained earlier.

There is a methodological problem in the fact that the O_G and N_G questionnaires were administered by the same researcher in the same interview sessions to the same subjects. Firstly, there is a possibility of error and bias in responses due to social desirability and related effects which perennially beset self-report measures. Secondly, there is a possibility of the interviewer subconsciously confounding the trends on the two dimensions in such a way as to fulfil the hypotheses. Both these tendencies are guarded against by making the questionnaire items as objective and straightforward as possible. The item questions call for simple, factual answers rather than attitudinal responses. Needless to say, the researcher tried to maintain an open and objective mind in this respect. The validity of N_G is testable by correlation with the N_{Req} criterion. Unfortunately, there was no corresponding structural criterion evident in the situation to support the O_G measure.

RESULTS

The instruments were pre-tested on a small pilot run on six subjects in two groups. Some minor adjustments in item wording were made to correct ambiguities or skewness in responses. The data are all in the form of "continuous" numerical scores, reduced to a 1-5 scale and tabulated for 107 individual cases grouped according to actual work groups. The groups ranged in size from 3 to 5

persons.

Two decisions had to be made on the pooling and grouping of scores. Firstly, it was decided to pool the data from the two organizations, because (a) the general characteristics of the two sites were qualitatively similar; they shared an atmosphere of the commercially-oriented technical organization, with tasks ranging from advanced research to service work. Professional, technical and social skills, training and background are generally similar; (b) the scores for the two samples are statistically similar; means and variances for each variable are similar in the two samples, and plots on an O_G versus N_G chart occupy the same area of scatter. $H: \mu_1 = \mu_2$ is acceptable ($p = .05$).

Secondly, a critical decision was made to derive group scores on the two main variables by simply adding the individual scores for all members of the work group and then dividing by the number of members. This is done on the assumption that the group average response to each stimulus item represents the best estimate of the group variable available from the data.

The data analyses and findings are presented in the order of the five hypotheses tested.

- 1) The 15 items of the "perceived innovativeness of task" instrument are substantially correlated among themselves. Inter-item product moment correlation coefficients range from $r = 0.25$ to 0.55 ($n = 107$). This suggests that the items can reasonably be combined into a single scale (Hypothesis No. 1). The internal consistency of the scale, as measured by the Kuder-Richardson formula, is high: $\alpha = 0.93$, $n = 107$.

The combined scale scores for individual cases were averaged across each group (as described above) to generate group scores for N_G . Individual and group scores have an approximately normal distribution across the scale in all items.

The "degree of innovativeness required" (N_{Req}) was ascertained for each group, and tested for correlation with the N_G scores. The correlation was high and positive ($r=0.80$, $n=28$).

The correlation coefficients and the test of consistency indicate that the innovativeness concept is a valid one, that the 15 item instrument (N_G) is a reliable and homogeneous instrument for its measurement, and that the method of generating group scores from averaged individual scores is justified. That is, Hypotheses 1 and 2 are amply supported by the data.

- 2) The 15 items of the "organicness of group structure" instrument are not so homogeneous as those of the innovativeness variable. Inspection of the inter-item correlation matrix suggested, in fact, three distinct groups of items:

- a) a group of 9 items, representing the core of the organic concept as applied to small work groups. Items refer to an integrated, team-oriented, situational approach to the division of work, blurred role boundaries, supportive interpersonal communications, and freedom of access to group decision processes.

b) a pair of items referring to the volume and direction of communications.

c) three items representing the orientation and commitment of individuals to their skills and professions rather than the organizations they work for.

One item was rejected (awareness of hierarchy of authority) because scores were very heavily skewed. Scores are approximately normally distributed across the scale for all other items.

The above factors are distinguished by strong inter-item correlations within the factors, but weak correlations between the factors. These statistical distinctions also make conceptual sense. The 9-item core factor is labelled "organicity." It represents the sharing of roles, tasks and responsibilities throughout the group, a democratic team orientation, and a situational adaptive approach to the group's job. The "organicity" scale has an internal consistency coefficient of $\alpha=0.84$ ($n=107$).

The items referring to the amount of time spent communicating, and the tendency for that communication to be "lateral," rather than with subordinates and superiors, are certainly relevant to the overall organic concept. However, in this sample, they are relatively independent of the above "sharing" items, while quite strongly correlated with each other ($r=0.38$, $n=107$). The item on the content of communication (directive vs. supportive), however, correlates

clearly with the organicity items, and not with the other two communication items. The latter factor (2 items) is labelled "communicativeness."

The three items on orientation and commitment are moderately correlated with each other ($r=0.21, 0.24, 0.27, n=107$).

The items were designed to tap the inward-outward orientation, but this does not seem to have been achieved. The actual questions are as follows:

- a) Do you feel you could apply your skills and abilities just as well in other firms...?
- b) How important to you is it to work as a...?
- c) If you had to choose between doing the same work with a different firm, or less attractive work with your present firm, which do you think you would choose?

These items are related, at least superficially, to the Burns and Stalker characteristics, and to Richard Hall's (1967, 1968) "professionalization" concept; this "cosmopolitan" notion is part of the organic concept. However, these three items, as they have been responded to, seem to reflect a variable which is not really structural. The impression was gained in the interviews that these items enter a very personal and subjective area, and the responses are determined by factors such as self-concept, age, ego-defense, etc. That is, the items may have tapped a concept which is not part of the group concept at all.

Statistically, the three items discriminate quite well and show some internal consistency, as noted above. However,

they are not widely correlated with other items in the organic variable. This group of items is labelled "local-cosmopolitan."

Thus, the hypothesis of a single organic structural dimension must be modified. The "organicity" scale appears to be a core dimension. Two other dimensions appear to split off from the original conception: "communicativeness" and "local-cosmopolitan." The former does appear to be conceptually related to small group process; the latter, however, seems to be a matter of person-institution relationships and, perhaps, individual traits, rather than group interpersonal relations.

Scores on all three dimensions were averaged across groups to obtain group scores (O_G).

- 3) The group scores for innovativeness of task and organicness of structure were tested for association by calculating the Pearson product moment correlation coefficients between N_G and the three O_G dimensions. The results are summarized in Table 3.

Table 3 -- about here.

The statistical significance of the innovativeness-organicity correlation is very high and the hypothesis of association is amply supported. The separation of the two "split off" dimensions is confirmed in that they are not correlated with innovativeness.

TABLE 3

Innovativeness (N_G) vs Organicity, etc. (O_G).
Pearson product moment correlations. (n = 28)

Innovativeness
(N_G) with -

"organicity"	r = 0.77*
"communicativeness"	r = 0.08
"local-cosmopolitan"	r = 0.01

* significant at p < .001)

- 4) As explained earlier, only a small sample of useable "performance" data was obtained, insufficient to test the hypotheses as intended. However, some trends are discernible and, therefore, worth reporting. There are five group cases in one set, in which group performance (R_G) ratings were provided by one judge. The N_G and O_G scores were dichotomized at the whole-sample means to give four cells; it was found that each cell had at least one case. This analysis is summarized in Table 4.

Table 4 -- about here.

The analysis shows higher (and equal) performance scores in two cases; where high organicity occurs in conjunction with high innovativeness of task, and low organicity with low innovativeness. These differences are in the predicted direction but, of course, no confident decision on the hypotheses can be made on the basis of these very few results.

DISCUSSION

The attempt to construct an organic structure measure for small work groups has resulted in an instrument which appears to measure more than one dimension. One of these dimensions, "organicity," fulfils the hypothesized relationship to innovativeness of task. The other two do not. This suggests that the main factor in organic structure which is important to innovativeness in such groups is narrower in scope than the original Burns and Stalker concept. It is possible that the measures of volume and direction of communication are more nearly related to aspects of

TABLE 4

Group Performance at high and low levels of
innovativeness and organicity (cf. Table 2)

		Innovativeness of task (N_G)	
		<u>High</u>	<u>Low</u>
<u>Organicity</u>	<u>High</u>	$R_{G3} = \underline{4.0}$	$R_{G1} = \underline{3.6}$
	<u>Low</u>	$R_{G4} = \underline{3.0}$ $R_{G2} = \underline{3.4}$	$R_{G5} = \underline{4.0}$

the nature and complexity of the group's task, than to the internal structure of the group. That is, it may be possible to improve the instrument by focussing specifically on internal group communications.

The measure of local-cosmopolitan commitment has apparently tapped a real variable. However, as Hall and Schneider (1972) have found, this kind of variable is probably a time-related product of the psychological contract between an individual (with his personality traits) and the organization (with its opportunities and rewards). In the present samples, this apparently does not enter into the task-group structure relationship.

It seems a reasonable step, therefore, to accept "organicity" as an operational measure of the organic structure concept in small work groups.

The proposition that group performance is contingent upon the appropriate combination of organic structure with innovative tasks, and of mechanistic structure with routine tasks, still remains to be tested. The measurement of innovative task performance, or the evaluation of innovative activity, is fraught with difficulties. It requires not only a stable and meaningful criterion by which to judge, but also a judge with sufficient information on a large number of groups, and a rating scale which can discriminate high and low performance among groups which must, however, all be reasonably competent to survive. Objective methods such as counting patents, papers, etc., might fail to appreciate the more subtle creative contributions; subjective methods such as ratings by informed opinion (used above) are beset by the problems of standardization referred to above (judges, criteria, scales). The latter approach should be more useful conceptually, provided the said

problems can be overcome.

There is, however, a second kind of outcome variable to be considered: namely, personal satisfaction. Motivation theory holds that job satisfaction is a function of, among other factors, the nature of the task and of the organizational arrangements (e.g., Porter, 1961, 1962; Vroom, 1960; Hackman and Lawler, 1971). Therefore, organicity and innovativeness might be expected to influence the satisfaction of group members in their work. Since satisfaction is a direct result of need fulfilment, a group member's satisfaction under certain conditions of task or interpersonal structure might be contingent on personality traits. This question of individual differences and satisfaction in relation to organic and innovative groups will be discussed in another paper.

CONCLUSION

This paper has endeavoured to establish the importance of innovative behavior in organizations and the relevance of structural factors to its cultivation -- specifically, of "organic structure." Recent research has confirmed that structural forms reflecting the organic concept are, in fact, found where organizations have to cope with uncertainty and produce new programs, products, etc. The unit of research analysis has typically been the management system, the department, the corporation and the agency. This paper describes a study of small work groups in two industrial organizations, and explores the validity of the organic-innovative association in their task requirements and their structure.

The results suggest that an organic structural concept,

named "organicity," has great relevance to the interpersonal working relationships in these small (3-5 persons) groups. This concept is more limited in scope than the "organic characteristics" originally used by Burns and Stalker to describe their organic type of management system. Organicity refers to a mode of group organization which emphasizes the sharing of roles, tasks and responsibilities, a democratic, team-oriented approach to the work at hand, and access of all members to the decision making processes of the group.

Organicity was found to correlate closely and positively with innovativeness of task -- a variable measured in terms of task variety, environmental change and other innovative press.

The question is raised of the expected effects of organic group structure on the work satisfaction of the group members, and the mediation of such effects by individual differences in personality. This question will be the subject of a later paper.

The instruments used in this study are new, and the approach has been exploratory. The positive results obtained, having extended the relevance of the organic structure concept into the domain of small group operations, warrant the further development of these instruments and of the theoretical model itself. In particular, a reliable and conceptually valid measure of group performance is needed.

The relevance of organic group structure to innovation and, potentially, to employee satisfaction underlines strongly the potential value of this organizational concept in a world which stresses adaptation to change and the quality of working life.

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APPENDIX

Organicity (9 items)

1. Is there a system in your group for the allocation of jobs to individuals? (Yes=M*)
2. Do you get a piece of the job to work on in isolation (M), or are you assigned to it as one of a team? (0)
3. How is it decided just what part you will play (in a new program, etc.) (Negotiated group decision=0; Don't know=M.)
4. Is it quite clear to you (in your group) what you are not expected to do? (Yes=M)
5. Is (the group leader) always the most influential in deciding what to do? (Yes=M)
6. (In communication with superiors and subordinates, do you give and get) mainly (a) orders and instructions, or (b) information and advice? (a>b=M)
7. Do you play an influential part in discussion and planning (re decisions made in your group)? (Yes=0)
8. Do you ever voice disagreement or disapproval with respect to these decisions? (Yes=0)
9. Do you feel free to criticize other members of your group? (Yes=0)

N.B.: The above items are paraphrased to some extent (indicated by parentheses) to compensate for their being taken out of the conversational context of the complete questionnaire. Standard bench marks were used with the questions to help grade responses. Details are available from the author.

* M indicates low organicity; 0 indicates high organicity.

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