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정보기술과 조직구조의 관련성에 대한 재고찰

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Rethinking Information Technology–Organizational Structure Relationship

Past research linking information technology and organizational structure has been inconclusive and contradictory. The purpose of this study is to resolve some of this confusion by taking into consideration one theoretical issue and three methodological problems. The one theoretical issue is an assessment of the importance of environment as a key external variable constraining both organizational structure and the use of information technology. To date, there has been no systematic, empirical research on the conceptual linkage among all three of these variables. The three methodological issues concern measurement problems associated with (1) controlling for different levels of analysis, (2) establishing a clear operationalization of information technology, and (3) differentiating institutional and questionnaire approaches to data collection.

The research results in four conclusions. First, data confirm the environment as a key external variable in the linkage between information technology and organizational structure. Second, three central dimensions of information technology are identified: Growth of Capacity, extensiveness of information technology use, and information technology sophistication. Third, in order to maximize the explanatory power of information technology on other organizational constructs, it is neces-

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sary to differentiate between the actual use of information technology as opposed to the mere presence of information technology. Fourth, carefully designed questionnaire measures reveal no significant differences from institutional measures in the assessment of key organizational constructs.

Ⅰ. INTRODUCTION

Since Leavitt and Whisler [1958] published their landmark article "Management in the 1980's," many studies have examined the relationship between information technology (or computer-based information systems) and organizational structure. Leavitt and Whisler [1958] predicted that information technology would facilitate recentralization while reducing the number of middle managers. However, subsequent research conclusions of these issues have been either contradictory or inconclusive.

For example, in support of Leavitt and Whisler [1958], case studies done by Siegmen and Karsh [1962] do report an increase in centralization with computerization. On the other hand, Hunt and Newell [1971] review the literature and contend that Information Technology (IT) will decentralize decision making and will not reduce levels of management. Furthermore, Robey [1981] reports that instances of no change outweigh the incidents of change and where computerized information system does not produce change in organizational structure, it reinforces the existing structure. The above examples clearly demonstrate the inconsistent results of research findings on the relationship between IT and organizational structure.

There are two main objectives of this study. The first objective is to consider environment as a key external variable constraining the relationships among IT and organizational structure. While contingency theorists stress the influence of environment on organizational structure and several information systems (IS) researchers recognize the importance of environment, there has been a lack of comprehensive studies examining the relationship among IT, environment, and organizational structure.

The second objective is to take into consideration three methodological issues in IS -related research: (1) the importance of different levels of analysis, (2) the conceptualization of information technolo-

gy, and (3) the measurement issues of institutional and questionnaire approaches.

Ⅱ. LITERATURE REVIEW & HYPOTHESES DEVELOPMENT

1. Literature Review

Literature Review The examples described in introduction section demonstrate the inconsistent results of research findings on the relationship between IT and organizational structure. One of the very plausible causes for these contradictory and inconclusive results is the way of looking at the cause-and-effect relationship between IT and organizational structure. There are two basic conceptual models that underlie much of the empirical research on this relationship: the technology imperative and the organization imperative. The technology imperative views IT as an exogenous factor, conceptually independent from the organizational variables which it affects. On the other hand, the organization imperative treats the use of IT as the outcome of managerial design choices intended to create a fit between the organization and its context.

The technology imperative was adopted by Leavitt and Whisler [1958] who argued that IT would recentralize and reduce the numbers of middle managers. Subsequent studies [Whisler, 1970; Blau et al., 1976; Robey, 1977; Kling, 1978 and 1980; Robey, 1981; Attewell and Rule, 1984; Foster and Flynn, 1984; Bjorn-Andersen, Eason, and Robey, 1986] do not confirm Leavitt and Whisler's prediction. Rather results are contradictory and inconclusive.

On the other hand, Simon [1977] also asserts that managers can achieve desirable objectives and avoid negative consequences by making technology fit their needs. Several recent studies on managerial choices and intentions support this view [Boddy, 1981; Robey, 1983; Boddy and Buchanan,1984; Dawson and McLaughlin, 1986]. However, Bjorn-Andersen, Eason, and Robey [1986] conclude that many of the impacts they observed in their eight cases were accidental, unintended, and uncontrolled. Findings which contradict the organization imperative.

To overcome these research discrepancies, a variation of the technology imperative has emerged. This alternative view includes contextual variables such as environmental uncertainty, performance, and organizational size. Klatzky [1970] asserts

that size is the more powerful variable in explaining organizational structure than is automation, especially in the case of decentralization. Carter [1984] also argues that size moderates the relationship between IT and organizational structure. Robey [1977] observes environmental uncertainty rather than size as a key variable. Pfeffer and Leblebici [1977] control for both size and environmental uncertainty and find a positive association between IT and decentralization as well as differentiation. Beginning in the late 1970's the use of contextual variables [Emusi-Mensah, 1981; MaCintosh, 1981; Waterhouse and Tiessen, 1978] and contingency theory started dominating IS-related research [Ginzberg, 1980]. Markus and Robey [1983] even introduce the term "organizational validity" to stress the importance of the fit between systems and user, organizational structure, power, and environment.

To thoroughly review the IS literature, all articles concerning IT and organizational structure relationships, published in 26 major organization and IS field journals, plus other well-cited articles, are examined. (Table 1 lists the journals reviewed.) Also, the summary list of authors, year of publication, their perspectives (technology or organization im-

Table 1 List of Journals Reviewed

ACM Computing Surveys	Academy of Management Journal
Academy of Management Review	Accounting, Organizations & Society
Accounting Review	Administrative Science Quarterly
California Management Review	Communications of the ACM
Database	Data Base
Decision Sciences	Decision Support Systems
Harvard Business Review	Human Relations
Information and Management	Information Systems
Interface	Interfaces
Journal of Accounting Research	Journal of Business
Journal of MIS	Management Science
MIS Quarterly	Sociological Perspectives
Sloan Management Review (before 71 Industrial Management Review)	

Table 2 Literature Review on IT-Organizational Structure

Author(s) & Year	Perspective	Centralization	Formalization	Differentiation	Specialization
Gordon & Narayanan (84)	Organ	−	+	+	
Mann & Williams (60)	Organ	+	+	+	
Debrabander et al. (72)	Organ			+	+
Kalatky (70)	Organ	−			
Zmud (82)	Organ	+	+		
Pfeffer & Leblebici (77)	Tech	−	−	+	
Blau et al. (76)	Tech	+		+	+
Carter (84)	Tech	N		+	N
Rourke & Brooks (66)	Tech	+			
Hill (66)	Tech				+
Dawson & McLaughlin (86)	Tech	−			
Boddy & Buchanan (84)	Tech			+	
Danziger (77)	Tech			+	+
Meyer (68)	Tech				
Weber (59)	Tech			N	
Robey (81)	Tech	N		+	
Hoos (60)	Tech	+			+
Hoos (60)	Tech	+			
Hofer (70)	Tech	−	+		+
Siegman & Karsh (62)	Tech		+	−	+
Lipstreau & Reed (65)	Tech	+		−	

+ denotes more centralized, formalized, differentiated, or specialized

− denotes less centralized, formalized, differentiated, or specialized

N denotes no change

Organ: Organization Perspective Tech: Technology Perspective

perative), conceptualization of IT, and corresponding organizational structure for 21 empirical studies identified is presented in Table 2.

Seven researchers report that IT is associated with centralization of decision making [Mann and Williams, 1960; Zmud, 1982; Blau et al., 1976; Rourke and Brooks, 1966; Hoos, 1960a and 1960b; Lipstreu and Reed, 1965] and 5 indicate that IT facilitates decentralization of decision making [Gordon and Narayanan, 1984; Klatzky, 1970; Pfeffer and Leblebici, 1977; Dawson and McLaughlin, 1986; Hofer, 1970]. Carter [1984] and Robey [1981] report no significant relationship between IT and decision-making structure. There is no noticeable differences in results whether research adopts the technology imperative or the organization imperative. On the other hand, the structural dimensions of formalization, vertical and horizontal differentiation, and specialization have more consistent associations with IT than does centralization (Table 2).

2. Level of Analysis

The level of analysis problem has been recognized in the organization theory literature [Ford and Slocum, 1977; Scott, 1975 and 1981; Comstock and Scott, 1977; Pfeffer, 1981; Fry, 1982]. However, reviewed studies of IT and organizational structure revealed few research attempts to control for possible level effects at the organization, subunit, and individual levels, despite the fact that Child [1984a] suggests that differences in units of analysis may cause differences in research results.

Since large organizations make use of a number of different IT in each subunit or functional unit and each of these subsystems may have a different structure, the subunit level is the major unit of analysis in this research [Miller et al., 1987; Duncan, 1974]. An organizational subunit is defined as a formally specified autonomous work unit within the organization under a superior, who (1) directly reports to the CEO of the organization, and (2) is charged with a formally defined set of responsibilities directed toward the attainment of the goals of the organization [Duncan, 1972; Blau and Schoenherr, 1971]. Therefore, subunit is used as the level of analysis in this study.

3. Hypotheses Development

According to some theorists, IT facilitates delegation of decision making through centralization of control and by helping managers make more timely and more accurate decisions [Leavitt and

Whisler, 1958; Child, 1984b; Hoos, 1960a and 19609b; Hunt and Newell, 1970]. This efficient and effective decision-making can be done in two main respects. First, by linking each unit within an organization into a common network, each unit is aware of the situation of other units immediately and thus allows its members to make decisions in timely and precisely fashion. Second, the improved analytical facilities provided by IT, such as expert systems, several management science models, and Decision Support Systems (DSS), could enhance the capacity of managers to make sound judgments in their decision making [Keen and Scott Morton, 1978; Huber, 1984b].

IT extends the possibilities for managerial control by providing faster, more comprehensive, and more accurate knowledge of operations [Child, 1984b; Rourke and Brook; 1966; Dawson and McLaughlin, 1986; Wagner, 1966; Leavitt and Whisler, 1958; Bariff and Galbraith, 1978; Mann and Williams, 1960; Whisler, 1970a and 1970b; Hoos, 1960a and 1960b]. The fact that superior information processing capabilities (better operational control data and fast feedback) of IT permits a more flexible response as unusual or unexpected conditions arise [Child, 1984]. Daily, monthly, or error reports will provide management with a full-spectrum of output control methods. It may therefore become possible to improve operational control without having to rely in the traditional way of formalization and centralization. Thus IT can facilitate decentralization, differentiation, specialization, and formalization by providing more organizational control [Pfeffer and Leblebici, 1977].

Pfeffer and Leblebici [1977] argue that IT enhances the manager's capability for dealing with organizational complexity (differentiated and specialized) by providing the manager with more rapid and comprehensive feedback concerning organizational performance. With this enhanced capability, the manager can effectively manage a more complex organization which requires a complicate controlling and coordinating procedures. Also with this feedback information, managers do not have to rely on the formalized rules for control; thus IT will facilitate less formalization. The past research conclusions support this line of reasoning. On the basis of arguments above, the following hypothesis is structured.

Hypothesis 1: High IT use is positively associated with organic[2] subunit struc-

ture.

According to Galbraith [1973 and 1977], organizations engage in information processing activities to reduce uncertainty, which is, the difference between the amount of information required to perform tasks and the amount of information already possessed by the organization. This argument begins when Galbraith [1973] integrates the works of Burns and Stalker [1961], Hall [1962], Woodward [1965], and Lawrence and Lorsch [1967] in terms of information processing. Gorry and Scott Morton [1971] recognize that different types of decisions are made at different hierarchical levels to process different information-processing requirements. Galbraith [1973 and 1977] further proposes that specific structural characteristics and behaviors would be associated with information requirements, and a line of research [Tushman, 1978, 1979a, and 1979b; Van de Ven and Ferry, 1980; Daft and MaCintosh, 1978 and 1981; Randolph, 1978; Daft and Lengel, 1986] has provided support for this relationship.

A major source of uncertainty is environment [Duncan, 1972 and 1974; Tung, 1979; Thompson, 1967; Lawrence and Lorsch, 1967; Huber, 1984a; Leifer and Huber, 1977]. According to Galbraith [1973, 1974, and 1977], an organization has two choices to reduce uncertainty: either reduce the need for information processing or increase the capacity to produce information. The first strategy is not discussed here since modern complex organizations performing in uncertain environment are unable to reduce the need for information processing.

To implement the second strategy, organizations have two choices: either change the organizational structure [Dale, 1958; Duncan, 1974; Tung, 1979; Leifer and Huber, 1977; Thompson, 1967; Lawrence and Lorsch, 1967] or adopt IT to increase information processing capabilities [Leavitt and Whisler, 1958; Gorry and Scott Morton, 1971; Saunders, 1981; Daft and MaCintosh, 1981]. Since the impact of environment on organizational structure has been recognized for a long time, it is not reviewed here. From this information processing view, the following hypothesis is formulated.

Hypothesis 2: Subunits in an uncertain

2) Organic structure shows less centralized, less formalized, more differentiated, and/or more specialized organizational characteristics.

environment will show high IT use or more organic structure than will subunits in the certain environment.

And if hypothesis 2 holds, then the following hypothesis should hold.

Hypothesis 3: In an uncertain environment, hypotheses 1 will receive more support than in the certain environment.

Ⅲ. RESEARCH METHODOLOGY

1. Research Design

Metropolitan area of Seoul, Korea, was selected for the location of study and the "Q" Group, a major Korean conglomerate, was chosen as the subject of study. In Stage I, the primary method of data collection was interviews. Annual reports, standard operating procedures, archival data, minutes of meetings, and company or industry publications were also collected as secondary sources of data. The main purpose of Stage I research was to explore the "Q" Group for a basic understanding of research setting as well as to secure rich, descriptive data to supplement the survey data collected in Stage II. In Stage II, structured questionnaires were administered to subunit heads and middle level managers of 60 subunits throughout 10 "Q" companies. Secondary sources of data were also collected at the subunit level to supplement the questionnaire data.

a. Sample Selection

All subunits selected for this study also met the following criteria: (1) Each performed functions that were distinctly different from those of other subunits in a specific organization—for example, sales, production, research and development, personnel, and accounting; and (2) Each subunit was fairly autonomous as is described above in the level of analysis section.

b. Questionnaire and Institutional Measures

There is some indication that discrepancies in the findings observed among IT researchers may be the result of differences between two types of measures [Nolan, 1979; Pfeffer and Leblebici, 1977; Blau et al., 1976; Carter, 1984]. The first type depends on whether researchers rely on direct measures from company records and interviews with organization representatives (hereafter referred to as the institutional measures). The second type is based

on the aggregation of interview and questionnaire data from organization members (hereafter referred to as the questionnaire measures) [Ford and Slocum, 1977; Fry, 1982; Pennings, 1973; Sathe, 1978].

In this study, both questionnaire and institutional data are used. Questionnaire data provide questionnaire measures while archival data and interviews with top executives provide more institutional measures. By comparing these two types of data, convergent validity [Perrow, 1967; Pennings, 1973] or predictive validity [Nunally, 1978; Ives, Olson, and Baroudi, 1983] can be assessed for data generalization, addition, and integration.

2. Definition and Measurement of Research Variables

a. Information Technology

The most serious obstacle in information technology (IT)-related research has been the conceptualization of IT. Overall, researchers have been conceptualizing IT differently in terms of both its definition and dimensionality. An inconsistent definition of IT leads to the problem of dimensionality. Is IT uni-dimensional or multi-dimensional? If IT has one dimension, then what is that one dimension? Is IT really different from "Technology" in general? To thoroughly review the definition and conceptualization of IT, all articles identified in Literature Review were examined. The summary list of authors, year of publication, conceptualization of IT, and research methodology are presented in Table 3. Out of 36 articles, 28 studies use IT interchangeably with computer system (automation, Electronic Data Processing Systems, Management Information Systems, Decision Support Systems). Two studies do not conceptualize IT at all [Leavitt and Whisler, 1958; Pfeffer and Leblebici, 1977). Four studies conceptualize IT as a variety of products or applications [Boddy and Buchanan, 1984; Warner, 1984; Child, 1984b; Burlingame, 1961] while two studies conceptualize IT as the degree of computerization and innovation [Carter, 1984; Zmud, 1982]. From 21 empirical studies (case studies and surveys), only 6 studies provide a meaningful operationalization of IT. This analysis clearly demonstrates an inconsistent and lack of conceptualization of IT.

The conceptualization of IT based on these 21 articles converges in to four categories of IT: extensiveness of use, growth of capacity, variety of products, and sophistication of applications. Extensiveness

of use means how much of a worker's task is accomplished by directly using computers [Carter, 1984; Blau et al., 1976; DeBrabander et al., 1972]. Growth of capacity includes the total budget of computing, the number of employees directly engaged in computing, the number of C.P.U.'s, and the number of terminals. [Nolan, 1979; Klatzky, 1970; Pfeffer and Leblebici, 1977]. Variety of products means what kinds of IT products, i.e., word processing, database management system, electronic mail, telecommunications, robotics, Computer-Aided Design and Computer-Aided Manufacturing (CADCAM), and Flexible Manufacturing Systems (FMS) that organization utilizes [Boddy and Buchanan, 1984; Warner, 1984; Child, 1984b]. Finally, sophistication of applications denotes how sophisticated the application of IT is in the organization, from record keeping to decision modeling or process control [Danziger, 1977; Alter, 1980].

(1) Extensiveness of Use

Extensiveness of Use deals with the degree to which individual work is accomplished by directly using IT. Interview data suggest that there are three different types of extensiveness of IT use in terms of time, tasks, and overall day-to-day operation rather than one type that Carter [1984] used. The rationale for including time and overall day-to-day operation is to measure extensiveness of IT use more accurately by examining different aspects of individual work.

(2) Growth of Capacity

The dimension of the physical growth of the information capacity of subunit was measured by the following five items: total budget for IT, total number of employees directly engaged in IT related work (number of job titles directly related to IT), total number of C.P.U.'s, total number of terminals, and total number of employees using IT. All these data were secured through questionnaires and responses were cross-checked with archival data provided by the DP department since DP department of each company keeps the records of IT activities and configuration by each subunit, by each division, and by whole company.

(3) Complexity

Complexity of the information environment was measured by six items in each subunit: number of operating systems, number of products (for example, word

Table 3 Literature Review on IT Conceptualization

Authors	Conceptualization	Methodology	Year
Zmud	Innovation	Survey	82
Leavitt & Whisler	IT	Theory	58
Blau et al.	MeaSure (Automation)	Survey	76
Klatzky	Measure (Automation)	Survey	70
Carter	Measure (Computerization)	Survey	84
Danziger	Measure (EDP)	Case	77
Pfeffer & Leblebici	Measure (IT)	Survey	77
DeBrabander et al.	Measure (Use)	Survey	72
Gordon & Narayanan	System (Accounting)	Survey	84
Meyer	System (Automation)	Survey	68
Olson & Lucan	System (Automation)	Theory	82
Lipstreu & Reed	System (Automation)	Case	65
Rourke & Brooks	System (Computer)	Survey	66
Hunt & Newell	System (Computer)	Theory	71
Robey	System (Computer)	Theory	70
Hertz	System (Computer)	Theory	65
Schmitt	System (Computer)	Theory	60
Dawson & McLoughlin	System (CBIS)	Survey	86
Mann & Williams	System (EDP)	Case	60
Weber	System (EDP)	Case	59
Wagner	System (EDP)	Theory	66
Hoos	System (EDP)	Case	60
Dearden	System (EDP)	Theory	67
Hofer	System (EDP)	Case	70
Hill	System (EDP)	Survey	66
Hoos	System (EDP, Automation)	Survey	60
Siegman & Karsh	System (EDP, Automation)	Case	61
Robey	System (MIS)	Case	82
Bariff & Galbraith	System (MIS)	Theory	78
Ein-Dor & Segev	System (MIS)	Theory	78
Dearden	System (MIS)	Theory	66
Markus & Robey	System (MIS)	Theory	83
Boddy & Buchanan	Variety of Technology	Case	84
Warner	Variety of Technology	Theory	84
Child	Variety of Technology	Theory	84
Burlingame	Variety of Technology	Theory	61

processing, data base management system, spreadsheet), number of mainframes, number of personal computers, number of application programs, and compatibility of hardware and software. Again these data were acquired through questionnaires and

responses were cross-checked with archival data provided by the DP department as in case of Growth of Capacity.

(4) Sophistication of Application Programs

The dimension of Sophistication of Application Programs was measured by asking each respondent to identify the ten most usable application programs in his or her subunit. Respondents were then asked to refer to that 10-item list and classify them into categories based on application purposes and target hierarchies. Also the list of 100 application programs of "Q" were complied during Stage I. Then, a three-member panel categorized these application programs into 25 generic application. Next, each panel member assigned the sophistication score to each generic application on a 7-point scale based on how sophisticated the application was and how advanced the technology that application used.

b. Environment

One of the most widely discussed and least understood concepts in the field of organizational analysis today is the relationship between the organization and its environment [Ford and Slocum, 1977]. To date, much of the theoretical and empirical work on this issue has focused on the uncertainty element [Thompson, 1967; Duncan, 1972; Miles, Snow, and Pfeffer, 1974; Osborn and Hunt, 1974; Leifer and Huber, 1977].

In the present research, uncertainty of the environment as measured by the Simple-Complex and the Stable-Dynamic dimensions are used since apparently the most appropriate representative phrase for environment is "uncertainty" and the underlying two dimensions incorporate the major elements of most studies on environment. Duncan [1972] and Tung [1979] show that uncertainty is the most proper representative element of the environment. Dill's [1958] and Lawrence and Lorsch's heterogeneity/homogeneity, as well as Duncan's [1972] and Tung's [1979] complexity, are studied in the simple-complex dimension while Burns and Stalker's [1961] and Child's [1975] stability, as well as Duncan's [1972] static-dynamic and Tung's [1979] move rate and stability, are measured by the stable-dynamic dimension. Environmental factors and components identified by Duncan [1972] were sued in this research.

(1) The Simple-Complex Dimension

The heads and middle level managers of each selected subunit were asked to identify factors and components from the list of factors that they took directly into consideration in their decision-making processes. If they did, respondents were asked to circle "Y". The formula is:

Sum of [(Weighted Factors) × (Components)^2] [Tung, 1979].

(2) The Stable-Dynamic Dimension

The Stable-Dynamic dimension incorporates (1) the degree to which the factors of the subunit's internal and external environment remain basically the same over time or are in a continual process of change [Duncan, 1972; Tung, 1979], (2) the magnitude of such change [Tung, 1979], and (3) the predictability of that change [Tung, 1979; Child, 1972a; Downey and Slocum, 1975].

Frequency of change was measured by asking respondents how often each of the relevant factors in the environment changed over the course of the past year. The 7-point Likert scale varies from 1= "never" to 7="very often." The second component, magnitude of the change, was measured as follows: After estimating the frequency of change in each factor, the respondents were asked to specify the magnitude of each change on a 7-point likert scale in terms of the seriousness of the impact on the subunit's operation. Predictability of contingencies confronting the focal unit was assessed by asking respondents "Can you predict the change of each relevant factor in advance?" The 7-point Likert scale varies from 1="Yes, 100% possible" to 7="No, impossible." The formula is:

Sum of [(frequency) x (magnitude) x (predictability)]

c. Organizational Structure

A definitive answer to the question of structural dimensionality is difficult to provide since there has been little agreement on this aspect. For example, Pugh et al. [1969] suggest four dimensions of structure while James and Jones [1976] and Champion [1975] suggest seven and eight dimensions, respectively. Montanari [1978] proposes that there are 16 possible dimensions of structure.

The present research, therefore, operationalizes the following four dimensions of organizational structure: centralization, formalization, specialization, and differentiation. Rationale for studying

these four dimensions of organizational structure is based on the growing agreement that these are the major dimensions of organizational structure.

(1) Centralization

Centralization is defined as the extent to which the locus of authority to make decisions affecting the organization is confined to the higher levels of the hierarchy [Pugh et al., 1968; Daft, 1986]. Authority to make decisions was defined as the last person whose assent must be obtained before legitimate action is taken—even if others have to confirm the decision subsequently [Pugh et al., 1968]. In Stage I, interviewees were asked to identify 20 recurring decisions covering a range of organizational activities. From these interview data, a standard list of 20 recurring decisions over four different areas of organizational activities was prepared to be used in Stage II. For each decision, a 7-point scale was presented to subunit heads and middle level managers to circle the appropriate locus of authority ranging from 1="Workers" to 7="Chairman of the Board."

The institutional measures on centralization were secured through determining the locus of authority on these 20 decisions by (1) using the organization chart and archival data, and by (2) interviewing the subunit heads as well as the company CEO or other high-level company representatives.

(2) Formalization

Formalization is defined as the extent to which rules, procedures, instructions, and communications are written and the degree to which organizational activities are subject to such written documents [Pugh et al., 1968; Hall, 1962 and 1963; Child, 1972b and 1984a]. In Stage I, each interviewee was asked to identify 20 of the most important documents covering a range of organizational activities.

From these interview data, a standard list of 20 documents was prepared for use in Stage II. The questionnaire measures were secured by asking respondents whether each document existed in their subunit. If it did, then they were asked the degree to which their activities are subject to that document. Documents amy vary in volume. Indeed some researchers simply quantify the number of document pages as an institutional measure of formalization [Pugh et al., 1968; Hall, 1962 and 1963; Khandawalla, 1978]. To take into account this aspect in the present research, for

each document, a 7-point scale was used according to the documents volume ranging from 1="1-10 pages" to 7="more than 200 pages." The answers for the same 20 documents used in questionnaire measures formed the basis for the institutional measures on formalization.

(3) Specialization and Differentiation

Specialization is defined as the degree to which organizational tasks are subdivided into separate jobs [Daft, 1986; Duncan, 1974; Pugh et al., 1968]. If specialization is extensive, each employee performs only a narrow range of tasks. This dimension was measured by the number of specific job titles in each subunit as recorded on formal documents [Blau and Schoenherr, 1971; Van de Ven and Ferry, 1980].

Differentiation can be divided in to two dimensions: vertical differentiation and horizontal differentiation. Vertical differentiation was measured by the number of hierarchical levels constructed by the longest chain of command found in a subunit while horizontal differentiation was measured by the number of sections [Blau and Schoenherr, 1971; Pugh et al., 1969; Hall, 1962 and 1963]. A section is defined as the major group of people in a subunit whose chief reports to the division head directly, provided that it consists of a supervisor and at least three workers. A Differentiation Index was calculated by adding the vertical and the horizontal differentiation measures.

3. Questionnaire Return Rate

The questionnaire return rate was 71 percent (212 out of 300). Fifteen returns were unusable. Therefore, the usable return rate was 66 percent. All 60 subunits returned at least two questionnaires. To check whether there were differences between respondents and non-respondents, more detailed analysis on return rates were performed. Return rates by companies and by functional areas were calculated to see whether there were significant patterned differences in return rates across companies and across functional subunits. Results reveal that return rates and usable return rates range from 60 percent to 80 percent and from 51 percent to 73 percent across companies, respectively. Across functional areas, return rates and usable return rates vary from 60 percent to 80 percent and from 55 percent to 70 percent, respectively. These return rates indicate a non-biased and stable questionnaire return pattern across companies and

across functional areas. As far as the return rates are concerned, there are no specific incidents to suspect a bias in non-respondents.

Ⅳ. RESEARCH FINDINGS

1. Organizational Structure

a. Centralization

For the Questionnaire Centralization Index, Cronbach's alpha of .8801 surpasses the standard set by Nunally [1978]. This high coefficient suggests the reliability of measures and the additivity of 20 centralization items to form a single measure [Cronbach, 1951]. Correlation analysis shows that all interitem correlations are positive (ranging from .1978 to .7452) and statistically significant at the 0.05 level. After varimax rotation, factor analysis reveals strong evidence for construct validity. Predictive validity is tested by correlating questionnaire and institutional measures on centralization. The correlation coefficients for 18 pairs range from .4895 t o .8546 ($p < .01$). The two insignificant pairs are dropped from centralization measure to improve validity. Therefore, the centralization measure consists of 18 decisions with a Cronbach's alpha of .8778.

The Questionnaire Centralization Index is calculated by adding respondents' scores on 18 decisions. Institutional Centralization Index is secured by summing 18 institutional measures. Since the correlation coefficient between Institutional Index and Questionnaire Index (.6159) and Cronbach's alpha (.8428) are high, these two measures are added to form a single Centralization Index. The Subunit Centralization Index is calculated separately by computing the average of all centralization indices of respondents of a particular subunit.

b. Formalization

The Cronbach's alpha of .8831 for the Questionnaire Formalization Index indicates the reliability and the additivity of 20 formalization items to form a single measure [Cronbach, 1951; Nunally, 1978]. Correlation analysis shows that all interitem correlations are positive (ranging from .1813 to .7852) and statistically significant at the 0.05 level. After varimax rotation, factor analysis reveals strong evidence for construct validity. Predictive validity is tested by correlating all questionnaire measures with corresponding institutional measures. All 20 correlation coefficients range from .4839 to .8961 and are

significant at the 0.01 level, indicating strong support for predictive validity. The Questionnaire Formalization Index and Institutional Formalization Index are calculated the same way as centralization do.

c. Differentiation and Specialization

Vertical differentiation is measured by the number of hierarchical levels constructed by the longest chain of command found in a subunit while horizontal differentiation is measured by the number of sections indicated for a subunit. Both measures are secured from organization charts. The Differentiation Index is calculated by adding these two measures. The Specialization Index is measured by the number of specific job titles in each subunit. If a subunit is more specialized, then each member of the subunit performs specific tasks which are indicated by job title. In short, the more specialized, the more job titles.

2. Information Technology

There are 17 items measuring information technology. Cronbach's alpha is low (. 2549) which is indicative of poor reliability and large variance among 17 items. In other words, there could be several dimensions. Correlation analysis detected a set of items which have very high positive correlation coefficients one another: number of C.P.U.'s, number of terminals, number of mainframes, number of P.C.'s, and number of operating systems.

For the sake of parsimony of variables, the variable "Number of Computers" is created by adding five items. Factor analysis is performed to check for underlying dimensions on the resulting 13 items. Three distinctive factors with a minimum eigenvalue of 1.00 are identified (Table 4).

Since all 13 items have high factor loadings in one of the three factors (greater . 50), no item is excluded. Complexity group (number of computers, number of products, number of applications, and compatibility) does not form a separate factor, rather these variables are highly loaded to either factor 1 or factor 2. Factor 1, which consists of budget, number of IT-related employees, number of IT-related jobs, number of computers, and compatibility, is almost the same as the Growth of Capacity group except compatibility. Compatibility is closely related with number of computers since several P.C.'s and mainframes with different operating systems would make the configuration of computer system incompatible. Fac-

tor 2, which consists of number of products, application sophistication, purpose of application, level of application, and number of applications, basically resembles the Sophistication group. Exceptions are number of products and number of applications, which originally belong to the Complexity Group. Factor analysis suggests that these two items are more close to the Sophistication group rather than the Growth of Capacity group. Factor 3 is exactly the same as the Extensiveness of Use Group.

While this factor analysis provides some support for the initial categorization of information technology into four groups, but a three-factor grouping seems more reasonable since the Complexity group does not form its own dimension as a factor. The factor 1 is named "Growth of Capacity" since it represents the physical growth of capacity. The factor 2 is labeled "IT sophistication" and the factor 3 is labeled "Extensiveness of Use" as the initial

Table 4 Factor Analysis of Information Technology

	Factor 1 (Growth)	Factor 2 (Sophistication)	Factor 3 (Extensiveness)
Budget	.9397	.1063	.0757
Employee	.9082	.0652	.0099
Job	.9122	.0884	.0539
Computer	.9496	.0866	.0206
Compatibility	.5950	.2666	.1108
Products	.2878	.7114	.1915
Sophistication	.2171	.7603	.1458
Applications	.3641	.5900	.1015
Purpose	-.1327	.7571	.1402
Level	.0087	.5661	.0881
Time	.0859	.2829	.9145
Task	-.0005	.0254	.7842
Operation	.1038	.2801	.8619
Eigenvalues	5.0612	2.6539	1.3720
Variance Explained	38.93%	20.41%	10.55%

grouping suggested in the literature review and research methodology chapters. Cronbach's alpha's are .8094 for Growth of Capacity, .7329 for IT Sophistication, and .7963 for Extensiveness of IT Use. These high coefficients support the formation of three factors of IT measures. All further analyses use these three factors.

3. Environment

Two environmental dimensions are measured: Simple–Complex and Stable–Dynamic. For each dimension, subunits are split at the median to form 4 quadrants. The simple and stable quadrant is labeled as the certain environment and the complex and dynamic quadrant as the uncertain environment. Since environment measures are already verified by several researchers [Duncan, 1972; Tung, 1979], no reliability or validity tests are performed.

The medians of 694.33 for the Simple–Complex and 595.17 for the Stable–Dynamic are used to split the subunits into the half to categorize environment as certain and uncertain. Splitting subunits by a median is arbitrary unless the distribution is bi–modal separated by the median, which is not the case. But, more dense gathering for the uncertain and certain environments (n=21 for each) compared to the two remaining quadrants (n=9 for each) supports the use of medians to split subunits in to certain and uncertain environments.

4. Hypotheses Testing

To test hypothesis 1, first–order correlation analysis is performed to determine the association between two groups of variables, organizational structure and information technology (Table 5). Hypothesis 1 states that there will be a positive relationship between high information technology use and organic structure. Table 5 shows that there are 12 combinations of correlation coefficients between IT and organizational structure. All correlation coefficients related with differentiation and specialization are not statistically significant at 0.05 level. On centralization and formalization, except Growth of Capacity, correlation coefficients with IT Sophistication and Extensiveness of Use are very significant at the 0.01 level. Therefore, the hypothesis 3 is partially supported.

To evaluate hypothesis 2, t–tests are performed to check whether there are differ-

Table 5 Correlation Coefficients for IT-Organizational Structure

	Centrali-zation	Formali-zation	Differentia-tion	Speciali-zation
Growth of Capacity	.2238	.0907	.2084	.2697
Extensiveness of Use	.7284*	.7617*	.1792	.1947
IT Sophistication	.6139*	.6814*	.0649	.1698

* denotes significant at 0.05 level

Table 6 Comparison between Uncertain and Certain Environments

	Uncertain	Certain	t-value
Centralization	130.75	92.45	3.75*
Formalization	127.44	101.25	3.38*
Differentiation	15.10	14.80	0.17
Specialization	27.25	25.44	0.21
Growth of Capacity	96.15	83.86	0.92
Extensiveness of Use	108.24	76.14	4.59*
IT Sophistication	100.97	80.80	4.24*

* denotes significant at 0.05 level

Table 7 IT-Organizational Structure Relationship in Uncertain and Certain Environments

	Uncertain	Certain
Centralization-Growth of Capacity	.2747	.1835
Centralization-Extensiveness of Use	.7645*	.6357*
Centralization-IT Sophistication	.6845*	.5324*
Formalization-Growth of Capacity	.1042	.0825
Formalization-Extensiveness of Use	.8327*	.6845*
Formalization-IT Sophistication	.7938*	.5645*

* denotes significant at 0.05 level

ences in IT use and organic organizational structure between subunits in certain environment and subunits in uncertain environment (Table 6). As expected, except in the

case of Growth of Capacity, subunits in uncertain environment show less centralized, and less formalized, more sophisticated IT application, and more extensive IT use than do subunits in certain environment. As in case of hypothesis 1, differentiation and specialization do not reveal any noticeable differences.

Hypothesis 3 states that in uncertain environment, hypothesis 1 will receive more support than in certain environment if hypothesis 2 holds. Since hypothesis 2 partially holds, this hypothesis should be evaluated by performing correlation analysis for subunits in certain and subunits in uncertain environments, respectively. In Table 7, correlations related with differentiation and specialization are dropped since they do not support hypothesis 1. All correlation coefficients in uncertain subunits are bigger than those in certain environment. Thus, this hypothesis 3 partially holds.

V. DISCUSSIONS

1. Symbolic Value versus Actual Use of Information Technology

The most noticeable finding is the lack of explanatory power of Growth of Capacity on organizational structure and environmental uncertainty. On the other hand, extensiveness of IT use and IT sophistication show strong association with these variables. This finding confirms the argument of Robey [1977, 1981, and 1983] that how and why organizations use IT, rather than the mere presence of IT, motivates organizational change. This finding also indicates why so many previous studies examining IT and organizational structure show inconsistent and contradictory results. Most previous studies used only one of three dimensions of IT, mainly Growth of Capacity, as definition of IT [Klatzky 1970; DeBrabander et al, 1972; Blau et al., 1976; Danziger, 1977; Olson and Lucas, 1982]. Growth of Capacity, measured by number of computers (either mainframes and P.C.'s), number of IT-related jobs, number of employees using IT, and budget, has been the most used definition of IT in IS literature [Weber, 1959; Dearden, 1966; Hill, 1966; Meyer, 1968; Bariff and Galbraith, 1978; Robey, 1981 and 1983]. It is not surprising to find that studies using Growth of Capacity [Mann and Williams, 1960; Ein-Dor and Segev, 1978; Markus and Robey, 1983; Gordon and Narayanan, 1984; Dawson and McLaughlin, 1986] show different results

from studies using Extensiveness of Use or IT Sophistication [Pfeffer and Leblebici, 1977; Carter, 1984; Child, 1984b; Boddy and Buchanan, 1984].

Robey and Markus [1984] argue that regardless of whether it actually produces rational outcomes or not, IT must symbolize rationality and signify that the actions taken are not arbitrary, but rather acceptable within the organization's ideology. Subunit A in this research demonstrates the symbolic value of IT. Meyer's [1982a and 1982b] studies' of hospitals support the notion that IT can play a key role as a symbol of an organization's rationality. In these two hospital cases, IT assumes a symbolic value beyond its utility as a tool for administrative decision making. It signals to employees, clients, and the outside world that the organization stood for progressive and efficient management.

According to Feldman and March [1981], information is a representation of competence and a reaffirmation of social virtue. Command of information and information sources enhances perceived competence and inspires confidence. By placing P.C.'s and mainframe terminals on employees' desks, organizations demonstrate competence and symbolize their commitment to rational choice beyond its instrumental value. Feldman and March [1981] argue that there is no reason to assume that organizational behavior with respect to information is stable, that the process is in equilibrium. They introduce the dynamics of symbolic life of IT by stating [1981: 180]:

> "When organizations establish information systems, however symbolic or strategic the initial reasons may be, they create a dynamic that reveals new justifications as the organizational process unfolds"

This dynamic process facilitates the transition from symbolic use of IT to sophisticated applications of IT and extensive use of IT. In this sense, the dynamics of symbolic life connects the missing link between Symbolic IT and two other dimensions of IT.

2. Paradigm Shifting

According to a range of theorists, most organizations in 1980's are moving from adapting to an industrial or manufacturing society to a post-industrial society [Huber, 1984], or a post-industrial state [Bell, 1973], a technetronic era [Brzezinski,

1970], an information society [Masuda, 1980], a telematic society [Martin, 1981], or the third wave [Tofler, 1980]. According to Huber [1984a], post-industrial organizations will be characterized by more and increasing knowledge, more and increasing complexity, and increasing turbulence. He suggests the use of computing and communication technology (information technology) as one way to cope with such environment. In short, the role of information technology in modern organizations begin to emerge as a major force rather than as just one more alternative.

Huber and McDaniel [1986] go a step further and argue that the existing organization design paradigm (workflow paradigm) is declining in scope, and that the switch to the decision-making paradigm is essential for organizations to survive in hostile, complex, and turbulent environments. On the workflow paradigm Huber and McDaniel state [1986: 573]:

> "The workflow paradigm's focal concept is that when designing organizations it is primarily important to create structures and administrative processes that match the organization's production processes or operations. The implied organizational effectiveness criterion is maximization of either the effectiveness of the production system or the joint effectiveness of the production system and the structural system together—effective organizations are those whose production system is effective."

But as manufacturing loses its position as a primary function of organizations [Tofler, 1980; Naisbitt, 1982], so does the workflow paradigm and the decision-making paradigm gains plausibility [Huber and McDaniel, 1986].

> "Its (decision-making paradigm) focal concept is that when designing organizations it is primarily important to create structures and processes that facilitate the making of organizational decisions. The implied organizational effectiveness criterion is maximization of the quality of organizational decisions—effective organizations are those whose decisions are of high quality [1986: 573]."

Even though most organizations still adopt the workflow paradigm, there are some movements toward using the information processing view of organization design [Galbraith, 1973 and 1977; Tushman, 1978, 1979a, and 1979b; Daft and MaCin-

tosh, 1978 and 1981, Daft and Lengel, 1986]. The present research utilizes the information processing view as the research hypotheses development chapter indicates.

This movement sheds some light on why research conclusions on the IT-structure association have been contradictory and inconsistent. In 1960's and 1970's, most organizations adopted a workflow paradigm and designed organizational structure to fit production processes or operations. Therefore, unless IT specifically and significantly affected production functions of organizations, the impact of IT was not realized. So depending on the purpose or goal of IT adoption, study results revealed vast differences. But in the 1980's, most organizations began to notice the impact of IT on all functions (finance, marketing, R and D, accounting, and others) because organizations no longer only primarily depended on the production function. Furthermore, the availability of low-cost hardware and software, easy-to-use and user-friendly application programs, and large memory storage capacity all made IT more attractive and readily available to a range of functions. So according to many theorists, with the advent of the decision-making paradigm, organizations will use more IT to facilitate information processing and decision-making and IT-structure will show more consistent results in the 1980's. This point is well summarized by Simon [1973: 270]:

> "In the post-industrial society, the central problem is not how to organize to produce efficiently (although this will always remain an important consideration), but how to organize to make decisions—that is, to process information."

Ⅵ. CONCLUSIONS

The hostile, complex, and turbulent environments of the 1990's are important external forces that shape the relationships among organizational structure and information technology. This conclusion is based on the finding that organizations in uncertain environments show organic organizational structure and high IT use while organizations in certain environment show the opposite. This conclusion together with information processing theory indicates that as environments become more hostile and complex, IT will become more important to organizations. Accordingly, a most critical issue will be the effective or strategic use of information technology as one way to deal with uncertain environ-

ments.

The second conclusion of this research is that how and why organizations use information technology rather than the mere presence of information technology motivates change in organizations. This conclusion is based on the lack of explanatory power of Growth of Capacity on organizational constructs compared to Extensiveness of IT Use and IT Sophistication. This conclusion supports Robey's [1977] argument that information technology is a flexible mechanism which can facilitate either form of organizational structure, depending on the basic requirements of the organization. Furthermore, in order to maximize the explanatory power of information technology on organizational constructs [Pfeffer and Leblebici, 1977; Carter, 1984], it is necessary to differentiate between the actual use of information technology (measured by Extensiveness of IT use and IT Sophistication) as opposed to the mere presence of information technology (measured by Growth of Capacity).

In terms of the methodological concerns, this research focused on the differences between questionnaire and institutional measures. Although many organization theorists argue that there are significant differences between questionnaire and institutional measures [Pennings, 1973; Ford and Slocum, 1977; Sathe, 1978; Fry, 1982], this research concludes that these two measures are not necessarily contradictory, rather they were shown to supplement each other. Carefully designed questionnaire measures reveal almost no differences from institutional measures. This finding leads to the conclusion that one type of measure can be used when the other type of measure can not be secured. Also one type of measure can be checked against the other type of measure when there is a suspicion that one type of measure may not be reliable or valid.

Even though this research has a number of merits and contributions, there are several limitations and drawbacks. Probably the most significant limitation is the lack of generalizability even though this research used a large population and random sampling. This research does not provide any causality among three groups of variables, organizational structure, environment, and information technology because of time and budget limitation to observe causality as a part of the research.

This research verifies that there are three key dimensions of information technology. While this is a significant improve-

ment from past uni-dimensional IT research, there is still room for further improvement in the areas of definition, operationalization, and measurement. The final limitation lies with questionnaire response. Even though the questionnaire was carefully designed and went through several verification processes, a number of respondents complained that it took quite an effort to finish the questionnaire.

There are several directions in which this research can be extended. One suggestion for future effort is to replicate this research with a larger population setting. In this cross-sectional study, no causality between organizational structure, information technology, and environment is specified even though it is speculated. Consequently, a study over time and the inclusion of causality in to future research would provide the opportunity to look at organizational processes more dynamically. The best way to study the impact of information technology on organizations is longitudinal research. In this way, researchers can not only study the causality among organizational constructs (structure, technology, strategy, environment, etc) but also the dynamicity of organizational processes.

참 고 문 헌

Alter, Steven L., *Decision Support Systems: Current Practice and Continuing Challenges*, Readings: Addison-Wesley, 1980.

Attewell, Paul and Rule, James, "Computing and Organizations: What we know and what we don't know," *Communications of the ACM*, Vol. 27, No. 11, December 1984, pp. 1184-1192.

Bariff, Martin L and Galbraith, Jay R., "Intraorganization Power Considerations for Designing Information Systems," *Accounting, Organization and Society*, Vol. 3, No. 1, 1978, pp. 15-27.

Bell, D., *The Coming of Post-Industrial Society*, Basic Books, New York, 1973.Bjorn-Andersen, N., Eason, K. and Robey, D., *Managing Computer Impact*, Norwood, New Jersey: Ablex, 1986.

Blau, P. M., Falbe, C. M., McKinley, W. and Tracy, P. K., "Technology and Organization in Manufacturing," *Administrative Science Quarterly*, Vol. 21, March 1976, pp. 20-40.

Blau, P. M. and Schoenherr, R. A., *The Structure of Organizations*, New York: Basic Books, 1971.

Boddy, David, "Micro-Electronics and the Experience of Work," *HRD International*, 1981, pp. 51-54.

Boddy, David and Buchanan, David A., "Information Technology and Productivity: Myths and Realities," *Omega*, Vol. 12, 1984, pp. 233-240.

Brzezinski, Z., *Between Two Ages: America's Role in the Technetronic Era*, Viking Press, NEw York, 1970.

Burlingame, James F., "Information Technology and Decentralization," *Harvard Business Review*, Vol. 39, 1961, pp. 121-126.

Burns, T and Stalker, G. M., *The Management and Innovation*, London: Tavistock, 1961.

Carter, Nancy M., "Computerization as a Predominant Technology: Its Influence on the Structure of Newspaper Organizations," *Academy of Management Journal*, Vol. 27, No. 2, June 1984, pp. 247-270.

Champion, D. J., *The Sociology of Organizations*, New York: McGraw-Hill, 1975.

Child, John, "Organization Structure and Strategies of Control: A Replication of the Aston Studies," *Administrative Science Quarterly*, Vol. 17, 1972a, pp. 163-177.

_____, "Organizational Structure, Environment, and Performance: The Role of Strategic Choice," *Sociology*, Vol. 6, 1972b, pp. 1-21.

_____, "Managerial and Organizational Factors associated with Company Performance, Part II-A Contingency Analysis," *Journal of Management Studies*, Vol. 12, 1975, pp. 12-28.

_____, *Organization: A Guide to Problems and Practice*, 2nd Ed., London: Harper and Row, 1984a.

_____, "New Technology and Developments in Management Organization," *Omega*, Vol. 12, No. 3, 1984b, pp. 211-223.

Comstock, D. E. and Scott, W. R., "Technology and the Structure of Subunits: Distinguishing Individual and Workgroup Effects," *Administrative Science Quarterly*, Vol. 22, June 1977, pp. 177-202.

Cronbach, Lee J., "Coefficient Alpha and Internal Structure of Tests," *Psychometrika*, Vol. 16, 1951, pp. 297-334.

Daft, Richard R., *Organization Theory and Design*, St. Paul: West Publishing, 1986.

Daft, Richard L. and Lengel, Robert H., "Organizational Information Requirements, Media Richness and Structural Design," *Management Science*, Vol. 32, No. 5, May 1986, pp. 554–571.

Daft, Richard L. and Macintosh, N. B., "A New Approach to the Design and Use of Management Information," *California Management Review*, Vol. 21, 1978, pp. 82–92.

_____, "A Tentative Exploration into the Amount and Equivocality of Information Processing in Organizational Work Units," *Administrative Science Quarterly*, Vol. 26, June 1981, pp. 207–224.

Dale, E., *Planning and Developing the Company Organization Structure*, New York: American Management Association, 1952.

Danziger, James N., "Computers, Local Governments, and the Litany to EDP,", *Public Administrative Review*, Vol. 37, No. 1, 1977, pp. 28–37.

Dawson, Patrick and McLaughlin, Ian, "Computer Technology and the Redefinition of Supervision," *Journal of Management Studies*, Vol.23, No. 1, January 1986, pp. 116–132.

Dearden, John, "Myth of Real-Time Management Information," *Harvard Business Review*, Vol. 44, May–June 1966, pp. 123–132.

DeBrabander, B., Deschoolmester, D., Leyder, R. and Vanlommel, E., "The Effect of Task Volume and Complexity upon Computer Use," *Journal of Business*, Vol. 45, No. 1, 1972, pp. 56–84.

Dill, W. R., "Environment as an Influence on Managerial Autonomy," *Administrative Science Quarterly*, Vol. 3, 1958, pp. 409–443.

Downey, H. and Slocum, J., "Uncertainty: Measures, Research and Sources of Variation," *Academy of Management Journal*, Vol. 18, 1975, pp. 562–578.

Duncan, Robert B., "Characteristics of Organizational Environments and Perceived,Environmental Uncertainty," *Administrative Science Quarterly*, Vol. 17, 1972, pp. 313–327.

_____, "Modifications in Decision Structure in Adapting to the Environment: Some Implications for Organizational Learning," *Decision Sciences*, Vol. 5, 1974, pp. 705–725.

Ein-Dor, Phillip and Segev, Eli, "Organizational Context and the Success of Management Information Systems," *Management Science*, Vol. 24, No. 10, June 1978, pp. 1064–1077.

Emusi-Mensah, Kweku, "The External

Organizational Environment and its Impact on Management Information Systems," *Accounting, Organizations and Society*, Vol. 6, No. 4, 1981, pp. 301–316.

Feldman, M. S. and March, James G., "Information in Organizations as Signal and Symbol," *Administrative Science Quarterly*, Vol. 26, 1981, pp. 171–186.

Ford, J. D. and Slocum, J. W. Jr., "Size, Technology, Environment and the Structure of Organizations," *Academy of Management Review*, Vol. 2, 1977, pp. 561–575.

Foster, L. W. and Flynn, D.M., "Management Information Technology: Its Effects on Organizational Form and Function," *Management Information Systems Quarterly*, Vol. 8, No. 4, December 1984, pp. 229–236.

Fry, Louis W., "Technology–Structure Research: Three Critical Issues," *Academy of Management Journal*, Vol. 25, No. 3, 1982, pp. 532–552.

Galbraith, Jay, *Designing Complex Organizations*, Reading, Mass: Addison–Wesley, 1973.

_____, "Organization Design: An Information Processing View," *Interface*, Vol. 4, No. 3, May 1974, pp. 87–89.

_____, *Organization Design*, Readings, MA: Addision–Wesley, 1977.

Ginzberg, Michael J., "An Organizational Contingencies View of Accounting and Information Systems Implementation," *Accounting, Organizations and Society*, Vol. 5, No. 4, 1980, pp. 369–382.

Gordon, Lawrence A. and Narayanan, V. K., "Management Accounting Systems, Perceived Environmental Uncertainty and Organization Structure: An Empirical Investigation," *Accounting, Organizations and Society*, Vol. 9, No..1, 1984, pp. 33–47.

Gorry, G. A. and Scott Morton, M. S., "A Framework for Management Information Systems," *Sloan Management Review*, Vol. 1, 1971, pp. 59–69.

Hall, Richard H., "Intra–Organizational Structure Variation," *Administrative Science Quarterly*, Vol. 7, 1962, pp. 295–308.

_____, "The Concept of Bureaucracy: An Empirical Assessment," *American Journal of Sociology*, Vol. 69, 1963, pp. 32–40.

Hill, Walter A., "The Impact of EDP Systems on Office Employees: Some Empirical Conclusions," *Journal of the Academy of Management*, Vol. 9, March 1966, pp. 9–19.

Hofer, Charles W., "Emerging EDP Pattern,"

Harvard Business Review, Vol. 48, March-APril 1970, pp. 16-31 & pp. 169-171.

Hoos, Dia R., "The Impact of Office Automation on Workers," *International Labor Review*, Vol. 32, No. 4, 1960a, pp. 363-388.

_____, "When the Computer Takes over the Office," *Harvard Business Review*, Vol. 38, November-December 1960b, pp. 102-112.

Huber, George P., "The Nature and Design of Post-Industrial Organizations," *Management Science*, Vol. 30, No. 8, August 1984a, pp. 928-951.

_____, "Issues in Design of Group Decision Support Systems," *Management Information Systems Quarterly*, Vol. 8, No. 3, September 1984b, pp. 195-204.

Huber, George P. and McDaniel, Reuben R., "The Decision Making Paradigm of Organizational Design," *Management Science*, Vol. 32, No. 5, Mat 1986, pp. 572-589.

Hunt, J. G. and Newell, P. F., "Management in the 1980's Revisited," *Personnel Journal*, Vol. 50, January 1970, pp. 35-43.

Ives B., Hamilton, S. and David, G. B., "A Framework for Research in Computer-based Management Information Systems," *Management Science*, Vol. 26, No. 9, September 1980, pp. 910-934.

Ives, Blake, Olson, Margrethe H. and Baroudi, Jack J., "The Measurement of User Information Satisfaction," *Communications of the ACM*, Vol. 26, No. 10, October 1983, pp. 785-793.

James, L. R. and Jones, A. P., "Organizational Structure: A Review of Structural Dimensions and Their Conceptual Relationships with Individual Attitudes and Behavior," *Organizational Behavior and Human Performance*, Vol. 15, 1976, pp. 322-334.

Keen, P. G. W. and Scott Morton, M. S., *Decision Support Systems: An Organizational Perspective*, Reading, MA: Addison-Wesley, 1978.

Khandawalla, Pradip N., *The Design of Organizations*, New York: Harcourt Brace Jovanovich, 1977.

Klatzky, S. R., "Automation, Size, and the Locus of Decision Making: The Cascade Effect," *Journal of Business*, Vol. 43, No. 2, April 1970, pp. 141-151.

Kling, Rob, "Automated Welfare Client Tracking and Service Integration," *Communications of the ACM*, Vol. 21, 1978, pp. 486-493.

_____, "Social Analyses of Computing: Theoretical Perspectives in Recent Empirical Research," *ACM Computing Surveys*, Vol. 21, No.

1, March 1980, pp. 61–110.

Lawrence, P. R. and Lorsch, J. W., *Organization and Environment*, Boston: Harvard, 1967.

Leavitt, Harold J. and Whisler, Thomas L., "Management in the 1980's," *Harvard Business Review*, Vol. 36, November–December 1958, pp. 41–48.

Leifer, Richard and Huber, George P., "Relations among Perceived Environmental Uncertainty, Organization Structure, and Boundary–Spanning Behavior, *Administrative Science Quarterly*, Vol. 22, June 1977, pp. 235–247.

Lipstreu, Otis and Reed, Kenneth A., "A New Look at the Organizational Implications of Automation," *Journal of the Academy of Management*, Vol. 8, March 1965, pp. 24–31.

MaCintosh, Norman B., "A Contextual Model of Information Systems," *Accounting, Organizations and Society*, Vol. 6, No. 1, 1981, pp. 39–53.

Mann, Floyd C. and Williams, Lawrence K., "Observations on the Dynamics of a Change to Electronic Data – Processing Equipment," *Administrative Science Quarterly*, Vol. 5, No. 2, September 1960, pp. 217–256.

Markus, M. Lynne and Robey, Daniel, "The Organizational Validity of Management Information Systems," *Human Relations*, Vol. 36, No. 3, 1983, pp. 203–226.

Martin, J., *Telematic Society: A Challenge for Tomorrow*, Prentice–Hall, Englewood Cliffs, N.J., 1981.

Masuda, Y., *The Information Society*, World Fortune Society, Bethesda, Md., 1980.

Meyer, Marshall W., "Automation and Bureaucratic Structure," *American Journal of Sociology*, Vol. 74, No. 3, November 1968, pp. 256–264.

Meyer, A. D., "Adapting to Environmental Jolts," *Administrative Science Quarterly*, Vol. 27, No. 2, December 1982a, pp. 515–537.

Meyer, A. D., "How Ideologies Supplant Formal Structures and Shape Responses to Environment," *Journal of Management Studies*, Vol. 19, No. 1, January 1982b, pp. 45–61.

Miles, R., Snow, C. and Pfeffer, J., "Organization –Environment: Concepts and Issues," *Industrial Relations*, Vol. 13, 1974, pp. 244–264.

Miller, Chet, Glick, C., W. H., Wang, Y. and Huber, G. P., "The Relationship between Technology and Organizational Structure: Empirical Truth or Theoreticians' Wishful Thinking?," Working Paper, Department of Management, The University of Texas at Austin, 1987.

Montanari, J. R., "Operationalizing Strategic Choice," in *Organization Theory: A Macro Perspective for Management*, ed. by J. H. Jackson and C. P. Morgan, Englewood Cliffs, New Jersey: Prentice-Hall, 1978, pp. 286-298.

Naisbitt, J., *Megatrends*, Warner Books, New York, 1982.

Nolan, Richard L., "Managing the Crises in Data Processing," *Harvard Business Review*, Vol. 57, March-April 1979, pp. 115-126.

Nunally, Jum C., *Psychometric Theory*, New York: McGraw-Hill, 1978.

Osborn, R. and Hunt, J., "Measures of Organization Effectiveness," *Administrative Science Quarterly*, Vol. 19, 1974, pp. 231-264.

Olson, Margrethe H. and Lucas, Henry C. Jr., "The Impact of Office Automation on the Organization: Some Implications for Research and Practice," *Communications of the ACM*, Vol. 25, No.11, November 1982, pp. 838-847.

Pennings, J., "Measures of Organizational Structure: A Methodological Note," *American Journal of Sociology*, Vol. 70, 1973, pp. 686-704.

Perrow, Charles, "A Framework for the Comparative Analysis of Organizations," *American Sociological Review*, Vol. 32, No., 1967, pp. 194-208.

Pfeffer, Jeffrey, *Power in Organizations*, Marshfield, MA: Pitman, 1981.

Pfeffer, Jeffrey and Leblebici, H., "Information Technology and Organizational Culture," *Pacific Sociological Review*, Vol. 20, No. 2, April 1977, pp. 241-261.

Pugh, D. S., Hickson, D. J., Hinings, C. R. and Turner, C., "The Dimensions of Organizational Structure," *Administrative Science Quarterly*, Vol. 13, 1968, pp. 65-105.

Randolph, W. A., "Organizational Technology and the Media and Purpose Dimensions of Organizational Communications," *Journal of Business Research*, Vol. 6, 1978, pp. 237-259.

Robey, Daniel, "Computers and Management Structure: Some Empirical Findings Reexamined," *Human Relations*, Vol. 30, No. 11, 1977, pp. 963-976.

_____, "Computer Information Systems and Organization Structure," *Communications of the ACM*, Vol. 24, No. 10, October 1981, pp. 679-687.

_____, "Information Systems and Organizational Change: A Comparative Case Study," *Systems, Objectives, and Solutions*, Vol. 3, 1983, pp. 143-154.

Rourke, Francis E. and Brooks, Glenn E., "Computers and University Administration," *Administrative Science Quarterly*, Vol. 11, No. 3, December 1966, pp. 575–600.

Sathe, V., "Institutional versus Questionnaire Measures of Organizational Structure," *Academy of Management Journal*, Vol. 21, 1978, pp. 227–238.

Saunders, C. S., "Management Information Systems, Communications, and Departmental Power: An Integrated Model," *Academy of Management Review*, Vol. 6, 1981, pp. 431–442.

Scott, W. Richard, "Organizational Structure," *Annual Review of Sociology*, Vol. 1, 1975, pp. 1–20.

_____, *Organizations: Rational, Natural, and Open Systems*, New Jersey: Prentice–Hall, 1981.

Siegman, Jack and Karsh, Bernard, "Some Organizational Correlates of White Collar Automation," *Sociological Inquiry*, Vol. 32, 1962, pp. 108–116.

Simon, Herbert A., "Applying Information Technology to Organizational Design," *Public Administration Review*, May–June 1973, pp. 268–278.

Simon, Herbert A., *The New Science of Management Decision*, Englewood Cliffs, New Jersey: Prentice–Hall, 1977.

Thompson, James D., *Organizations in Action*, New York: McGraw–Hill, 1967.

Toffler, A., *The Third Wave*, Morrow, New York, 1980.

Tung, Rosalie L., "Dimensions of Organizational Environment: An Exploratory Study of Their Impacts on Organization Structure," *Academy of Management Journal*, Vol. 22, No. 4, 1979, pp. 672–693.

Tushman, M. L., "Technical Communication in R & D Laboratories: The Impact of Project Work Characteristics," *Academy of Management Journal*, Vol. 21, 1978, pp. 624–645.

_____, "Work Characteristics and Subunit Communication Structure: A Contingency Analysis," *Administrative Science Quarterly*, Vol. 24, 1979a, pp. 82–98.

_____, "Impacts of Perceived Environmental Variability on Patterns of Work–related Communication," *Academy of Management Journal*, Vol. 22, 1979b, pp. 482–500.

Van de Ven, A. and Ferry, D., *Measuring and Assessing Organization*, New York: John Wiley & Sons, 1980.

Wagner, L. G., "Computers, Decentralization, and Corporate Control," *California Management Review*, Winter 1966, pp. 25–32.

Warner, Malcolm, "New Technology, Work Organizations and Industrial Relations," Omega, *International Journal of Management Science*, Vol. 12, No. 3, 1984, pp. 203–210.

Waterhouse, J. H. and Tiessen, P., "A Contingency Framework for Management Accounting Systems Research," *Accounting, Organizations and Society*, Vol. 3, No. 1, 1978, pp. 56–65.

Weber, C. Edward, "Change in Managerial Manpower with Mechanization of Data-Processing," *Journal of Business*, Vol. 32, No. 2, 1959, pp. 151–163.

Whisler, Thomas L., *The Impact of Computers on Organizations*, New York: Praeger Pub., 1970a.

_____, *Information Technology and Organizational Change*, Belmont: Wadsworth Pub., 1970b.

Woodward, Joan, *Industrial Organization: Theory and Practice*, London: Oxford Univ. Press, 1965.

Zmud, Robert W., "Diffusion of Modern Software Practices: Influence of Centralization and Formalization," *Management Science*, Vol. 28, No. 12, December 1982, pp. 1421–1431.

◇ 저자소개 ◇

저자 **성태경**은 성균관대학교 경영학과를 졸업한 후, 미국 University of Texas at Austin에서 경영학박사 (경영정보학 전공)을 취득하였고, 현재 경기대학교 경영정보학과 교수로 재직하고있다. 현재 주요 연구 분야는 정보기술이 조직 및 전략에 미치는 영향, 경영혁신, 정보시스템 전략 및 관리 등이다.