DETERMINANTS OF COORDINATION MODES WITHIN ORGANIZATIONS*

ANDREW H. VAN DE VEN

The Wharton School
University of Pennsylvania

ANDRÉ L. DELBECQ

University of Wisconsin - Madison

RICHARD KOENIG, JR.

Kent State University


This paper classifies alternative mechanisms for coordinating work activities within organizations into impersonal, personal and group modes. It investigates how variations and interactions in the use of these coordination mechanisms and modes are explained by task uncertainty, interdependence and unit size. Nine hypotheses that relate these three determining factors to the use of the three coordination modes are developed in order to test some key propositions of Thompson (1967) and others on coordination at the work unit or departmental level of organization analysis. Research results from 197 work units within a large employment security agency largely support the hypotheses. The findings suggest that there are differences in degree and kind of influence of each determining factor on the mix of alternative coordination mechanisms used within organizational units.

Basic to a theory of organizations is the premise that all organizations need coordination. Coordination means integrating or linking together different parts of an organization to accomplish a collective set of tasks. Different levels of analysis and perspective have been taken to study coordination. Most organization sociologists have studied managerial coordination at the organizational level of analysis (e.g., Blau, 1968; Thompson, 1967; Meyer, 1972; Hage, 1974; Heydebrand, 1973). In this sense, mechanisms for coordinating task roles within work units or departments of organizations remains relatively obscure. Yet it is within work units or departments where the majority of instrumental functions are performed (Parsons, 1962). Further, while many researchers have followed Weber (1947) by measuring the degrees of structural integration in terms of complexity, centralization, formalization or socialization, few (Hage, 1974; Galbraith, 1970) have pursued the redirections offered by March and Simon (1958) and Thompson (1967) for conceptualizing and measuring processes of coordination.

This paper will attempt to focus upon coordination processes and test some key propositions of Thompson (1967) and others about coordination at the work unit level of organization analysis. Three alternative modes for coordinating work activities will be presented (impersonal, personal and group). The research will examine the extent to which task uncertainty, task interdependence and unit size predict variations in the use of the three modes of coordination.

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MODES OF COORDINATION IN ORGANIZATIONS

ALTERNATIVE MODES OF COORDINATION

According to March and Simon (1958), there are two general ways in which organizations can be coordinated: (1) by programming or (2) by feedback.

For our purposes, we will classify all forms of coordination by programming as an impersonal coordination mode. Coordination by programming is a clear construct exemplified by such integrating mechanisms as the use of pre-established plans, schedules, forecasts, formalized rules, policies and procedures, and standardized information and communication systems. The common element of each of these exemplary mechanisms is that a codified blueprint of action is impersonally specified. Departures from the blueprint are immediately obvious and human discretion does not enter into the determination of what, where, when and how roles are to be articulated to accomplish a given set of tasks (March and Simon, 1958); rather, roles and their articulation are formally prescribed in impersonal, standardized blueprints or action programs (Thompson, 1967). In addition, since these impersonal mechanisms of coordination are codified, once implemented their use requires minimal verbal communication between task performers (Galbraith, 1970; 1973).

Coordination by feedback, however, is a less crystallized construct. Thompson (1967:56) defines coordination by feedback as mutual adjustments based upon new information. Two operational modes for developing plans and making mutual adjustments are frequently used in organizations: a personal mode and a group mode. In the personal mode, individual role occupants serve as the mechanism for making mutual task adjustments through either vertical or horizontal channels of communication. In the group mode, the mechanism for mutual adjustment is vested in a group of role occupants through scheduled or unscheduled staff or committee meetings.

Within the personal mode, patterns of vertical and horizontal communications have received much attention for evaluating coordination processes in organizational literature (Hall, 1972:275). The mechanisms for vertical communication are usually line managers and unit supervisors (Thompson, 1967). When horizontal channels are used, the linkage function is assumed by an individual unit member who communicates directly with other role actors on a one-to-one basis in a non-hierarchical relationship. Alternatively, Lawrence and Lorsch (1967) suggest non-hierarchical coordination may be vested in a designated coordinator, integrator or project expediter who has no formal authority over the individuals whose activities require coordination.

Within the group mode, Hage et al. (1971) make the distinction between scheduled and unscheduled meetings. The former is used for the more routine, usually planned communications such as staff or committee meetings; the latter is used for unplanned communications, such as informal, impromptu conferences between more than two staff members about a work-related problem (Hage, 1974:151).

In summary, three predominant modes are frequently used to coordinate work activities within an organization. Coordination by programming is exercised through an impersonal mode, while feedback or mutual adjustments occur through either personal (vertical or horizontal) channels or group (scheduled or unscheduled) meetings.

Simple observations and experiences in organizational life suggest that each of the specific mechanisms for coordination in each mode are used often, and in various combinations, to achieve integration of a collective set of activities. The more interesting question, which we turn to now, is to identify which situational factors determine when one or a combination of these mechanisms are used.

DETERMINANTS OF COORDINATION MODES

Classically, impersonal and vertical mechanisms have been advocated as the most efficient and rational means for coordination, while use of horizontal communication mechanisms and group meetings are at variance with prescribed administrative practice (Fayol, 1949; Urwick, 1943; Weber, 1947).
The fact is well established, however, that horizontal channels and group meetings are used extensively to coordinate task activities in organizations, particularly at the work unit level (Simpson, 1962). Further, research by organization sociologists (e.g., Rosengren, 1964; Blau, 1968; Carzo and Yanouzas, 1969; Tannenbaum, 1974) and social psychologists (e.g., Bavelas, 1950; Shaw, 1964) suggest there are potential benefits (e.g., efficiency, corrective feedback, speedy conflict resolution and quality in task performance) and costs (e.g., information omission, distortion, overload and low motivation) in the use of any specific coordination mechanism.

Thus, variations in the use of coordination mechanisms within organizations are not explained solely by administrative prescriptions. There are a set of more fundamental factors which may explain the use of alternative mechanisms for coordination; and this research will examine task uncertainty, interdependence and unit size.

**Task Uncertainty**

Task uncertainty refers to the difficulty and variability of the work undertaken by an organizational unit. Task variability has been operationalized as the number of work exceptions encountered by a unit (Perrow, 1967). Alternatively, Hall (1972) measures variability as the sameness of work from day to day, the variety in methods and the repetitiveness of task processes. Task difficulty has been measured as the analyzability of the work and predictability of work methods. Alternative measures are: (1) the degree of complexity of the search processes; (2) the amount of thinking time to solve problems (Perrow, 1967); (3) the extent to which task processes or interventions have knowable outcomes (Thompson, 1967; Burns and Stalker, 1961); (4) the amount of time required before outcomes are known (Lefton and Rosengren, 1966). Taken together, task difficulty and variability constitute the major dimensions of task uncertainty at the work unit level.

Research has found that if the work undertaken by an organizational unit is analyzable and non-variable, most of the task activities can be standardized and programmed (Litwak, 1961; Hall, 1972; Perrow, 1970). However, as the task increases in uncertainty, it becomes more difficult to coordinate by impersonal means. This can be due to a greater number of exceptional cases arising (March and Simon, 1958; Thompson, 1967) or to encountering tasks more difficult to analyze. If the task is not well understood, then during the process of task execution there is learning which leads to changes in role allocations, schedules and priorities (Galbraith, 1973; Perrow, 1967). In the extreme case, a high level of uncertainty may require that mutual adjustments be accomplished by group judgments (Van de Ven and Delbecq, 1974). This leads to the following hypotheses:

A. Increases in the degree of task uncertainty for an organizational unit is associated with
   1. a lower use of the impersonal coordination mode
   2. a greater use of the personal coordination mode
   3. a significantly greater use of the group coordination mode.

**Task Interdependence**

Interdependence at the work unit level of analysis is the extent to which unit personnel are dependent upon one another to perform their individual jobs. Mohr (1971) defines interdependence as the extent to which work unit members have one-person jobs and the degree of collaboration required among unit members to produce or deliver the finished product or service of the unit. Thus, the fewer the one-person jobs and the greater the degree of task-related collaboration, the greater the interdependence.

Pennings (1974), however, points out that interdependence is a very difficult concept to define, both theoretically and empirically. For Pennings, the concept involves at least four different bases of interconnectedness between unit personnel: task (the flow of work between actors), role (the position of actors en-
gaged in concerted action), social (mutual needs or goals of actors) and knowledge (the differentiated expertise of actors). From this perspective, Mohr’s (1971) definition and measures of task interdependence should be seen as focusing upon role interdependence.

Thompson (1967:54-65) defines interdependence in terms of work flow and suggests that it be measured by focusing upon the flow of work, materials and objects between unit personnel. Hickson et al. (1969) have referred to this as “operations technology.” Building upon Thompson, a hierarchy of increasing levels of task interdependence between unit personnel can be determined by observing whether the work flow is (1) independent (Thompson calls this “pooled”), (2) sequential, (3) reciprocal or (4) in a team arrangement. Because the team arrangement is an extension of Thompson’s three work flow strategies, we will elaborate on the concept.

Team work flow refers to situations where the work is undertaken jointly by unit personnel who diagnose, problem-solve and collaborate in order to complete the work. In team work flow, there is no measurable temporal lapse in the flow of work between unit members, as there is in the sequential and reciprocal cases; the work is acted upon jointly and simultaneously by unit personnel at the same point in time. Examples of team work flow in organizational units include group therapy sessions in mental health units, a sports team playing a game and a group of research colleagues designing a study as a “think tank.”

(See Appendix for further illustration and description of measurement procedures of the four alternative work flow strategies.)

Thompson (1967:54-65) theorized that a hierarchical relationship exists between the type of work flow interdependence: pooled must exist before sequential, and sequential must exist before reciprocal forms of interdependence. A similar hierarchy exists between the type of coordination mechanisms; with programming first, plans and schedules second and mutual adjustments third. As task interdependence increases, more elaborate coordination mechanisms are required to link organizational units. Specifically, pooled interdependence causes standardization, sequential interdependence causes planning and scheduling and intensive interdependence causes mutual adjustments.

For example, the simplest and least costly method of coordinating independent work flow in a unit is to specify impersonally the behaviors to be followed by each role actor in advance of their execution (March and Simon, 1958). However, Galbraith (1973) suggests that rules and plans have limited information processing capacities. As the unit members undertake tasks that require increasing amounts of collaboration (e.g., shifts in work flow from independent to sequential to reciprocal), an increasing need arises for hierarchy in addition to impersonal coordination. In this case, recurring job situations are programmed, while exceptions are referred to higher levels of authority. This combination of mechanisms is functional within their limited capacities to process information. As the number of mutual adjustments increase, still more elaborate coordination mechanisms are required. Horizontal direct contact between unit members and group modes (when a number of actors need simultaneous feedback to make adjustments) will be added while the capacity and sophistication of impersonal and personal coordination modes will be expanded.

Although there is always a problem in moving from an evolutionary theory to cross-sectional hypotheses, the key idea suggested by Thompson (1967) and Galbraith (1973) is that impersonal, personal and group coordination modes are additive linkage mechanisms as work flow interdependence increases. This leads to the following hypotheses:

**B.** Increases in work flow interdependence from independent to sequential to reciprocal to team arrangements will be associated with

1. small increases in use of impersonal coordination mechanisms
2. moderate increases in use of personal coordination mechanisms
3. large increases in use of group coordination mechanisms.
Size of Work Unit

Size is defined here as the total number of people employed in a work unit.

Many researchers have investigated the relationship between total organization size and a number of structural dimensions (see Child, 1973 for a review). In general, increases in size increase structural differentiation at decreasing rates (Blau, 1971:204). This produces a corresponding tradeoff between increasing the complexity and cost of coordination at the aggregate administrative level and decreasing the coordination burden within work units because activities within units tend to become more homogeneous.

However, the relationship between unit size and unit coordination is not clearly known. Small group researchers who have treated size as an independent variable have measured its effects on a number of properties relevant to coordination. As size increases: (1) group cohesiveness decreases and sub-group formation increases (Miller, 1952; Jennings, 1960); (2) member participation decreases more mechanical methods are used to introduce information and more direct attempts are made to control the behaviors of participants in reaching a solution (Hare, 1962:240); (3) face-to-face techniques of leadership behavior give way to more impersonal techniques of coordination (Van de Ven, 1975); (4) demands on the leaders become more complex and numerous, and group members become more tolerant of highly structured and directive leadership (Hemphill, 1950; Maas, 1950). These research findings suggest the following hypotheses:

C. An increase in work unit size is associated with
   1. a decrease in use of group coordination
   2. an increase in use of personal coordination
   3. a significant increase in use of impersonal coordination mechanisms.

The direction of the relationships between work unit size and the three coordination modes is therefore hypothesized to be in an opposite direction from that of task uncertainty and task interdependence. As task uncertainty and interdependence increase, the use of personal and group modes of coordination will increase. The inverse of this direction of relationships is predicted for work unit size.

RESEARCH METHODOLOGY

Research Design

The data reported here to test the hypotheses were collected in 1972 in 16 district offices and the administrative headquarters of a large state employment security (ES) agency. The sample consisted of 197 formal work units (officially designated in the organization chart) from the local and administrative levels of the ES agency. For research purposes, a formal work unit was defined as consisting of a supervisor and all non-supervisory personnel immediately reporting to the supervisor. Only stable and established work units were included in the sample. Work units in the transitional stage (due to supervisory turnover, major changes in working operations, etc.) were excluded. The data were collected by on-site administration of questionnaires to the supervisors and all members for each work unit. Questionnaires were completed by 197 unit supervisors and 880 unit personnel. Additionally, a standardized follow-up interview was conducted with each unit supervisor.

Measurement

Multiple-item indices as well as parallel indices were constructed to measure task uncertainty, task interdependence and unit size. Operational measures and procedures used to test the reliability and validity of the measures are presented in a Measurement Appendix.

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1 A detailed description of the composition of state employment security agencies and of the work units within such an organization is available in Blau and Schoenherr (1971) and therefore needs no re-statement here.
MODES OF COORDINATION IN ORGANIZATIONS

The use of impersonal, personal and group modes of coordination was measured by asking respondents to indicate the extent to which each of the following mechanisms were used to coordinate the work among unit personnel within the unit:

I. Impersonal Coordination Mode

1. Through formally or informally understood policies and procedures for coordinating the work within the unit
   \( \bar{X} = 7.3; \sigma = 2.0; \text{Range} = 2-10; \text{spv-mbr response} \ r = .50 \)

2. Through predetermined work plans or work schedules for coordinating the work within the unit
   \( \bar{X} = 6.8; \sigma = 2.0; \text{Range} = 1-10; \text{spv-mbr response} \ r = .50 \)

II. Personal Coordination Mode

A. Vertical Channels

3. Through the unit supervisor as a coordinator of work within the unit
   \( \bar{X} = 7.1; \sigma = 1.8; \text{Range} = 2-10; \text{spv-mbr response} \ r = .61 \)

4. Through an assistant unit supervisor who is responsible for coordinating the work within the unit
   \( \bar{X} = 3.0; \sigma = 2.3; \text{Range} = 1-9; \text{spv-mbr response} \ r = .53 \)

B. Horizontal Channels

5. Through a formally designated work coordinator (rather than a line supervisor)
   \( \bar{X} = 2.2; \sigma = 1.9; \text{Range} = 1-10; \text{spv-mbr response} \ r = .58 \)

6. Through informal communication channels (simply contacting another unit member who is likely to have the desired information)
   \( \bar{X} = 6.9; \sigma = 2.2; \text{Range} = 1-10; \text{spv-mbr response} \ r = .59 \)

III. Group Coordination Modes

A. Scheduled Group Meetings

7. Through a standing committee that meets regularly to plan and coordinate the work within the unit
   \( \bar{X} = 1.9; \sigma = 1.6; \text{Range} = 1-9; \text{spv-mbr response} \ r = .61 \)

8. Through staff meetings that are held to coordinate the work within the unit
   \( \bar{X} = 4.4; \sigma = 2.7; \text{Range} = 1-10; \text{spv-mbr response} \ r = .73 \)

B. Unscheduled Group Meetings

9. Through a group brought together for problem solving on particular issues relating to the work within the unit
   \( \bar{X} = 4.4; \sigma = 2.5; \text{Range} = 1-10; \text{spv-mbr response} \ r = .64 \)

Respondents answered each of the nine questions on a ten-interval scale ranging from (1) “used to no extent” to (10) “used to a great extent.” These questions were answered by respondents only after each coordination mechanism was defined and clearly described. In addition, the unit supervisors were asked to qualitatively indicate the specific circumstances when each coordination mechanism was used. Composite indices of impersonal, personal and group coordination modes then were constructed by averaging the items under the heading listed above. Organizational unit scores were obtained by assigning equal weights to responses of unit supervisors (1/2) and unit members (1/2) as discussed by Hage and Aiken (1967:76-7).

RESEARCH RESULTS

Table 1 presents the zero-order correlation matrix among the independent variables and the coordination modes and mechanisms, while Table 2 shows the results of multiple regression analyses of task uncertainty, interdependence and size on each of the dependent coordination mechanisms.

Task Uncertainty and Coordination

Looking just at the relationship between perceived task uncertainty and coordination modes in Table 2, we see that as the uncertainty of the tasks undertaken by a work unit increases, the use of impersonal coordination

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2 Below each item is listed the mean, standard deviation and response range for all units as well as the zero-order correlation between the response of the unit supervisor and the average responses of the unit members.
Table 1. Zero-Order Correlations among Independent Variables and Coordination Modes (N=197 Organizational Units)

<table>
<thead>
<tr>
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<th>1</th>
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<th>8</th>
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<td>5. Rules and Procedures</td>
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<td>-.22</td>
<td>.16</td>
<td>.78</td>
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<td>.75</td>
<td>.49</td>
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<td>-.04</td>
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<td>8. Vertical Channels</td>
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<td>.06</td>
<td>.11</td>
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<td>.27</td>
<td>.23</td>
<td>.74</td>
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<td>.75</td>
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Table 2. Multiple Regression Analyses of Independent Variables on Coordination

<table>
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<tr>
<th>Dependent Coordination Modes and Mechanisms</th>
<th>Perceived Task Uncertainty</th>
<th>Work Flow Interdependence</th>
<th>Work Unit Size</th>
<th>R²</th>
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<td>Std. Error</td>
<td>Std. Beta</td>
<td>Std. Error</td>
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<td>2. Plans and Schedules</td>
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<td>-.09</td>
<td>.07</td>
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<td>B. Personal Mode</td>
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<td>1. Vertical Channels</td>
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<td>.08</td>
<td>.07</td>
<td>.08</td>
</tr>
<tr>
<td>2. Horizontal Channels</td>
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<td>.04</td>
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<td>C. Group Mode</td>
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<td>.06</td>
<td>.23*</td>
<td>.06</td>
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<td>2. Unscheduled Meetings</td>
<td>.60*</td>
<td>.06</td>
<td>.08</td>
<td>.06</td>
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</table>

* Significant beyond the .01 level.
To Great Extent
To Much Extent
To Some Extent
To Little Extent
To No Extent
N=43
N=125
N=29
LOW
MEDIUM
HIGH

Figure 1. Profile of Coordination Mechanisms on Classified Levels of Unit Task Uncertainty

mode is coordination. A substitution or tradeoff effect implies that the significant negative zero-order correlations between impersonal coordination and group meeting ($r = -.32$) and between impersonal coordination and horizontal communications ($r = -.30$) are explained by variations in task uncertainty. One indicator of this “substitution effect” of task uncertainty is that the partial correlations between impersonal coordination and the other horizontal and group mechanisms should vanish when controlling for task uncertainty. When partialing out the effects of task uncertainty, the relationship between the impersonal and group coordination modes is -.01, and between impersonal coordination and horizontal communications is -.06. Indeed, the partial correlations between rules, plans, and the other coordination mechanisms (except vertical channels) were all found to be near .00 when controlling for task uncertainty. The interested reader can compute these partial correlations directly from Table 1.

These interesting findings indicate (but do not demonstrate) that the tradeoffs or negative relationships between impersonal coordination and horizontal and group mechanisms are “explained” by task uncertainty. These cross-sectional indications of a substitution effect of task uncertainty on the use of alternative coordination mechanisms warrant further, more controlled laboratory research.

**Task Interdependence and Coordination**

As work flow interdependence among unit members increases from independent (pooled) to team, Table 2 shows that the use of imper-
sonal and personal coordination mechanisms remain invariant; while there are significant increases in group coordination, particularly the use of scheduled meetings. These results provide little support for the hypotheses. The profile of the average uses of the coordination mechanisms on task interdependence shown in Figure 2, however, suggest that the relationships may not be linear.

Figure 2 shows that as task interdependence increases, there is an overall greater use of all coordination mechanisms combined (the grand mean). Further, the graph shows there are substantial increases in the use of all coordination mechanisms except impersonal rules and plans over the range from pooled to sequential to reciprocal work flows. Thus, the only significant exception to Thompson’s “additive” hypothesis in this study is the decrease in impersonal coordination mechanisms between sequential and reciprocal work flows.

Our extension of Thompson’s work flows with the team arrangement provides a clue on the range over which the additive effect of interdependence holds. When moving from reciprocal to team work flows, there are increases in the average uses of all the coordination mechanisms except for plans and hierarchy. Overall, therefore, with minor exceptions, Thompson’s additive hypothesis appears to hold up quite well at intensive levels of interdependence.

Equally important is the hierarchical pattern in the use of coordination mechanisms that is apparent with variations in task uncertainty (Figure 1), interdependence (Figure 2) and unit size (Figure 3). One of Thompson’s (1967:57) key propositions is that under norms of rationality, organizations will struc-
ture themselves so as to minimize coordination costs. Although Thompson was referring to aggregate organization design, the data here suggest support for the same proposition at the work unit level. Impersonal, personal and group mechanisms are increasingly more costly forms of coordination. Figures 1-3 show that impersonal rules and plans, being the least costly mechanisms to operate, are used the most. Horizontal channels and group meetings, being classically viewed as the most inefficient and costly mechanisms for coordination are used the least overall; and as March and Simon (1958) suggest, their use increases significantly only at higher levels of task uncertainty and interdependence where mutual adjustments to task situations cannot be predetermined or programmed. Finally, the use of hierarchy, relative to other mechanisms, remains constant throughout as a coordination mechanism for dealing with exceptions.

**Work Unit Size and Coordination**

The direction of the relationships between work unit size and coordination mechanisms are all in the hypothesized direction. Table 2 shows that as unit size increases, the use of impersonal coordination increases significantly; the use of hierarchy increases, but to a smaller degree; while the use of horizontal channels and group meetings remains invariant with work unit size.

Figure 3 shows that over the range of unit size from 2-10 people, the findings are consistent with small group studies indicating that as size increases, more mechanical techniques are used to introduce information, and more direct leader attempts are made to control the behaviors of participants through hierarchy (Hare, 1962:240). However, beyond size 10, the use of hierarchy decreases and even greater use is made of rules, policies and procedures to coordinate work activities. Beyond 10 people, an impersonalizing effect of large unit size appears to become prominent. This finding within work units at the micro-level parallels nicely with the macro-level findings by Blau (1970) and Hickson et al. (1969) that with increasing organization size, reliance on hierarchy decreases and formalization increases.
CONCLUDING DISCUSSION

This research suggests that not only is there a difference in degree of influence of task uncertainty, task interdependence and work unit size on the use of coordination mechanisms in organizational units, there also appears to be a difference in kind of influence of each factor on the mechanisms of coordination used.

As tasks increase in uncertainty, mutual work adjustments through horizontal communication channels and group meetings are used in lieu of coordination through hierarchy and impersonal programming. This substitution between alternative coordination mechanisms appears to be the major effect associated with task uncertainty.

Associated with increases in work flow interdependence among unit personnel is an additive use of all coordination mechanisms, except for impersonal rules and plans over the sequential-reciprocal work flow range. An increased use in all coordination mechanisms combined is also observed as interdependence increases. At intensive levels of work flow interdependence (the team arrangement), Thompson's additive hypothesis continues to hold up quite well with the exception of a slight decrease in the use of hierarchy and a large decrease in the use of plans for coordinating activities within organizational units.

Unit size, on the other hand, appears to have an impersonalizing effect on coordination. As unit size increases, there is a greater use of impersonal coordination and of hierarchy. It is important to note that increases in size are not directly associated with a corresponding decreasing use of group coordination mechanisms as was hypothesized and then suggested by the zero-order correlations. The regression coefficients in Table 2 show that the use of horizontal communication channels and group meetings are invariant with respect to size. Further, as unit size increases beyond 10 people, the use of hierarchy decreases. It appears, therefore, that size has an impersonalizing effect on the kind of coordination mechanisms used within a work unit.

It must be recognized that the data do not warrant proof or disproof of the cause and effect relationships implied in the above discussion. Future studies need to examine not only the degree of impact but also the different kinds of impact of task uncertainty, task interdependence and work unit size on alternative coordination mechanisms.

Finally, we evaluate the comparative strengths of the three independent variables in explaining variations in the coordination mechanisms. When comparing the relative weights of the standardized regression coefficients across the columns in Table 2, one is struck by the strength of the contributions of task uncertainty in explaining variations in the use of the coordination mechanisms within the work units and the overall insignificance of size. This finding is contrary to the conclusion drawn by Mohr (1971:452) that "the technological imperative has not been supported" at the work unit level and supports the suggestions made by Hickson et al. (1969:395), Fullan (1970) and Aldrich (1972) that technology has a greater influence than size at the work unit or "shop-floor" level.

The coefficients of determination (R²) in the far right column of Table 2 suggests that, while there is much room for improvement, the three situational factors are quite good predictors. Task uncertainty, interdependence and size, as a group, account for substantial variations in the use of all coordination mechanisms, except hierarchy. The use of vertical channels is not significantly explained by any of the independent variables. At the unit level, hierarchy is structurally pre-established and it remains as the only stable mechanism of coordination while the use of all other mechanisms vary under different unit conditions.

Of course, the findings presented here are limited to the work unit or departmental level within a large state employment security agency. To generalize the findings, future research is required to replicate this study in other organizations. To extend and make more complete our understanding of coordination within organizations, future research should also examine the managerial level (Parsons, 1962) as the unit of analysis and investi-
gate the use of alternative mechanisms for coordination across work units and levels within organizations.

APPENDIX

MEASUREMENT OF INDEPENDENT VARIABLES

I. Index of Task Uncertainty

Task uncertainty is defined as the difficulty and variability of the work that is undertaken by an organizational unit. In order to test for validity, two approaches were used to measure task uncertainty: a perceptual questionnaire approach and a standardized classification of tasks.

A. Perceptual Questionnaire Approach

Perceived task uncertainty was measured in the questionnaire as the average response of all unit personnel to the following eight questions:

1. To what extent is there a clearly defined body of knowledge or subject matter which can guide you in doing your work? (Unit $\bar{X} = 4.2; \sigma = 2.4; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .50$)

2. During the course of your work, how often do you come across specific but difficult problems that you don't know how to solve, and you have to take some time to think through by yourself or with others before you can take any action? (Unit $\bar{X} = 5.3; \sigma = 2.0; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .55$)

3. In general, how much actual "thinking" time do you usually spend trying to solve such specific problems? (Unit $\bar{X} = 3.5; \sigma = 2.3; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .56$)

4. In some jobs things are fairly predictable. In others, you are often not sure what the outcome will be. What percent of the time would you say that you are generally sure what the results of your efforts will be? (Unit $\bar{X} = 3.8; \sigma = 2.0; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .55$)

5. In terms of the major tasks you are assigned, on the average how long is it before you know whether your work effort is successful? (Unit $\bar{X} = 5.1; \sigma = 1.7; \text{Range} = 1-9; \text{Spv-Mbr Response} \ r = .66$)

6. How much variety in cases, claims, clients, or things do you generally encounter in your normal working day? (Unit $\bar{X} = 6.8; \sigma = 2.0; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .70$)

7. Regardless of the variety of cases, claims, or clients, to what extent are the activities or methods you follow in your work about the same for dealing with classes of categories of cases, claims, or clients? (Unit $\bar{X} = 4.8; \sigma = 2.3; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .64$)

8. To what extent do people in this unit do about the same job in the same way most of the time? (Unit $\bar{X} = 4.6; \sigma = 2.4; \text{Range} = 1-10; \text{Spv-Mbr Response} \ r = .71$)

*Below each item is listed the mean, standard deviation and response range for all units, as well as the zero-order correlation between the response of the unit supervisor and the average responses of the unit members.

B. Standardized Classification of Tasks Approach

In order to test the validity of the perceptual measurement approach, a classification of tasks into levels of uncertainty (i.e., task difficulty and variability) was used to measure task uncertainty in a standardized, non-perceptual way. The procedures for classifying the work of units into levels was as follows:

1. All unit personnel were asked in the questionnaires to list the specific tasks they perform in a normal day, as well as the percent of time spent on each task.

2. The population of tasks was edited for duplication and classified into levels of high, medium and low task difficulty and task variability.
3. The predominant task requiring the most time of personnel in each unit was then scored according to its level of task difficulty and variability.

4. Individual scores on task difficulty and variability were then averaged for each unit to obtain the unit task uncertainty score. (Unit $\bar{X} = 2.0; \sigma = .6; \text{Range} = 1-3$)

C. Reliability and Validity of Task Uncertainty

1. Using coefficient alpha, the reliability of the perceptual task uncertainty measure is .92.

2. The correlation between perceptual and classified indices of task uncertainty is .84.

3. The correlation between the classified task difficulty and classified task variability score is .58.

Overall, then, these findings suggest good reliability for the perceptual index of task uncertainty, good content validity when comparing the perceptual and classified indices and substantial discriminant validity to the sub-indices of task difficulty and task variability contained within the composite task uncertainty index.

II. Task Interdependence Index

Task interdependence is defined as the work flow interconnectedness of unit personnel in performing their individual jobs. In order to test for validity, two approaches were used to measure task interdependence; one is an extension of Thompson's (1967) work flows, and the other is based on Mohr's (1971) measures of task interdependence.

A. Work Flow Interdependence Index

Thompson (1967) presented three alternative ways work can flow between units: pooled (which we call independent), sequential and reciprocal. We added a fourth possible strategy, team work flow, in order to measure the alternative possible flows of work between unit personnel. In the 197 interviews with unit supervisors, the following questions were asked to measure work flow interdependence.

Please indicate what percent of the total work within your unit flows in each of the ways as shown by this figure (show work flow figure to supervisor), and as I will now describe.

1. Independent Work Flow Case, where work and activities are performed by your immediate subordinates independently and do not flow between them.

   ![Diagram 1](image1)

   (Unit $\bar{X} = 64.2; \sigma = 30.5; \text{Range} = 0-99$)

2. Sequential Work Flow Case, where work and activities flow between your immediate subordinates, but only in one direction.

   ![Diagram 2](image2)

   (Unit $\bar{X} = 12.2; \sigma = 20.7; \text{Range} = 0-99$)

3. Reciprocal Work Flow Case, where work and activities flow between your immediate subordinates in a reciprocal “back and forth” manner over a period of time.
WORK ENTERS

WORK LEAVES

(Unit $\bar{X} = 17.7; \sigma = 22.5; \text{Range} = 0.99$)

4. **Team Work Flow Case**, where work and activities come into your unit and your immediate subordinates diagnose, problem-solve and collaborate as a group at the SAME TIME to deal with the work.

(Unit $\bar{X} = 6.0; \sigma = 9.1; \text{Range} = 0.99$)

For each work flow case that the unit supervisor said represented 30 percent of the work flow within the unit, a series of six questions was asked to validate the supervisor’s response as well as to obtain qualitative understanding of unit processes in each work flow case.

Following Thompson’s (1967) suggestion, we assume that independent, sequential, reciprocal and team work flows, in order, imply increasing levels of task interdependence in the form of a Guttman scale. Ideally, therefore, the responses of unit supervisors to each work flow case could be weighted to arrive at an overall measure of task interdependence. Unfortunately, we cannot test the Guttman-like characteristics of such a scale directly because responses were forced to add up to 100 percent, which forces substitutions rather than additive responses.

A more rudimentary measure of work flow interdependence is therefore being reported here. Independent, sequential, reciprocal and team work flow cases were assigned values of 0, 3, 6, 9, respectively. The scaled value corresponding to the most predominant work flow case in each unit is being used here as the measurement of task interdependence.

**B. Mohr Task Interdependence Index**

In order to test the validity of the Workflow Interdependence Index, two questions, which are based on Mohr’s (1971) index, were asked of all unit personnel to measure task interdependence in a different way. The two questions were included in the questionnaire and answered along a ten-point scale:

1. **To what extent do the people in this unit have one-person jobs; that is, in order to get the work out to what extent do unit members independently accomplish their own assigned tasks?** (Unit $\bar{X} = 3.6; \sigma = 2.4; \text{Range} = 1-10; \text{Spv-Mbr Response} r = .35$)

2. **To what extent do all the unit members meet together to discuss how each task, case, or claim should be performed or treated in order to do the work in this unit?** (Unit $\bar{X} = 3.3; \sigma = 2.7; \text{Range} = 1-10; \text{Spv-Mbr Response} r = .65$)

**C. Reliability and Validity of Task Interdependence**

1. The correlation between the two items in the Mohr index is .72.

2. The correlation between the workflow and Mohr independence indices is .59.

3. In order to present some insight on the characteristics of the workflow index, listed below are the means and standard deviations of the Mohr index on the four workflow cases.
Mohr Interdependence Scale

<table>
<thead>
<tr>
<th></th>
<th>Independent</th>
<th>Sequential</th>
<th>Reciprocal</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Means</td>
<td>2.8</td>
<td>2.5</td>
<td>4.4</td>
<td>7.1</td>
</tr>
<tr>
<td>- Standard Deviation</td>
<td>1.6</td>
<td>1.5</td>
<td>2.7</td>
<td>2.3</td>
</tr>
</tbody>
</table>

If the two indices sample the same domain, then the .59 correlation between the work flow and Mohr indices is an appropriate indicator of construct validity of task interdependence. Further, if the two indices measure the same construct, then the diagram above suggests that the work flow index violates the properties of a Guttman scale for independent and sequential work flow cases. A reverse of the two work flow cases would result in a systematic increase in the means of the Mohr scale from 2.5 (sequential), 2.8 (independent), 4.4 (reciprocal), to 7.1 (team work flow). This, however, is not an adequate test of the Guttman-like characteristics of the work flow index. Clearly, further research on the measurement of interdependence is needed.

III. Measurement of Unit Size

Two approaches were also used to measure unit size: from organization charts and from organization records.

A. Measure of Unit Size from Organization Charts

The most conventional approach (e.g., Blau and Schoenherr, 1971; Hickson et al., 1969; Hall, 1972) is a count of the number of people in the organization—usually from organization charts. To measure work unit size, we first constructed up-to-date organization charts for each unit and verified them in the interviews with unit supervisors. The unit charts included, but distinguished between, full-time and part-time employees. Work unit size was then measured by adding each full-time employee as 1 and each part-time employee as ½ in arriving at the total unit size. (Unit $\bar{X} = 5.8; \sigma = 3.7; \text{Range} = 1-21$)

B. Measure of Unit Size from Organization Fiscal Records

To test the validity of the above approach, data were obtained from the Budget and Fiscal Bureau of the agency on the number of equivalent positions salaried during the fiscal year in each unit.

C. Validity of Unit Size Measure

The correlation between the organization chart and fiscal records measures of size is .97, which is very good. However, if one only counts the number of full-time employees from the organization charts and does not include part-time employees, the correlation drops to .81, suggesting that it was important to include and weigh by 1/2 part-time employees in a measurement of unit size from organization charts in this employment security agency.

Questionnaire Administration

The questionnaires were personally administered to all members of each work unit present at the time of the site visit by the research team. In all cases, the work unit supervisors completed the questionnaire. Respondents filled out the questionnaire only after a member of research team verbally explained the nature of the research study, the meaning of the questionnaire items and answered all questions respondents might have. A standardized format was used by the researchers to make the verbal introductory presentation of the questionnaire to all re-
respondents. An available conference or testing room was used in order that respondents could leave their work stations and not be interrupted while completing the questionnaires. A member of the research team was available at all times to answer questions while respondents completed the questionnaires.

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REWARDS, RESOURCES, AND THE RATE OF MOBILITY: A NONSTATIONARY MULTIVARIATE STOCHASTIC MODEL*

NANCY BRANDON TUMA

Stanford University


Most research on social mobility has concentrated either on identifying the causes of status attainment or on describing a population's movement over time by means of a stochastic (usually Markov) model. Viewing mobility as a semi-Markov process suggests that the rate of mobility is a proper object of explanation, and the status attainment literature suggests substantive determinants. In particular, I argue that the rate at which a person leaves a job declines with duration in the job and depends on initial levels of job rewards, stationary and changing individual resources, and on the distribution of rewards and resources in the social system. Results from testing the proposed model with data on 1609 jobs of 456 different Chicano men support most points of the argument.

The sociological study of social mobility has had two major traditions. One tradition inquires into the causes of social attainment;

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*Nancy Brandon Tuma, Assistant Professor of Sociology, Stanford University.

...the change in the way in which the movement of a population among social positions unfolds over time (see, e.g., Praiss, 1955a; 1955b; Blumen et al., 1955). These traditions...