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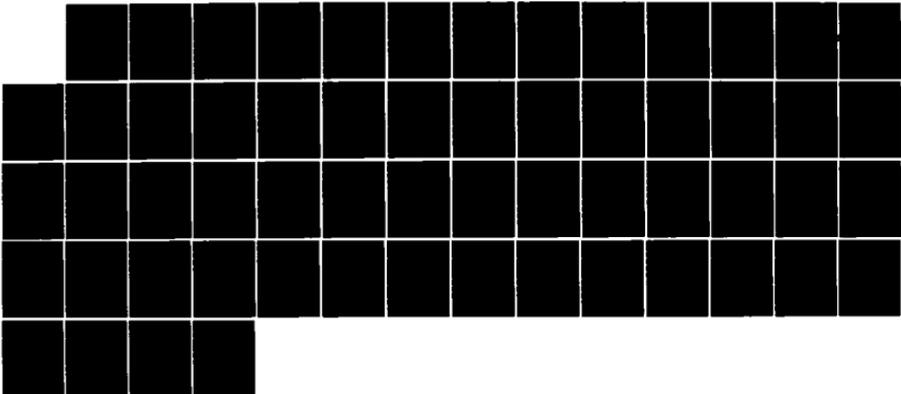
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EMPIRICAL STUDY(U) TEXAS A AND M UNIV COLLEGE STATION
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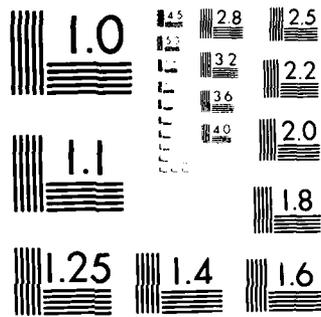
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Organizations As Information Processing Systems

Office of Naval Research
Technical Report Series

Management Control Systems and Interdependencies:
An Empirical Study

N.B. Macintosh
R.L. Daft

TR-ONR-DG-13

March 1985

Department of Management
Texas A&M University

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U.S. DEPARTMENT OF COMMERCE
OFFICE OF TECHNOLOGY POLICY AND STANDARDS
WASHINGTON, D.C. 20540

Office of Naval Research
N00014-83-C-0025
NR 170-950



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Organizations as Information Processing Systems

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TR-ONR-DG-13	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Management Control Systems and Interdependencies: An Empirical Study		5. TYPE OF REPORT & PERIOD COVERED Technical Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) N. B. Macintosh and R. L. Daft		8. CONTRACT OR GRANT NUMBER(s) N00014-83-C-0025
9. PERFORMING ORGANIZATION NAME AND ADDRESS College of Business Administration Texas A&M University College Station, TX 77843		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR170-950
11. CONTROLLING OFFICE NAME AND ADDRESS Organizational Effectiveness Research Programs Office of Naval Research Arlington, VA 22217		12. REPORT DATE March 1985
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approval for public release: distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
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management control systems. Standard operating procedures are an important control device when interdependence is moderate. When interdependence between departments is high, the role of all three control systems diminish. The findings support the themes that accounting based systems are one device in the organizational control package and that control systems are employed differently according to organizational characteristics.

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MANAGEMENT CONTROL SYSTEMS AND
INTERDEPENDENCIES: AN EMPIRICAL STUDY

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Abstract

Two themes in behavioral accounting research suggest that management accounting system characteristics are related to characteristics of the larger organization and that the management accounting system is one element in a control system package. The research reported here investigates the relationship between departmental interdependencies and the design and use of three management control systems--the operating budget, periodic statistical reports, and standard operating policies and procedures. The findings support the idea that interdependency between departments influences the emphasis placed on specific management control systems. Standard operating procedures are an important control device when interdependence is moderate. When interdependence between departments is high, the role of all three control systems diminish. The findings support the themes that accounting based systems are one device in the organizational control package and that control systems are employed differently according to organizational characteristics.

It has been recognized for some time that overall characteristics of the organization impact on the design and focus of management accounting systems used within the organization (Golembiewski, 1964; Hofstede, 1968; Khandwalla, 1972; Bruns & Waterhouse, 1975; Swieringa & Moncur, 1975, Watson & Baumler, 1975; Gordon & Miller, 1976). From this perspective accounting is seen as intertwined with way organizations function and should be studied in conjunction with its organizational setting (Waterhouse & Tiessen, 1979; Otley, 1980; Birnberg et al., 1983; Flamholtz, 1983; Gordon & Narayanan, 1984). As yet, however, the field still lacks insight into which specific organizational characteristics influence the shape and operations accounting systems. Our existing knowledge is limited in scope, fragmentary, and lacking in theory (Hopwood, 1983). Investigations which specify organizational contingency variables and map their association with accounting and other management controls remains an important research task (Otley, 1980; Dent and Ezzamel, 1982).

The purpose of the research reported here is to explore the relationship of departmental interdependency with management control systems. Interdependency is the extent to which departments depend upon each other and exchange information and resources to accomplish their respective tasks. The concept of interdependency (Thompson, 1967) was selected as the organizational context variable in our study for several reasons. First, interdependency influences the amount of coordination and feedback among departments, and hence has significant impact on the selection and design of management systems used to manage and control departments (Thompson, 1967; Van de Ven et al., 1976; Tushman, 1977; Mintzberg, 1979; Burchell et al., 1980; Daft, 1983).

Second, several accounting researchers have identified interdependencies across departments as an important organizational variable for management accounting studies (Watson & Baulmer, 1975; Hayes, 1977; Ginzberg, 1980, Otley, 1980; Kilmann, 1983). And, finally, the interdependency concept incorporates control (coordination of effort) as a central organizational requirement.

Organizational Interdependencies

Thompson (1967) first proposed the role of interdependency in organizational design, and defined types that are widespread in modern organizations -- pooled, sequential and reciprocal. Each of these, he argued, place unique and identifiable demands on management systems and processes.

Pooled is the lowest form of interdependence. Little work flows between departments. Organizations that have pooled interdependencies often provide services to widely distributed clients. Branch banks and franchise stores are examples of routine services provided to customers in diverse locations. Each branch or store operates independently of other organizational units. Major units share financial resources from a common pool and their success contributes to the success of the organization. Organizational components need not concern themselves with other operating components. The low level of interdependence does not place a heavy demand on management for coordination, and typically leads to standardized coordination through rules and procedures.

Sequential interdependence involves the linkage of organizational components in serial fashion. The output of one department becomes a direct input to the next department. Each organizational unit performs successfully

and completes its work by depending on the preceding unit. The result is a value added system of specialist departments whereby each performs its portion of the larger task and passes the work along the chain. The modern automobile assembly plant is an example. Over time each department gains experience and the entire chain is coordinated. Economies of scale and efficiencies are possible, particularly if a standard product is produced repetitively and at a constant rate. Breakdowns and disruptions do occur, and sequential interdependence places greater coordination and control demands on the organization than does pooled interdependence. The control system must facilitate detailed planning and scheduling, and also encourage feedback to coordinate workflow between departments.

The third and highest form of interdependence is reciprocal. It is characterized by the movement of work back and forth amongst departments in reciprocal fashion. The output of department A is the input to department B, and the output of department B is the input back again to department A. Organizations that have reciprocal interdependence typically consist of several specialized activities that are used in joint fashion on some object. Examples would be a multidisciplinary research project, a hospital, or a construction project. Services are customized and coordinated on the basis of feedback from the object and mutual adjustment among the specialized departments to the emerging and changing needs of the object. A general hospital, for example, may provide X-ray, laboratory, surgical, dietary, and psychiatric services to a patient. The patient may move back and forth among these departments on the basis of the most current information and feedback about the state of the patient's health. The necessary coordination among

departments is achieved through the transmission of information during the treatment process. Reciprocal interdependence makes a heavy demand on management for coordination. Standardization and planning are not sufficient for coordination, so continuous interaction and mutual adjustment are required. Under reciprocal interdependence, the impact of management accounting systems for the traditional score keeping, attention directing, and problem solving functions will be less than for pooled and sequential interdependencies (Hayes, 1977).

Several researchers have argued that departmental interdependency provides a useful way of analyzing and understanding the design and utilization of management accounting based control systems. Watson & Baulmer (1968), for example, proposed that the state of interdependence between organizational components is a factor in the role of management accounting systems as an integrating device. Kilmann (1983) used an interdependency typology as a conceptual device for better organizational design, more effective control systems, and fewer misdirected conversion costs. Tushman (1977) and Van de Ven, et al (1976) found that task interdependence systematically influenced the amount and direction of information flow within departments. Otley (1980) and Hayes (1977) included interdependency as an organizational design parameter in frameworks for accounting and information systems design. And Ginzberg (1980) concluded that organizations featuring sequential and reciprocal interdependence have substantially different accounting and information processing requirements than organizations featuring pooled interdependence; the former require organizational support systems while the latter need personal support systems. Thus there is theoretical support for

1b that the operating budget and the statistical reports will not be as important for pooled interdependency. For the operating budget (Table 6, column 1), the difficulty of target levels ($r = -.26$), the importance of the measuring and monitoring ($r = -.18$), and the influence on daily activities ($r = -.25$) were negatively associated with the measure of pooled interdependence. For statistical reports (Table 7, column 1), seven characteristics were negatively associated with pooled interdependence-- frequency of reporting ($r = -.33$), target difficulty ($r = -.37$), departmental managers and employees influence in target setting ($r = -.33$ and $-.28$), importance for coordination ($r = -.28$), their importance for measuring and monitoring ($r = -.29$), and their influence on daily operations ($r = -.22$). The overall finding is that the use of SOPs appears important for pooled interdependencies while the budget and the statistical reports are less so.

Hypothesis 2a proposed that under conditions of serial interdependence organizations will rely on the operating budget and statistical reports control (H2). The results in Table 6, column 2, provide support for the budget. Coordination ($r = .18$), measuring and monitoring ($r = .25$), emphasis on meeting budget targets ($r = .25$), the influence of the budget on daily activities ($r = .29$) are positively correlated with serial interdependence, along with upper management influence in setting target levels ($r = .23$).

The results in Table 7, column 2, provide data about the statistical reports. Several characteristics of statistical reports are associated with serial interdependence--target difficulty ($r = .33$), upper management influence in target setting ($r = .19$), emphasis on meeting target ($r = .25$), and their influence on daily activities ($r = .20$).

FINDINGS

The statistical tests of the association of the characteristics of the three control systems with the various interdependencies are shown in Table 5,6 and 7. The partial correlation coefficient (controlling for the effect

TABLES 5,6 and 7 about here

of department size as measured by the number of employees in the department) was selected as the test statistic for the relationship between interdependency and control system use. Size was controlled in the statistical analysis because it has been shown in previous research to influence the design and utilization of control systems, especially SOPs (Child, 1972; Khandwalla, 1972; Bruns & Waterhouse, 1976; Waterhouse & Tiessen, 1979; Merchant, 1981).

The results in Table 5 support Hypothesis 1a that the use of SOP's will have a positive correlation with pooled interdependence (H1). Five of the six SOP characteristics were significantly associated with pooled interdependence including the quantity and coverage of SOP's, the necessity to follow them to do the job well and SOP influence on daily operations.

Table 5 also indicates that the amount of sequential interdependence has no relationship with standard operating procedures, and reciprocal interdependence has a negative relationship. These findings are consistent with the argument that as the level of interdependence increases, the use of standard operating procedures as a primary control device will decline.

The results in the first column of Tables 6 and Table 7 support Hypothesis

followed by the department managers themselves, while employees in the department have only a modest amount of influence. Target levels are in the "difficult but achievable range". These reports are used for the planning and measuring functions, are important for helping to do things correctly, but are of only modest importance for the coordination function. The budget has more influence in the planning function while the statistical reports are more important for measuring and monitoring performance. Both controls contain a good deal of motivational force and play an important role in making departmental activities visible to upper management. The managers are quite satisfied with the way these controls work in their organizations. Overall, then, the descriptive statistics suggest that budget and statistical reports are important and valuable components of organizational control.

The profile for the SOP's, as shown in Table 4, exhibits a similar pattern. SOPs contain information about how to conduct daily operations. They cover over 60% of the work performed, and for about 60% of the work it is necessary to conform to the practices outlined to do a good job. SOPs have a good deal of motivational force. Managers are satisfied with the way they are used in their organizations. Like the budget and the statistical reports, the SOP's are an important part of the overall organization control package.

These profiles conform closely to conventional ideas of how three control systems ought to look and how they ought to work. The standard deviations, however, indicate some variation among departments. It was hypothesized that some of this variation might be caused by differences in interdependencies.

items, and back-up pages of the budget and the statistical reports, as well as physical counts of the number of books, pages and lines of standard operating procedures and practices. The second measurement technique involved asking managers for their opinion about specific aspects of the controls and getting them to rate their responses on interval scales. The managers were asked, for example, to rate the level of difficulty of budget targets, using a nine point scale ranging from "very easy to achieve" to "almost impossible to achieve." For the interdependencies variables the managers were shown diagrams (see Appendix B) and asked for their perception of the work flow for their department. This instrument was developed and validated by Van de Ven et al. (1976) who asked unit supervisors to indicate the percentage of the total work within the unit that fell into the pooled, sequential and reciprocal categories. Their results were validated by series of six questions which were posed to the supervisors to see if they had qualitatively understood the work flow in their department.

Descriptive statistics

The descriptive statistics for the three controls are shown in Tables 3 and 4. The data in Table 3 indicate that the budget and statistical reports

TABLES 3 and 4 about here

routinely provide a great deal of information to upper management about departmental activities and performance relative to predetermined targets. Upper management have a great deal of influence in setting target levels,

several department managers in the organization. Every attempt was made to obtain a cross section of departments in each organization. In one company, for example, managers from the plants, marketing, personnel and engineering departments were selected. The final sample included 86 major departments from twenty organizations in five sectors of the economy. The organizations were located in the U.S.A. and Canada. Details of the sample are given in Table 2.

TABLE 2 about here

Data Collection

The primary method of data collection consisted of a personal interview with each department manager. A preliminary questionnaire had been pre-tested on several managers in several different organizations, after which the final questionnaire was developed. During the interview, this questionnaire (see Appendix A) was administered to each manager.

The interviews were conducted in the offices of the managers. They were asked to pull out the actual budget and statistical reports under investigation, and these documents remained in front of the managers as they responded to the questionnaire. The SOP's also were on hand, usually in the manager's office or nearby. Personal interviews are more time consuming and expensive than mail questionnaires but they eliminate some of the distortions ascribed to mail questionnaires.

The control systems questionnaire consisted of two measurement techniques. First actual counts were taken of items such as the number of pages, line

In summary, we have proposed that formal management control systems play an important role in organizations, but the use of these control systems is related to the level of interdependence among departments as summarized in Table 1. When interdependence is low (pooled), SOPs are sufficient to handle coordination and control requirements among departments. When interdependence is moderate (sequential), the budget and statistical reports are suited to control requirements. When interdependence is high (reciprocal) then formal control systems will tend to be used less because personal control mechanisms are needed to provide the mutual adjustment and face-to-face coordination needed in this dynamic production process.

RESEARCH METHODOLOGY

Sample

The main criterion used to guide sample selection was the need to include a wide range of organizational tasks in order to have variation in interdependencies. To accomplish this, a few firms from each industrial and commercial category in a directory of industrial and commercial enterprises were contacted to see if they would participate in the study. Some organizations from the service and public sectors were also included to ensure that the sample included a wide cross section from both the private and public sectors.

Nearly eighty percent of the organizations contacted agreed to participate in the study. During the preliminary visits, the management control system in each organization was discussed with the corporate controller or his counterpart. Arrangements then were made to interview

Under conditions of reciprocal interdependence, organizational performance is based on the ability to fuse diverse experts into smoothly functioning teams. Employees are based in functional departments, but are deployed out of those departments to achieve organizational outcomes (Mintzberg, 1979). Flexibility and innovation are key requirements. Normal bureaucratic control mechanisms such as standardization, rules, formalization, and planning and control systems are less important for control when interdependence is high. Coordination and control comes from organic processes that encourage mutual adjustment, face-to-face communication among departments, and feedback from the customer or client (Thompson, 1967). The performance criteria is whether the customized application of joint activities produces the best outcome. Such information is not normally found in formal accounting reports (Hayes, 1977). The impersonal control of SOPs and the hard data in the budget and statistical reports tend not to capture the dynamic nature of mutual adjustment. Professional norms, supervision, and other forms of personal control become more important under conditions of reciprocal interdependence. Thus the scope, function, and motivational impact of formal management control systems such as SOPs, budget, and statistical reports are expected to be less under conditions of reciprocal interdependence.

Hypothesis 3. The use of SOPs, budget, and statistical reports for control will be negatively correlated with the amount of reciprocal interdependence among departments.

interdependent departments. The primary control systems under these conditions is expected to be the budget and statistical reports. The budget provides for the planning and scheduling of resources into each department and statistical reports measure and monitor outputs from each department. These two control systems function on a periodic cycle that allows updating and adjustments for changes in the production sequence. Economic efficiency is important under conditions of sequential interdependence. The scope, function, and motivational impact of the budget and statistical reports are expected to be high. Managers will place emphasis on formal accounting and information systems that provide quantitative and aggregated information.

Moreover, the greater coordination and control demands of sequential interdependence means that budgets and statistical reports will tend to replace SOPs as the mechanism of control. SOPs are appropriate for standardization when interdependence is low, but are not sufficient to coordinate high levels of interdependence. Thus the greater importance of budgets and statistical reports in sequential interdependent departments will mean that COPs are used less. These relationships are reflected in the following hypotheses.

Hypothesis 2a. The use of the operating budget and statistical reports for control will be positively correlated with the amount of sequential interdependence among departments.

Hypothesis 2b. The use of SOPs for control will be negatively correlated with the amount of pooled interdependence among departments.

consequently the scope, function, and motivational impact of SOPs is expected to be greater under conditions of pooled interdependence. Other control systems, such as the budget and statistical reports will receive less emphasis in organizations typified as pooled interdependence because the detailed planning and measure are not needed.

Hypothesis 1a. The use of SOPs for control will be positively correlated with the amount of pooled interdependence among departments.

Hypothesis 1b. The use of operating budget and statistical reports for control will be negatively correlated with the amount of pooled interdependence among departments.

Sequential interdependence involves a serial chain of activities, with the output of each department becoming the input to the next department in the chain of operations. For sequential interdependence, unlike pooled interdependence, performance in any one unit is dependent on the work of other units in the chain. Under these conditions, planning and scheduling are critical to insure that all units are providing necessary resources for other units further along in the operation. Measurement is also important so that management can monitor whether activities are on schedule, and so they can respond to any exceptions or deviations that arise. The pressure to run smoothly and without interruption can lead to a strong control mentality that pervades from top to bottom (Mintzberg, 1979). Management enforces a tightly controlled atmosphere that resolves conflicts and differences among the

The three types of interdependencies are hypothesized to be served by distinct features within the package of three control systems. The overall research model is illustrated in Figure 1. The reason for the hypothesized relationships are as follows.

Figure 1 about here

For pooled interdependence, organizational departments or units work closely with customers and clients, but not with other units in their own organization. Under this condition, organizations are expected to rely on standardization for coordination among units (Thompson, 1967; Van de Ven, et al., 1976). One form of standardization is to define standard categories of inputs and product or service outputs so that customers and clients know what to expect, and so that each unit of the organization knows that other units are operating in compatible ways. Standardization is implemented primarily through rules and procedures. Policy manuals, rule books, job descriptions, and standard reporting forms represent methods for controlling departments characterized by pooled interdependence. Standardization enables the pooled interdependent company to maintain uniformity to attain high outputs. Standard dialing codes and physical plant, for example, enable telephone users to call parties at almost any location around the globe. Standardized credit procedures enable a customer to charge items at any store in a retail chain. Standard rules and procedures provide the amount of coordination and control needed to allow relatively independent departments to operate in compatible ways as part of a larger company. SOPs will be the primary control medium and

typically defined as a three-stage cycle that includes target setting, monitoring of performance, and feedback for correction (Ouchi, 1977; Todd, 1977). Management control systems assist managers in performing the cycle, and control systems also help managers evaluate employees and coordinate across departments. Depending upon the emphasis given to a control system within the organization, its scope and frequency may vary, and so will the emphasis given to each control function, such as target setting, monitoring, and coordination. Moreover, control systems exert a distinct motivational force on employees who are affected by the system. Thus to understand the relationship of control system design and departmental interdependence, the following aspects of control systems will be evaluated.

Control System Scope: This includes the number of books, the number of pages, frequency of reports, and percent of work covered by the control systems.

Control System Function: This includes the role of control systems in planning, monitoring of performance, helping do things correctly (feedback), coordinating with other departments, and promotion and salary decisions.

Motivational Impact: This includes emphasis given to control systems for meeting targets, percentage of time it is necessary to follow rules, and the extent to which target setting involves lower managers (decentralization). The budget and statistical reports operate on an annual cycle within organizations while SOPs are standing bodies of rules. Thus the impact of each control system is operationalized in a somewhat different way within organizations, but each control system is hypothesized to be related to the extent of interdependency among departments.

activities, volume, resource levels, and outputs. And they vary considerably across organizations and departments. For example, in one of our research sites, the credit department of a large national department store, statistical reports included eight documents that provided information about the operation of the department. The eight reports consisted of the following: details of accounts, cost of each account, comparison to previous years, credit sales ratio, delinquent accounts, uncollectable accounts, growth report, and bad debt write-offs. Detailed statistical reports tend to reflect the key activities and outputs relevant to each department and were used widely in the organizations sampled.

Standard Operating Procedures and Policies

The set of formal procedures, policies, and operating manuals (SOPs) are used to guide managers as they run their departments. These materials include policies and standard operating procedures for the department and the organization. SOPs contain general policy guidelines as well as rules and procedures to provide guidance for specific exceptions such as handling a grievance or dismissing an employee. In some cases, the SOP's also included job descriptions and prescriptions for how managers should handle operational situations that might arise. The SOP's formally prescribe how managers ought to behave under particular conditions and when faced with specific problems.

THE RESEARCH MODEL

The theoretical question to be addressed concerns the relationship between the design and use of management control systems and the extent of interdependence among departments within the organization. Control is

as the way the package fits the organizational setting (Young, 1979). Consequently, the investigation reported here included three major systems-- the operating budget, the set of periodic statistical reports providing upper management with information about departmental performance, and the set of formal standard operating procedures and policies.

Operating Budget

The operating budget is a key part of the organizational control package (Horngren, 1982; Kaplan, 1982). The planning cycle of the budgeting process usually begins several months before the beginning of the budget year. Operations for the coming year are forecast and the financial implications for each operating department are reflected in a preliminary budget document. Budget estimates and requirements are analyzed and in some cases adjusted by a central accounting group, returned to department managers and eventually reviewed by upper management for final approval. Discussion and negotiating among interested parties takes place during this process until the final agreed upon budget is approved. Then periodic budget reports (usually monthly) are issued to provide information to department managers and upper management about progress toward budget accomplishment.

Statistical Reports

In addition to the operating budget, most organizations also rely on reports which provide upper management with information on departmental progress and performance (Daft and Macintosh, 1984). For purposes of this study these operational reports were treated as a package and called "statistical reports". These reports contain information on departmental

the potential impact of departmental interdependence, although little research has been conducted exploring its empirical relationship with accounting and information systems.

ORGANIZATIONAL CONTROL SYSTEMS

Traditionally the role of management accounting systems in providing control over managers and employees has been studied in isolation from both the organizational context in which the system is embedded and from other non-accounting based control systems. Recently, however, a number of researchers have argued that this narrow view is part of the reason that we still do not have a very good understanding of how management accounting systems function (Gordon & Miller, 1976; Hopwood, 1978; Otley & Berry, 1980; Daft & Macintosh, 1984). The point was stated succinctly by Flamholtz (1983, who said that studies which focus mainly on accounting controls yield a limited and impoverished view.

The reason accounting systems alone represent a narrow view is that the formal control package of an organization typically includes: accounting reports, the budget, formal hierarchy and supervision; job descriptions; rules and standard operating procedures; statistics for measuring performance; organization structure; and corporate culture (Lawler, 1976; Flamholtz, 1983). These controls are not merely an ad-hoc collection of techniques and mechanisms, but in many cases are the tangible elements of a deliberate strategy to create an integrated organizational control package (Otley & Berry, 1980; Otley, 1980; Flamholtz, 1983). Thus, it is logical to investigate the way control sub-systems interrelate with and reinforce one another as well

Hypothesis 3 stated that under conditions of reciprocal interdependence organizations will rely less on the three formal controls. The results generally support this hypothesis for the SOP's and the budget. Five of the six SOP characteristics (Table 5, column 3) and four budget characteristics (Table 6, column 3) are negatively associated with reciprocal interdependence. SOP's and budgets are used less as the level of interdependence increases.

For the statistical reports, while frequency ($r = -.22$) and importance for measuring and monitoring performance are negatively associated, contrary to expectations some characteristics are positively associated with reciprocal interdependence (Table 7, column 3). Statistical reports appear to be used more for planning ($r = .36$) and coordination ($r = .21$). Department managers and employees have more influence in target setting ($r = .21$ and $.22$, respectively). Thus SOP's and budgets are used less under conditions of reciprocal interdependence while the statistical reports seem important for planning and measurement.

DISCUSSION

The research reported here gathered data from 86 departments in 20 organizations to test the relationship between departmental interdependence and management control systems. The hypothesized pattern was that increasing levels of interdependence would be associated with differences in the design and use of control systems. All three control systems were used in the organizations, but the scope and extent of use differed by amount of interdependence. SOPs were more important under conditions of pooled interdependence, and budgets and statistical reports were more

important for serial or sequential interdependence. Some aspects of statistical reports received greater emphasis under reciprocal interdependence, although management control systems seem more important for lower levels of interdependence. Face-to-face and other forms of mutual adjustment are probably used for the dynamic conditions surrounding reciprocal interdependence.

More specifically, under conditions of pooled interdependence, organizations rely more on SOP's and less on budget and statistical reports. A requirement of pooled interdependence is that departments operate in predictable ways so that customers will know what they are getting and other parts of the organization are assured each department operates in a compatible way. The role of SOPs was illustrated in a nation-wide finance company from our sample. Each of the 800 branches closely followed hundreds of pages of SOP's which covered every aspect of branch operations. The SOP's served to guarantee standardization throughout the organization. Each branch operated independently of the other branches, but shared common resources and followed standard procedure.

While SOP's are emphasized for pooled interdependent departments they are used less as a control mechanism when interdependence is high. Other researchers have reported similar results. Van de Ven et al. (1976) found that formal rules and procedures were used to a greater extent under low levels of interdependence. Mintzberg (1979) argued that in professional bureaucracies where components share common resources great reliance is placed standardized skills and behavior by the people doing the work. Daft (1983) cites the McDonald's fast-food chain as an example of pooled interdependence

where each component used standardized procedures and reports as a way of controlling outcomes. Standardization, through the application of impersonal rules to be followed by managers, is the simplest and least costly method of coordinating independent work flow (March & Simon, 1958). The classical bureaucratic techniques of categorization and impersonal application of rules and policies work well and come to the fore (Thompson, 1967).

For sequential interdependent departments the findings indicate the organizations tend to emphasize budgets and statistical reports more than SOPs. The tight linkage among departments seems to require more emphasis on targets, scheduling, monitoring, and feedback, which are accomplished with budgets and periodic operational reports. What seems to happen is that organizations try to create a tightly controlled performance atmosphere by buffering the interdependent departments from environmental fluctuations, thus permitting them to coordinate input and output requirements among departments and to use efficiency tests for assessing performance (Thompson, 1967). Management accounting systems are well-suited to measuring the performance of production departments where internal variables are the major explanators of effectiveness (Hayes, 1977), and they work well in large, process dominated, technological organizations (Bruns & Waterhouse, 1975). Budgets and statistical reports, then, seem to play the largest part in management control under conditions of serial interdependence.

The findings also indicate that under conditions of reciprocal interdependence, formal controls are not relied upon as much as for the lower forms of interdependence. The budget and SOP's decline in importance. Statistical reports are used to some extent for planning and coordination but

less for measuring and monitoring. Management accounting tools and other traditional controls seem to lose their efficacy. As Mintzberg (1979) suggests, when there is a need for quick adaptation and sophisticated innovation, with different specialists joining forces in multi-disciplinary teams formed around specific projects, the organization cannot rely on rules, standardization and all the regular bureaucratic trappings, particularly with their emphasis on planning and control. Expert knowledge, mutual adjustment, and special integrating mechanisms replace formal reporting systems, SOP's, and emphasis on hierarchical arrangements. Formal controls such as management accounting techniques work well in production departments but are less suitable to measure performance in departments such as R & D and marketing which feature reciprocal interdependence (Hayes, 1977).

Reciprocal interdependence poses the greatest challenge to formal management control systems. Formal control systems are not responsive to conditions of reciprocal interdependence, and organizations do not rely on them as much as they do when interdependence is lower and more predictable. Financial data and budgets do not serve well for departments, such as R & D and Marketing, in which reciprocal interdependence dominates (Hayes, 1977). The basic tenet of management accounting that managers should be held accountable for aspects of performance, such as costs, over which they have control, does not apply in the case of reciprocal interdependence because the work of each component is highly dependent on the on-going work of several other components (Hayes, 1977). Formal reporting systems can be important as a signalling device, but they do not provide current detailed information for coordinating or measuring the effectiveness of R & D effort (Hayes, 1977).

The requisite control can be achieved only through continuous interaction, frequent communication, and mutual adjustment by the various managers and units involved (Daft, 1983).

IMPLICATIONS AND CONCLUSIONS

The research reported here indicates that the nature of departmental interdependencies places specific requirements on the major functions of accounting and information systems (Ginzberg, 1980). The findings also support the idea that management accounting and information systems can be studied as an integral part of the organization's overall structural characteristics, and are related to other control mechanisms to form the organization's control package (Waterhouse & Tlessen, 1989; Earl & Hopwood, 1980; Otley, 1980; Otley & Berry, 1980; Ewusi-Mensah, 1981; Ginzberg, 1983; Gordon & Narayanan, 1984). The findings are also consistent with the idea that organizations employ a large number of control mechanisms (Lawler, 1976; Flamholtz, 1983). Although we focused on only three controls, we found that all three were important, facilitated key management functions, and had a good deal of motivational force. Moreover, department managers reported a high degree of satisfaction with these control systems.

The findings have implications for management accountants. Designers may want to consider the management accounting system as one part of a larger control systems package. The presence of management controls such as SOP's and periodic statistical reports may influence how the accounting systems are designed and used. Accountants tend to focus on the financial aspects of accounting reports, and pay less attention to the other parts of the control

package. Analysis of departmental interdependency patterns, for example, is relatively easy to do, and may help designers obtain an optimum control package among SOPs, budgets, and other reports. Management accountants could play a leading role in designing and managing the total package that is appropriate for their organization. The organization looks to the management accounting function for leadership in the important area of management control systems. Management accountants can be aware of the unique control problems posed by pooled, sequential and especially reciprocal interdependence, and participate in the selection of the requisite management controls.

This study also suggests that the organizational theory approach to understanding management accounting systems is a valuable one. Organization theory represents a macro approach to accounting and control that is a relatively new area of inquiry. It seems probable that management accounting systems are related to factors such as environmental uncertainty, strategy, technology, division of labor, interdependence, and other properties of organizational structure. Of course the field still has a long way to go before understanding the precise relationship among macro organizational variables and accounting control systems sufficient to develop comprehensive and robust theories (Gordon & Narayanan, 1984). Additional research in this area of inquiry may yield progress toward integrated findings and stronger theory (Hopwood, 1983).

Studies based on organization theory, cybernetics, and large case studies as well as investigations based on agency, markets and hierarchies frameworks contain a great deal of potential to further our understanding of the role accounting plays in organizational functioning (Otley, 1980; Kaplan, 1984;

Tiessen & Waterhouse, 1983). While a great deal of work remains to be done before a general unifying theory emerges, this study indicates that one macro variable--interdependencies--maybe a factor in how management controls are designed and deployed.

Component interdependency	Type of Work	Transactions with other components	Major Control Means
pooled	service to client	few	SOP's
sequential	assembly line	preceeding and sub-sequent units	Operating budget and statistical reports
reciprocal	custom producer	intensive	informal controls (feedback and mutual adjustment)

Table 1. Interdependencies, work, transactions and control

<u>Sector</u>	<u>Main Activities of Each Organization</u>
1. Manufacturing	<ul style="list-style-type: none"> a. machinery (6) b. electronics (6) c. wood products (3) d. textiles (4) e. oil, gas, and petrochemicals (3) f. wine (4) g. spirits (7) h. telephone and telecommunications equipment (5)
2. Merchandising	<ul style="list-style-type: none"> a. large, general department store chain (7) b. specialty department store chain (3) c. clothing retail chain (3)
3. Consumer Marketing	<ul style="list-style-type: none"> a. food products (5) b. personal, food, and grocery products (4)
4. Service	<ul style="list-style-type: none"> a. advertising (3) b. telephone and telecommunications (6) c. bank (3) d. finance (2) e. trust and banking (4)
5. Health Care	<ul style="list-style-type: none"> a. hospital (9) b. faculty of medicine (3)

(Figures in brackets represent the number of departments sampled in each organizations.)

TABLE 2 : Sample composition

	Budget		Statistical Reports	
	\bar{X}	S	\bar{X}	S
Frequency of reporting (weeks)	4.5	1.2	4.1	2.3
Difficulty of targets	5.5	2.0	5.9	1.6
Influence in setting targets:				
- upper management	6.8	2.3	6.6	2.3
- the department manager	6.5	2.1	6.7	2.0
- subordinates and employees in the department	4.0	2.4	4.4	2.5
Importance of the reports for:				
- planning	7.5	1.5	7.3	1.5
- measuring and monitoring department performance	6.8	2.2	7.8	1.5
- coordinating with other departments	4.9	2.5	5.9	2.3
- promotion and salary decisions for the department manager	4.5	2.4	4.7	2.2
- helping do things correctly	5.1	2.3	5.8	2.2
Emphasis is placed on meeting targets	7.5	2.0	7.5	1.5
Response to negative variances	7.2	1.9	7.8	1.2
Influence of the reporting process on day-to-day department operations	6.2	2.1	6.4	2.3
The reporting process works well	7.0	1.8	7.3	1.4

\bar{X} - mean score (9 point Likert-type scale)

S - standard deviation

N - 86 for budget and between 65 and 75 for statistical reports items

TABLE 3: Descriptive statistics for characteristics of the budget and statistical reports

	<u>X</u>	<u>S</u>	<u>Range</u>	
			<u>Min.</u>	<u>Max.</u>
Number of books	5.1	7.0	1	45
Number of pages	973	1484	2	7000
Percentage of work activities covered by SOP's	62%	35%	0%	100%
Percentage of the time it is necessary to follow SOP's to do a good job	60%	38%	0%	100%
Extent to which people that deviate from SOP's get into trouble(1)	7.1	2.0	2	9
Extent to which adherence to SOP's is used to evaluate the manager's performance(1)	6.1	2.2	1	9
Satisfaction with SOP's(1)	6.8	1.9	1	9

(1) Nine point scale.

TABLE 4 : Descriptive statistics for SOP's

	Budget		Statistical Reports	
	\bar{X}	S	\bar{X}	S
Frequency of reporting (weeks)	4.5	1.2	4.1	2.3
Difficulty of targets	5.5	2.0	5.9	1.6
Influence in setting targets:				
- upper management	6.8	2.3	6.6	2.3
- the department manager	6.5	2.1	6.7	2.0
- subordinates and employees in the department	4.0	2.4	4.4	2.5
Importance of the reports for:				
- planning	7.5	1.5	7.3	1.5
- measuring and monitoring department performance	6.8	2.2	7.8	1.5
- coordinating with other departments	4.9	2.5	5.9	2.3
- promotion and salary decisions for the department manager	4.5	2.4	4.7	2.2
- helping do things correctly	5.1	2.3	5.8	2.2
Emphasis is placed on meeting targets	7.5	2.0	7.5	1.5
Response to negative variances	7.2	1.9	7.8	1.2
<i>ok. read</i> → Influence of the reporting process on day-to-day department operations	6.2	2.1	6.4	2.3
The reporting process works well	7.0	1.8	7.3	1.4

\bar{X} - mean score (9 point Likert-type scale)

S - standard deviation

N - 86 for budget and between 65 and 75 for statistical reports items

TABLE 5: Descriptive statistics for characteristics of the budget and statistical reports

INTERDEPENDENCIES

CHARACTERISTICS OF THE STANDARD OPERATING PROCEDURE:	<u>Pooled</u>	<u>Sequential</u>	<u>Reciprocal</u>
1. number of books	.33***	-	-.22**
2. number of pages	.31***	-	-.30***
3. percentage of departmental work covered	.29**	-	-.24**
4. percentage of time necessary to follow SOP's to do work well	.22**	-	-.21**
5. adherence to SOP's use to evaluate performance	-	-	-
6. influence of SOP's on department activities and operations	.27**	-	-.32***

... p < .01

.. p < .05

. p < .10

- not significant

Table 5. Partial correlations (controlling for size) of standard operating procedures and interdependents

INTERDEPENDENCIES

	<u>Pooled</u>	<u>Sequential</u>	<u>Reciprocal</u>
BUDGET CHARACTERISTICS			
frequency	.22**	-	-
target difficulty	-.26**	-	-
influence in target setting:			
- upper management	-	.23**	-.23**
- department manager	-	-	-.32***
- department employees	-	-	.18*
importance for:			
- planning	-	-	-
- coordination	-	.18*	-
- measure and monitor	-.18*	.24**	-.23**
emphasis on meeting targets	-	.25**	-.19*
response to negative variances	-	-	-
influence on daily activities	-.25**	.29***	-

... p < .01

.. p < .05

. p < .10

- not significant

Table 6. Partial correlations (controlling for size) of budget characteristics and interdependencies

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INTERDEPENDENCIES

	<u>Pooled</u>	<u>Sequential</u>	<u>Reciprocal</u>
STATISTICAL REPORTS CHARACTERISTICS			
frequency	-.33 ^{***}	-	-.22 ^{**}
target difficulty	-.37 ^{***}	.33 ^{**}	-
influence in target setting:			
- upper management	-	.19 [*]	-
- department manager	-.33 ^{***}	-	.21 ^{**}
- department employees	-.28 ^{***}	-	.22 ^{**}
importance for:			
- planning	-	-	.36 ^{**}
- coordination	-.28 ^{***}	-	.21 ^{**}
- measure and monitor	-.29 ^{***}	-	-.29 ^{***}
emphasis on meeting targets	-	.25 ^{**}	-
response to negative variances	-	-	-
influence on daily activities	-.22 ^{**}	.20 ^{**}	-

... p < .01

.. p < .05

. p < .10

- not significant

Table 7. Partial correlations (controlling for size) of statistical reports characteristics and interdependencies

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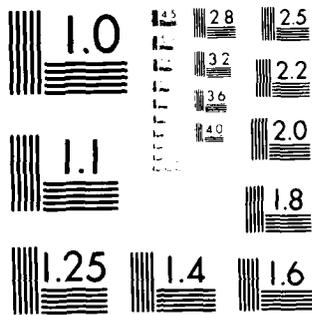
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