Organization Context, Structure, and Flexibility: A Comparative Study of Organizations

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Introductiom

The major objective of this study is to determine the role of size and task environment on organizational structure and flexibility in a bureaucratic system.

If there are differences among organizations in terms of power structure, the level of expertise, and flexibility, how and why do these differences come about and what are the implications for a bureaucratic system?

For contingent theorists uncertainty and routineness of task environment or technology are the most important variables used to explain and predict organizational structure and flexibility.[1] But this position has been challenged by

(1) Persons who emphasize environment as the major cause of structure and flexibility are: Philip Selznick, *TVA and the grass roots: a study in the sociology of formal organization*, (New York: Harper and Row), 1969; J. Thompson, *Organization in action*, (New York: McGraw Hill), 1967; J. Thompson and William J. McEwen, "Organizational goals and environment," *American Sociological Review*, 23:23-51, 1958; William R. Dill, "Environment as an influence on managerial autonomy," *Administrative Science Quarterly*, 2:409-43, 1958; Tom Burns and G.M. Stalker, *The management of innovation*, (New York: Barnes and Noble), 1961; William M. Evan, "The organization-set: Toward a theory of interorganizational relations," in J. D. Thompson (ed.), *Approaches to organizational design*, (Pittsburgh: U. of Pittsburgh Press), 73-91, 1967; Paul R. Lawrence and J. W. Lorsch, *Organizations and environment: managing differentiation and integration*, (Homewood: Irwin), 1967; Shirley Terryberry, "The evolution of organizational environments," *Administrative Science Quarterly*, 12:590-613, 1968; Rolf P. Lynton, "Linking an innovative subsystem into the system," *Administrative Science Quarterly*, 4:398-416, 1969; Andrew H. Van de Ven and Andre L. Delbecq, "A task contingent model of work-unit structure," *Administrative Science Quarterterly*, 19:183-97, 1974; Robert B. Duncan,

Hage and Aiker [2], Hickson, et al. [3], Mohr, [4] and Child and Mansfield. [5] Child and Mansfield [6] concluded that "the results of both the Aston and National studies taken together would appear totally to refute any argument that technology is the single major correlate of organizational structure." Also Hage and Aiken [7] showed that routineness of task (or task environment) is not an important variable to explain organizational innovation.

Structuralists emphasize the importance of size as a basic determinant of organization structure. In turn, they believe, size and organization structure explain and predict organizational flexibility. [8]

Flexibility refers to the degree to which change

"Characteristics of organizational environments and perceived environmental uncertainty," *Administrative Science Quarterly*, 17:313-27, 1972; R. Jurkovich, "A core typology of organizational environments," *Administrative Science Quarterly*, 19:380-94, 1974; Richard N. Osborn and James G. Hunt, "Environment and organizational effectiveness," *Administrative Science Quarterly*, 19:231-46, 1974.

Writers who emphasize technological imperatives of structure and flexibility are: Joan Woodward, *Industrial organization: Theory and practice*, (Oxford: Oxford U. Press), 1965; J. Thompson, Op. Cit.; Charles Perrow, "A framework for the comparative analysis of organizations," *American Sociological Review*, 32:194-208, 1967; Charles Perrow, *Complex organizations: A critical essay*, (Glenview: Scott), 1972; Edward Harvey, "Technology and structure of organizations," *American Sociological Review*, 33:247-59, 1968; Michael Fullan, "Industrial technology and worker integration in the organization," *American Sociological Review*, 25:1028 -39, 1970; Howard E. Aldrich, "Technology and organizational structure: A reexamination of the findings of the Aston Group," *Administrative Science Quarterly*. 17:26-43, 1972; Lawrence G. Hrbiniak, "Job technology, supervision, and work-group structure," *Administrative Science Quarterly*, 19:395-410, 1974; B. P. Lynch, "An empirical assessment of Perrow's technology construct," *Administrative Science Quarterly*, 19:338-56, 1974.

(2) J. Hage and M. Aiken, "Routine technology, social structure and organization goals, *Administrative Science Quarterly*, 14:366-76, 1969.

(3) D.J. Hickson, D.S. Pugh, and D.C. Phesey, "Operations technology and organization structure: An empirical reappraisal," *Administrative Science Quarterly*, 14, 378-97, 1969.

(4) Lawrence B. Mohr, "Determinants of innovation organizations," *American Political Science Review*, 63:111-26, 1969.

(5) John Child and Roger Mansfield, "Technology, size, and organization structure," *Sociology*, 6: 371-93, 1972.

(6) Ibid, 388.

(7) Hage and Aiken, Op Cit.

(8) Theorists who emphasize imperative of structure and flexibility are: P. M. Blau, "A formal theory of differentiation in organizations," *American Sociological Review*, 35:201-18, 1970; P.M. Blau and R. A. Shoenherr, *The structure of organizations*, (New York: Basic Books), 1971; L. Mohr, 1969, Op Cit.; D. J. Hickson, et al. 1969, Op cit.

Persons who emphasize relations among structure and flexibility are: V. Thompson, *Modern organizations*, (New York: Knopf), 1961; V. Thompson, "Bureaucracy and innovation," *Administrative Science Quarterly*, 10:1-20, 1965; V. Thompson, *Bureaucracy and innovation*, (Alabama: U. of Alabama Press), 1969; R. H. Hall, "The concept of bureaucracy: An empirical assessment," *American Journal of Sociology*, 68:32-40, 1963; R.H. Hall, "Professionalization and bureaucratization," *American Sociological Review*, 33: 92-104, 1968; R. H. Hall, *Organizations: structure and process*, (Englewood Cliffs: Prentice Hall), 1972; R. H. Hall, N. J. Johnson, and J. E. Haas, 'Organizational size, complexity, and formalization," *American Sociological Review*, 32:903-12, 1967; Martin M. Rosner, "Economic determinants of

is introduced in techology, training, structure, transfer and policy adoptions. Among various aspects of organization structure we are interested in centralization and level of expertise. Centralization refers to vertical power relations among hierarchical units within an organization. The level of expertise refers to the average level of formal education for an organization.

The thesis that size affects organization structure has been challenged by Hall[9] and Hall, Haas, and Johnson.[10] At this early stage of organizational analysis researchers have paid less attention to organizational flexibility than to other aspects of performance, e.g., efficiency or effectiveness.

Generally, in the study of organization, it is assumed that structure has an asymmetric effect on organizational flexibility.[11] But no research has justified why there would be only a one-way effect of structure on flexibility. Holdaway, et al.,[12] however, have suggested a new direction in which program innovation is used as a predictor for explaining centralization.

The arguments raised so far called for examination of the following questions;

(1) the effects of characteristics of task (variety, changeability, uncertainty of task) on organization structure and flexibility;

organizational innovations," *Administrative Science Quarterly*, 12:614-25, 1968; D. S. Pugh, D. J. Hickson, C.R. Hinnings, K.M. McDonald, C. Turner, and T. Lupton, "A conceptual scheme for organizational analysis, "*Administrative Science Quarterly*, 8, 289-315, 1963; D.S. Pugh, D.J. Hickson, C. R. Hinnings, and C. Turner, "Dimensions of organization structure," *Administrative Science Quarterly*, 13:33-47, 1968; Pugh, Hickson, Hinnings, and Turner, "The context of organization structures," *Administrative Science Quarterly*, 14:91-113, 1969a; Pugh, Hickson, Hinnings, "An empirical taxonomy of work organizations," *Administrative Science Quartely*, 14;115-26, 1969b; B.C. Reiman, 'On the dimensions of bureaucratic structure: an empirical reappraisal," *Administrative Science Quarterly*, 18:426-76, 1973; John Child, "Organization structure and strategies of control: A replication of the Aston study," *Administrative Science Quarterly*, 17:163-77, 1972b; Child, "Strategies of control and organization behavior," *Administrative Science Quarterly*, 18:1-17, 1973a; Child, "Predicting and understanding of organization structure," *Administrative Science Quarterly*, 18:168-85, 1973b; Mansfield, "Bureaucracy and centralization: an examination of organizational structure," *Administrative Science Quarterly*, 18:477-83, 1973; Jerald Hage, "An axiomatic theory of organization," *Administrative Science Quarterly*, 10:289-320, 1965; J. Hage and M. Aiken, "Program change and organizational properties: a comparative ananlysis," *American Journal of Sciolology*, 72,503-10, 1967; Hage and Aiken, 1969, Op Cit.; Hage and Aiken, *Social change in complex organizations*, (New York: Random House), 1970; Aiken and Hage, "Organizational alenation: a comparative analysis," *American Sociological Review*, 31:497-507, 1966; Aiken and Hage, "Organizational interdependence and intraorganizational structure," *American Sociological Review*, 33:912-29, 1968; Aiken and Hage, "The organic organization and innovation, *Sociology*, 5:63-82, 1971; Edward A. Holdaway, John F. Newberry,David J. Hickson, and R. Peter Heron, "Dimensions of organizations in complex societies: the educational sector," *Administrative Science Quarterly*, 20:37-58, 1975.

(9) Hall, 1963, op cit.; Hall, 1972, op cit.; Hall, et al., op cit.
(10) Hall, et al., op cit.
(11) Hage, 1965, op cit.; Hage and Aiken, 1967, op cit.; Aiken and Hage, 1971, op cit.; Gerald Zaltman, Robert Duncan, and Jonny Holbek, *Innovations and organzations*, (New York: Wiley), 1973; Steven K. Paulson, "Causal analysis of interorganizational relations: an axiomatic theory revised," *Administive Science Quarterly*, 19:319-37, 1974.
(12) Holdaway, et al., op cit.

(2) the effect of size on organizational structure and flexibility; and

(3) the relationships between organizational structure and organizational flexibility.

In order to explore these questions the Korean bureaucratic organizations (say, bureaus) have been selected as units of analysis for comparative study. In particular, those government bureaus engaged in economic activities have been selected for the reasons that those organizations with similar functions can allow us to compare them in a consistent way.

Survey data have been obtained from civil servants in 42 bureaus of 11 Korean economic ministries or offices.[13] 882 civil servants completed the survey questionnaire.

I. Conceptual Models

I-1. Contextual Variables as Explanatory Variables

A. Asymmetric Effect of Uncertainty, Changeability, and Variety on Structure and Flexibility

(1) *Structur*

Uncertainty refers to the degree of randomness in assessing the cause-effect relationship among a set of alternatives. Uncertainty requires experts or professionals who handle it. Uncertainty also gives lower participants power (expert or information) in an organization.[14] The more uncertain the task, the more the expertise of lower participants and therefore the less the power of the director.

In a theoretical context, Burns and Stalker[15] and Perrow[16] suggest that changeability is positively related to organizational expertise and decentralization. Changeability indicates the degree to which the factors of the decision unit's internal and external environment remain basically the same over time.[17] The negative relation between centralization and changeability is questionable because as changeability increases, organization as a whole has more discretion, and this hould result in an increase in director's power.

Variety refers to the range of activities which are relevant to an organization's operation.[18] Variety without changeability and uncertainty should result in an increase in the number of personnel in the lower levels of the hierarchy. Hence, variety is positively related to the span ratio and certralization measured in a configurational sense.

(2) *Flexibility*

Organization members are concerned with variety, changeability, and uncertainty in that order. Tangible goals dominate intangible goals[19] and routine work drives out nonroutine work.[20]

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(13) 42 bureaus consist of: 1 from the Economic Planning Board, 2 from the Ministry of Finance, 2 from the Ministry of Agriculture and Fishery, 3 from the Ministry of Industry and Commerce, 7 from the Ministry of Construction, 5 from the Ministry of Transportation, 6 from the Ministry of Communication, 4 from the Office of Forestry, 6 from the Office of Supply, and 7 from the Office of Railroad.

(14) Michael Crozier, *The bureaucreatic phenomenon*, (Chicago: U. of Chicago), 1964; David Mechaic, "Sources of power of lower participants in complex organization," *Administrative Science Quarterly*, 7: 349-64, 1962; Charles Perrow, 1967, op. cit.

(15) Tom Burns and G.M. Stalker, op. cit.

(16) Charles Perrow, 1970, op. cit.

(17) R. Duncan, op. cit., 316.

(18) John Child, "Organizational structure, environment and performance: the role of strategic choice,' *Sociology*, 6: 1-22, 1972a.

(19) Amitai Etzioni, *Modern organizations*, (Englewood Cliffs: Prentice Hall), 1964.

(20) Northcote C. Parkinson, *Parkinson's law or the pursuit of progress*, (London: Murray), 1958.

Because of these organizational response patterns, new introduction of technology and structure usually result from variety and changeability, and less so from uncertainty. Rogers and Shoemaker's[21] suggestion further supports our speculation: technological innovation is more likely to be introduced if the innovation is simple, testable, and observable.

Simon's[22] satisficing model and Lindblom's[23] disjointed incrementalism are heavily based on variety, changeability, and uncertainty of means-ends relationships. As March and Simon[24] and J. Thompson[25] suggested, organizations do not frequently respond to uncertainty because, in the face of uncertainty decisions are made a priori and by intuition. Hence, changeability and variety are more important in determining in frequency of adoption of new policies. Decisions handling variety normally are not included in policy adoptions, because variety is ongoing rather than new. Hence, changeability should be the most important predictor for new policy adoption.

Studies by Lynton[26] and Lawrence and Lorsch[27] suggest that uncertainty in task environment is important in the differentiation and integration of organizations. In order to handle uncertainty organizations create segregated offices such as 'research and development' or 'information agencies.' Integration of this segregated part with other parts of an organization will follow. So, structural flexibility is necessary. A substitute for such structural flexibility is an increment of expertise, which is a less expensive device for an organization in the short run. In the long run structural change is necessary insofar as the conditions of task environment are continuously uncertain and direct.[28]

B. Asymmetric Effect of Size on Structure and Flexibility

(1) Structure

There are competing arguments on whether size is the basic determinant of organization structure. Pugh and his colleagues[29] maintain that "size causes structuring through its effect on intervening variables such as the frequency of decisions and social control." But their study did not find size effect on the line control of workflow and the concentration of authority.[30] On the contrary, Child[31] suggests that size has an effect on centralization(concentration of authority) but not on structuring of activity.

Meyer[32], Pondy[33], Klatzky[34], Blau and

(21) Everett M. Rogers and F.F. Shoemaker, *Communications* of innovations, (New York: Free Press), 1971.
(22) Herbert A. Simon, "A behavioral model of rational choice," in H.A. Simon, *Models of Man*, (New York: Wiley), 241-60, 1957.
(23) Charles E. Lindblom, "The science of muddling through," *Public Administration Review*, 19: 79-88, 1959.
(24) J.C. March and H.A. Simon, *Organizations*, (New York: Wiley), 1958.
(25) J. Thompson, op. cit.
(26) Rolf P. Lynton, op. cit.
(27) P.J. Lawrence and J.W. Lorsch, op. cit.
(28) Rolf P. Lynton, op. cit.
(29) Pugh, et al., 1969a, op. cit., 112.
(30) Ibid.
(31) John Child, 1973a, op. cit.
(32) Marshall W. Meyer, "Two authority structure of bureaucratic organization," *Administrative Science Quarterly*, 13: 211-28, 1968.
(33) Louis R. Pondy, "Effects of size, complexity and ownership on administrative intensity," *Administrative Science Quarterly*, 14: 47-61, 1969.
(34) S.F. Klatzky, "Relationship of organizational size to complexity and coordination," *Administrative Science Quarterly*, 15: 428-38, 1970.

Shoenherr[35] have suggested that size is a major determining factor of differences in organizational configuration such as differences in span of control, administrative ratio, and degree of role differentiation. In fact, Blau[36] and his discussants[37] have proved deductively several relationships between the size and configurational aspects of organization under a set of assumptions. On the other hand, Hall[38] and Hall, et al.[39] do not agree that size imposes imperatives on organizational configuration and structuring of atctivity.

Child[40] has suggested that size is positively correlated with expertise measured by the total number of professionals. As size increases, the tasks of handling variety will increase more rapidly than tasks of handling changeability which require professionals. In our analysis expertise is measured by the mean level of education. Hence, size has negative effect on organizational expertise.

(2) Flexibility

There are few discussions of the effect of organizational size on organizational flexibility. Mohr[41] suggests that the size of an organization is a facilitator of innovation rather than a moti-

vator of innovation. Especially in progressive innovative programs the size of organization (measured by expenditure) is a very poor predictor ($r = 0.04$). Evan and Black[42] also have suggested that organizational size is not related to the acceptance of innovative proposals. However, Becker and Stafford[43] and Carrol[44] suggest that administrative size is one of the determinants for predicting innovation if other variables are uncontrolled statistically.

From these competing findings, we take Mohr's[45] position that "size itself is not related to innovativeness by logical necessity. It becomes significant only when it implies or indicated the conceptual variables that are important in themselves."

C. Asymmetric Effect of Tenure and Number of Committees on Structure and Flexibility

These two variables have not been incorporated often in studies which are designed to explain organizational structure and flexility. Relations between these variables and structure and flexibility are inconclusive. In two respects, these two

(35) Blau and Shoenherr, op. cit.

(36) Blau, op. cit.

(37) Marshall W. Meyer, "Some constraints in analyzing data on organizational structures: a comment on Blau's paper," *American Sociological Review*, 36: 294-97, 1971. N.P. Hummon, "A mathematical theory of differentiation in organizations," *American Sociological Review*, 36: 297-303, 1971. Foster G. Dieckoff, "On Hummon's mathematical formulation of Blau's theory of differentiation in organizations," *American Sociological Review*, 38: 387-90, 1973. Bruce H. Mayhew, "System size and ruling elites," *American Sociological Review*, 38: 468-75, 1973. Dayid A. Specht, "System size and structural differentiation in formal organization: an alternative baseline generator," *American Sociological Review*, 38: 479-80, 1973.

(38) Hall, 1972, op. cit., 119.

(39) Hall, et. al., op. cit.

(40) Child 1973b, op. cit., 178-79.

(41) Mohr 1967, op. cit.

(42) William M. Evan and Guy Black, "Innovation in business organizations: some factors associated with success or failure of staff proposals," *Journal of Business*, 40: 519-30, 1967.

(43) Selwyn Becker and F. Stafford, "Some determinants of organizational success," *Journal of Business*, 40: 511-18, 1967.

(44) Jean Carrol, "A note on departmental autonomy and innovation in medical schools," *Journal of Business*, 40: 533, 1967.

(45) Mohr 1969, op. cit., 120-22.

variabl s are important:(1) tenure as the average of indi ·idual members' tenures would be negatively re ated to transfers and new policy adoptions; (2) th number of committees as an interorganzationa coordination device should be positively related to decentralization in terms of configuration ar d to the level of expertise. For coordination and fo prevention of conflicts among several bureau my expectation is that an organization will re uire more expertise and less centralization in a cc figurational sense.

I-2. Relations Among Structure and Flexibility

A. Between Structure and Flexibility

In H ge's[46] analysis centralization is negatively related to organization change and program change in particular. V. Thompson[47] argues similarl y in referring to monocratic structure. He[48] speculated that: (1) if an organization is centrali ed, then the organization tends to prohibit conflict among different views; (2) conflict prohibition, a turn, will result in a decrease in possible sources of innovation; therefore, if the organization is centralized, then organization change will be less likely to occur. Limited sources of innovation s the main core from which he derived the hyp)thesis. But Thompson[40] did not consider the adoption rate among a set of alternatives.

If bot a the adoption rate and number of sources of innovative ideas are larger in the more decentralized system than in the less decentralized

system, then the adoption of innovation will be larger in the decentralized system than in the centralized one. But the conditional of this statement is not true. In a less centralized system, adoption rate will not be any higher than the adoption rate in a centralized system. Also in a centralized system the power holders within the system can increase the information which is necessary to stimulate program change. Wilson[50] and Zaltman, et al.[51] among others, agree that the more centralized an organization is, the higher will be its adoption rate. If these two assumptions are true, then one should expect that the more centralized, the more innovation. Holdaway, et al.,[52] however, suggested a positive relation between centralization and innovation.

How about the reverse direction? If an organiz ation has more new policy adoptions, then the directors may exercise more power over matters of planning, rule-making and management. Hence the organization would be more centralized in terms of director's power.

If the organization has more program innovation, consequently, this might require more experts or skills. Hence the level of expertise in the organization would be increased. Also leader of an organization with a high level of expertise may encourage program innovation, and the result would be an increase in the frequency of new policy adoptions.[53]

(46) Hage, 1965, op. cit.
(47) V. Thompson, 1965, op. cit.
(48) Ibid.
(49) Ibid.
(50) James Q. Wilson, "Innovation in organization: notes toward a theory," in J.D. Thompson (ed.), *Approaches to organizational design*, (Pittsburgh: U. of Pittsburgh), 193–218, 1936.
(51) Zaltman, et. al., op. cit.
(52) Holdaway, et. al., op. cit.
(53) Cf. Rufus Browning, 'Innovative and non-innovative decision processes in government budgeting," in R.T. Golembiewski (ed.), *Public budgeting and finance*, (Ithaca: F.E. Peacock), 128–45, 968.

II. Procedures to Extract Simultaneous Model

II-1 Relations Among Block Variables

We already have discussed theoretical and empirical relations among our variables. Contextual variables are considered as predictors for structure and flexibility in most organization research.[54] We maintain this assumption for all our analysis.

We assume that causal relation between the blocks of structure and flexibility is indeterminate. In Hage and Aiken's study of program innovation, structural variables are considered as predictors for flexibility (especially program innovation). The Aston group included flexibility variables in their first design[55], but in the later analysis[56] they excluded them due to difficulty in assessing flexibility. Most analysts do not consider flexibility as an independent variable that might explain structural variables due to lack of suitable statististical techniques. Simultaneous effects among variables cannot be tested by path analysis or by ordinary least squares analysis. This weakness in use of statistical analysis cannot justify assuming recursive effects of structural variables on flexibility variables.

Based on cross-sectional data, we can partially handle the simultaneous effects between flexibility and structure such as the following relational model:

$$\text{Contextual Variables} \rightarrow \text{Structural Variables and Flexibility Variables}$$

This simultaneous model and the discussions in Chapter I do not give us the specific causal relations among variables. Some of the causal relations are indeterminate. This justifies our statistical search for specific models and relationships.

II-2 Use of Statistical Analysis for Derivation of Models

The statistical procedures used to extract the empirical models are as follows:

(1) run step-wise regressions based on the simultaneous model suggested above;

(2) cut the steps where t-value of regression coefficients equals or is larger than 1.684 (significant at 0.10 level) and include one or two more variables in further steps when these variables significantly contribute to the model by raising R^2 or the F-ratio;

(3) add the theoretically important variables in that system while taking care to avoid the problem of underidentification;

(4) run two-stage least squares analysis based on several models specified in steps (1) to (3);

(5) examine $\bar{R}^2$, F-ratio, and t-values of coefficients in the simultaneous system of equations;

(6) select models that satisfy the following conditions:

    a. the smallest $\bar{R}^2 \geq 0.20$ (or $\bar{R} \geq 0.45$) and

    b. at least one t-value equals or is larger than 1.303 (significant at 0.20 level in a two-tailed test) in each equation in the system.

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(54) Pugh, et. al., 1963, op. cit.; Hage and Aiken, 1969, op. cit.; Hall, et. al., 1967, op. cit.; Blau and Schoenherr, op. cit.

(55) Pugh, et al., 1963, op. cit.

(56) Pugh, et. al., 1969a, op. cit.; Pugh, et. al., 1969b, op. cit.; Pugh, et. al., 1968, op. cit.

III. Summary of Variables and Indicator

Classification	Variables	Indicators
Contextual Variables	1. TENURE	Bureaus' average tenure
	2. Changeability(CHN)	Evaluate the degree of changeability for your tasks (3-point scale)
	3. Variety(VAR)	Evaluate the degree of variety for your tasks (4-point scale)
	4. Uncertainty(UNC)	Evaluate the degree of difficulty in assessing the consequences of policies adopted (4-point scale)
	5. SIZE	Number of full-time bureaucrats
	6. COMT	Number of committees affiliated with the bureau
Structural Variables	7. Level of Expertise (EDUC)	Mean level of education in a bureau
	Centralization[1]	
	8. Configuration(PCI)	Distribution of individual's power in planning, rule-making, and management.[2] Ratio of managers to size of bureau[3] Span ratio of immediate superior subordinate relations[4] Generalized span ratio[4]
	9. Director's power (PCD)	Director's power in planning, rule-making and managemement[2]
	10. Level's Power distribution(PCL)	Power distribution among levels in planning, rule-making, and management[2]
Flexibility[5] variables	11. Technology(TECH)	Evaluate the frequency of usage of EDPS in the recent period (1970's) compared to 1. the past (1960's); 2. other bureaus within the same ministry; 3. other bureaus outside the ministry. Evaluate the degree of introduction of new management skills in the recent period (1970's) compared to 4. the past (1960's); 5. other bureaus within the same ministry: 6. other bureaus outside the ministry.
	12. Training(TRAN)	Evaluate the degree of training in the recent period(1970's) compared to 7. the past (1960's); 8. other bureaus within the same ministy; 9. other bureaus outside the ministry.
	13. Structure(STR)	Evaluate the degree of structural change in the recent period (1970's) compared to 10. the past (1960's); 11. other bureaus within the same ministry; 12. other bureaus outside the ministry.
	14. Transfer(TRNS)	Evaluate the degree of transfer in the recent period (1970's) compared to

Classification	Variables	Indicators
Flexibility variables		13. the past (1960's);
		14. other bureaus within the same ministry;
		15. other bureaus outside the ministry.
	15. Frequency of new policy adoptions (FREQ)	Evaluate the frequency of new policy adoptions in the recent period (1970's) compared to
		16. the past (1960's)
		17. other bureaus within the same ministry;
		18. other bureaus outside the ministry.
	16. Quality improvement in policies(QULT)	Evaluate the number of conditions considered in decision-making process in a recent period (1970's) compared to
		19. the past (1960's);
		20. other bureaus within the same ministry.

Note:
1. Three factors (variables) in centralization were extracted by varimax rotated factor analysis based on 12 power distribution indicators at the bureau level.
2. The response categories for the power indicators varied along a 5-point scale: (1) little or none, (2) some, (3) quite a bit, (4) a great deal, (5) a very great deal.
3. $\dfrac{\text{Number of members above rank 3-A}}{\text{Total number of members}}$

4. $\text{SPAN} = \dfrac{1}{n-1} \prod_{i=j+1}^{n} \left(\dfrac{S_j}{S_i}\right)^{\frac{1}{j-i}} = \left(\dfrac{S_n}{S_1}\right)^{\frac{1}{n-1}}$

$\text{GSPAN} = \dfrac{1}{{}_nC_2} \prod_{i=1}^{n-1} \prod_{i=j+1}^{n} \left(\dfrac{S_j}{S_i}\right)^{\frac{1}{j-i}}$

   where S_i refers to the number of persons in the level i; n is the number of levels within an organization. $_nC_2$ refers to n Combination of 2.
5. The response categories for flexibility varied along a scale of: (1) much less, (2) less, (3) same, (4) more, and (5) much more.
6. Abbreviations in gothics

IV. Discussions and Implications of Findings

As Table 1 demonstrates, major findings of this study are:

(1) Size has the primary effect on organization structure but not on the organizational flexibility. Size has a positive effect on centralization in terms of configuration, and negative effects on the level of expertise and on centralization in terms of director's power ($t(p<0.20)$, $t(p<0.05)$ and $t(p<0.20)$, respectively).

(2) Changeability and variety of task are the important predictors of organizational flexibility but not of organization suructure: (a) Changeability

has a positive effect on the quality and frequency of new policy adoptions ($t(p<0.20)$) and a negative effect on structural change ($t)p<0.20$); (b) Variety of task has a positive effect on flexibility in technology and structure ($t)p<0.10$) and $t(p<0.05)$ respectively).

(3) Organization structure has some effects on organization flexibily and organization flexibility has some effects on its structure: (a) The frequency of new policy adoptions has positive effect on the level of expertise and centralization in terms of director's power ($t(p<0.30)$, $t(p<0.10)$,

Table 1. Simultaneous Equations of Structure and Flexibility

1 EDUC TSLS

	FREQ	TEN	SIZE	COMT	CONS	R/SE	DW/F
	0.2553	−0.0969	−0.0167	0.1519	14.4100	0.5916	1.5935
	1.1996	−3.3904	−3.6562	2.0905	5.9835	0.5388	15.8492

2 PCI TSLS

	PCD	SIZE	COMT	CONS	R/SE	DW/F
	0.1384	0.0245	−0.3114	−0.8363	0.4279	1.8189
	0.3607	2.4875	−3.1136	−1.6841	0.7564	11.2208

3 PCD TSLS

	PCI	STR	TRNS	FREQ	SIZE	CONS	R/SE	DW/F
	−0.0401	−0.5267	0.4642	0.7025	−0.0206	−5.9170	0.3277	1.5839
	−0.1194	−0.9199	0.7421	1.9683	−1.4143	−1.0141	0.8199	4.9968

4 TECH TSLS

	EDUC	PCD	TRAN	VAR	CONS	R/SE	DW/F
	−0.6220	0.6831	1.1219	1.6816	13.8095	0.2943	2.4357
	−1.1065	1.1690	0.8397	1.9721	0.7171	1.4236	5.2755

5 TRAN TSLS

	PCI	TECH	FREQ	CHN	CONS	R/SE	DW/F
	0.2796	0.1691	0.2299	−0.8549	5.7091	0.3777	2.0063
	1.4100	1.0295	0.3816	−0.8761	1.1338	0.5477	7.2200

6 STR

	PCD	TRAN	TRNS	CHN	VAR	CONS	R/SE	DW/F
	0.0946	−0.2001	0.4103	−0.1379	1.3816	6.8609	0.4703	1.5960
	−0.3441	−0.5156	1.4463	−1.6444	2.8272	1.6094	0.5208	8.2800

7 TRNS TSLS

	PCD	STR	FREQ	TEN	SIZE	CONS	R/SE	DW/F
	0.6487	0.4328	−0.5449	−0.0555	0.0261	10.4699	0.2157	1.9269
	1.3140	0.9731	−1.2404	−1.5234	2.2719	2.2259	0.6897	3.2551

8 FREQ TSLS

	EDUC	PCD	QULT	CHN	CONS	R/SE	DW/F
	0.2174	−0.1307	0.7316	1.1457	0.0214	0.4092	2.1779
	1.2553	−0.5200	1.1580	1.8804	0.0040	0.5806	8.0997

9 QULT TSLS

	STR	FREQ	UNC	CONS	R/SE	DW/F
	0.2183	0.4732	−0.3064	0.7270	0.3587	2.4556
	1.1460	2.1750	−0.8374	0.3405	0.3854	8.6452

Key: 1. Figures in upper level denote regression coefficients while figures in the lower level denote student t-values.

2. $t \cdot p < 0.20 = 1.303$; $t(p < 0.10) = 1.684$; $t(p < 0.05) = 2.021$; $t(p < 0.01) = 2.704$, in a two-tailed test.

3. To calculate these two-stage least square we used program ECONTRAN, Version=EC written by M.R. Norman, University of Pennsylvania.

4. Endogeneous variables are EDUC, PCI, and PCD, TECH, TRAN, STR, TRNS, FREQ, and QULT. There are six exogeneous variables in this system of equations. They are UNC, VAR, CHN, SIZE, TENURE, and COMT.

5. CONS: Constant; R/SE: R-Squared; DW: Dubin-Watson Statistics; F: F-ratio. For other abbreviations see Chapter III.

respetively; (b) The level of expertise has also a positive effect on the frequency of new policy adoptions $(t(p < 0.30))$; (e) Centralization in terms of configuration has a positive effect on flexibility in training $(t(p < 0.20))$.

This chapter examines and discusses the general implications of these empirical findings for organizational analysis. They are:

(1) size imperatives on organizational structure and flexibility; (a) the pervasive effect of size on structure, and (b) effects of size on flexibility or possible size effects on organizational rigidity;

(2) environmental or technological imperatives on organization structure and flexibility; (a) the meaning of uncertainty, and (b) effects of variety and changeability on organization structure and flexibility;

(3) relations between the structural variables and the flexibility variables; (a) the effects of the frequency of new policy adoptions on centralization, and (b) mutual relations between the level of expertise and the frequency of new policy adoptions.

VI-1, Reconsideration of the Size Effect on Structure and Flexibility

Larger bureaus have more jobs that do not require a large degree of discretion. Larger bureaus do not require large numbers of personnel with expert qualifications, and this results in higher span ratios and lower management ratios. This suggests that larger organizations are more centralized in terms of configuration, and less centralized in terms of director's power.

The conlusion from this Korean data is that size is the most important condition affecting the structure of organizations and this confirms findings or hypothesis in American studies by Blau and Shoenherr [57] Meyer,[58] Pondy[59], and Klatzky,[60] and in English studies by Pugh, et al.,[61] Hickson, et al,[62] and Child.[63] Our conclusion differs from that reached by some other investigations. For example, Hall[64] and Hall,et al.[65] conclude from their research that "size and organizational structure are not closely related."

Let us further examine why an organization increases in size. There are two possible ways to explain why organizations increase in size: they may increase in size in order to handle more variety and they may increase in size in order to handle more changeability(or uncertainty). These two different causes of increasing size lead to differences in organization structures and possibly in flexibility. If an organization increases its size

due to an increase in variety, then the organizational members would have little discretion in performing their tasks, and hence, indirect control, such as standardization, formalization, and job codification, would be dominant as the control and coordination device. An increase in size based on variety, in turn, causes decentralization in terms of director's power.

If an organization increases its size in response to changeability, then the influence model of changeability→new policy adoptions→director's power can be applied. That is, organization is more centralized in terms of director's power as an organization increses its size in response to changeability.

It is evident that organizations increease in size due to variety rather than changeability. Size is positively but weakly correlated with variety $(r=0.10)$ and negatively but weakly correlated with changeability and uncertainty $(r=-0.05, -0.05$ respectively). The discussion sofar directs our attention towards the discussions of Blau.[66] "Increasing size generates structural differentiation in organizations along various dimensions at decelerating rates."

Our data supports the first part of this postulate by Blau[67] and later discussants.[68] The larger the size of an organization, the higher the configuration, e.g., through higher span ratio, and lower management ratio. But our data cannot

(57) Blau and Shoenherr, op. cit.
(58) Meyer, 1968, op. cit.
(59) Pondy, op. cit.
(60) Klatkzy op. cit.
(61) Pugh, et. al., 1969a, op. cit.
(62) Hickson et. al., 1969, op. cit.
(63) Child, 1973b, op. cit.
(64) Hall, 1972, op. cit.
(65) Hall, et al., op. cit.
(66) Blau, op. cit.
(67) Ibid.
(68) See Meyer, 1971; Hummon, 1971; Dieckoff, 1973; Specht, 1973.

confirm the *decelerating rate* which Blau says[69] follow from decreasing returns to scale.

It is worth noting that increasing size in response to variety causes an increase in configuration due to economies of scale. If an organization increases its size in response to changeability and uncertainty then the postulates and their derivations suggested by Blau[70] and later discussants[71], should be reconsidered. As an organization increases its size in response to changeability, the configuration decrease. Blau's postulate[72] is an analogy with the common notion of economies of scale in industry. He speculates that as an organization expands, it requires relatively fewer managers, but that gains from economies of scale decline as the organization expands further. If his conclusion is correct, although it is not supported by Korean data, a partial explanation might be that explanation might be that expansion in response to changeability counters gains from economies of scale in that such expansion requires higher span ratios.

Bureau ize is positively and weakly correlated with flexibility in technology, structure, and training except the degree of transfer. Also the weak effects of size on flexibility in technology, training, and structure are positive and indirect. The positive effect of size on transfer is strong and significant $(t(p<0.05))$.

The negative and indirect effects of size on flexibility in the frequency of new policy adoptions and quality improvement in policies are negligible.

What is the meaning of these findings for a goverment organization? It is commonly assumed that larger organizations are more rigid than smaller ones, i.e., that size has a negative effect on organizational flexibility.

Bureaucratic rigidity, generally, implies one of the following characteristics: (1) rule-rigidity including impersonal work rules[73] e.g., red tape; (2) monocratic structure;[74] (3) status quo in policy adoptions;[75] (4) reduced adaptability in the introduction of new technology or training (this is related to the concept of obsolescence of technology in general.);(5)difficulties in changing role structure and recruiting new personnel.

Three aspects of rigidity can be examined in our data: (3), (4), and (5). These three aspects are not positively related to the size of organization:

(1) Our data do not support the claim that the larger the size of an organization, the less flexible it is in the frequency of new policy adoptions and in quality improvement of policies;

(2) Our data contravene the hypothesis that the larger the size of an organization, the less the flexibility in organizational structure and technology. Size has positive effects on the flexibility in technology and structure.

VI-2. Reconsideration of Environmental Imperatives on Structure and Flexibility

Basically, I have found the following relationships among changeability, variety, uncertainty, organization structure, and flexibility:

(69) Blau, op. cit.
(70) Ibid.
(71) See, Meyer, 1971; Hummon, 1971; Dieckoff, 1973; Specht, 1973.
(72) Blau, op. cit.
(73) Robert K. Merton, "Bureaucratic structure and personality," *Social Forces*, 18: 560-68, 1940; Crozier, 1964, op. cit.
(74) V. Thompson, 1969, op. cit.
(75) March and Simon, op. cit.; Mohr, 1969, op. cit.; Hage and Aiken, 1967, op. cit.; Anthony Downs, *Inside bureaucracy*, (Boston: Little Brown), 1967.

(1) variety has a significant and positive effect on flexibility in technology and structure (t(p< 0.10), t(p<0 05) respectively);

(2) uncertainty has almost no effect on any variable in flexibility and structure except for the effect on the level of expertise and that was found only in a recursive model;

(3) changeability has a negative effect on flexibility in structure (t (p<0.20)) and a positive effect on flexibility in the frequency of new policy adoptions (t(p <0.20)) and quality improvement.

Uncertainty can be used as a fundamental concept in explanations of social phenomena in general, and organizational phenomena in particular, e.g., use of uncertainty in systems theory, in economics, and in game theory.[76] In other words uncertainty can be defined and used as a primitive or initial concept to explain other properties without considering causes of uncertainty.

Uncertainty as a concept, however, is not very useful in organizational analysis, because different causes of uncertainty result in different types of organizational structures and produce differences in flexibility. Our Korean data suggest that organizational structure and flexibility respond differently to changeability of task. Organization structure and flexibility may respond differently to the degree of ambiguity in goals as one of causes of uncertainty. This suggests the following directions of future research on uncertainty: (1) explication of notion of uncertainty based on its causes as was done with the concept of environment by Jurkovich;[77] (2) examination of the relationships of causes of uncertainty and uncer-

tainty itself; (3) examinatin of the direct and indirect relations between these causes of uncertainty and other organizational variables.

The characteristics of task and task environment, especially variety and changeability, have significant effects on the flexibility dimensions rather than on organizational structure when the assumption of recursiveness of structural variables to flexibility variables is relaxed. These findings are contrary to part of contingent theory, in which certain writers have emphasized the environmental imperatives on organization structure rather than organizational flexibility. The new direction should put emphasis on the effects of task environment, task, or technology on the organizational flexibility rather than on organization structure.

Variety has a positive effect on flexibility in technology and strucuture(t(p<0.10), t(p<0.05) respectively). But changeability has a negative effect on flexibility in structure (t(p<0.20) and a positive effect on the frequency of new policy adoptions(t(p<0.20)) and quality improvement of policies. What do these findings imply?

(1) As Rogers[78] and Rogersd an Shoemaker[79] suggest, innovation (technological) is easily adopted and implemented when its content is easily observable, can be tried, and is simple. Technology which handles variety is more similar to Rogers and Shoemaker's conditions[80] than technology which handles changeability. In this respect, organizational flexibility in technology is a device to handle variety rather than changeability of task.

(2) An organization could change its structure

(76) Duncan Luce and Howard Raiffa, *Games and decision*, (New York: Wiley), 1957; W.H. Riker and P.C. Odershook, *An introduction to positive political theory*, (Englewood Cliffs: Prentice Hall), 973.

(77) Ray Jukovich, op. cit.

(78) E.M. Rogers, *Diffusion of innovations*, (New York: Free Press), 1662.
(79) Rogers and Shoemaker, op. cit.
(80) Ibid.

when the work volume handling variety of task increases.If an organization changed its structure in response to changeability, organizational instability would result. Hence, flexibility in structure is positively dependent on variety and negatively dependent on changeability.

(3) Policy refers to a set of decisions made by heads of ministries or offices ranging from the bottom level upward through bureau directors. An organization with a more changeable tasks or task environment tend to adopt new policies more frequently. Changeability, therefore,has a positive effect on flexibility in the frequency of new policy adoptions.

(4) Together with (1), (2) and (3) we can conclude that flexibility in technology and structure is not the device to make better policy decisions.

It should be mentioned that variety of task has no effect on centralization in terms of configuration $(t(p<0.30))$. This is contrary to our speculation that variety has a positive effect on configuration. The absence of an effect results from the fact that bureaus as supraorganizations to rural or field organization can delegate their authority and responsibility in handling variety. A supra-organization can easily control subordinate organizations with this kind of delegation through indirect means such as formalization, standardization, and job codification.

VI-3. Reconsideration of Asymmetric Effects of Structural Variables on Flexibility Variables

Comparative studies of organizational flexibility are not common in organizational analysis, where the units of analysis are organizations. Most analyses, but not all, e.g., Holdaway, et al. [81] employ the structual variables as predictors of organization flexibility, especially for program innovation. [82] This common practice cannot justify the assumption of recursiveness from structural variables on flexibility variables. When we relax the assumption of recursiveness we obtain interesting findings (1) a positive effect of the frequency of new policy adoptions on centralization in terms of director's power $(t(p<0.10))$ and a very weak and negative effect of centralization on the frequency of new policy adoptions $(t(p<0.60))$; and (2) the positive mutual effects between the level of expertise and the frequency of new policy adoptions $(t(p<0.30))$.

Korean data on government bureaus suggest that if an organization more frequently adopts new policies, then the organization becomes more centralized $(t(p<0.10))$. A new policy is a product of direct control or coodination by directors rather than the product of indirect control or coordination through formalization, job codification, or standardization. So, the frequency of new policy adoptions gives power to the directors. Hence, an organization becomes more centralized in terms of director's power as the frequency of new policy adoptions increases.

It is commonly hypothesized that "the more centralized an organization is, the less program innovation there will be." The negative effect of centralization on program innovation is too weak $(t(p<0.60))$ in our Korean data to support this hypothesis. V. Thompson [83] justified this negative effect of centralization on program innovation with the following arguments:

(1) An organization which is more centralized is more likely to prohibit conflicts among indivi-

(81) Holdaway, et al., op. cit.
(82) Hage and Aiken, 1967; Evan and Black, 1967; V. Thompson, 1969; Zaltman, et. al., 1973; and Paulson, 1974.
(83) V. Thompson, 1969, op. cit.

dual membe[r]s than an organization which is less centralized;

(2) Confli[c]t prohibition results in a decrease in number o[f] source of innovation or change;

(3) There[f]ore, innovation (program change) in a more cent[r]alized organization is less likely to occur than i[n] a less centralized organization.

As was su[g]gested before, this negative effect of centraliza[t]ion on the frequency of new policy adoptions is [p]ossibly true, but the degree of the effect is wea[k]ened by the way in which the number of s[o]urces of innovation and the rate of their adopti[o]n in a centralized system are increased.

We have b[e]en observing the mutual relationship between the frequency of new policy adoptions and the level of expertise. The frequedcy of policy adoptions has a positive effect on the level of expertise $(t(p<0.30))$ and the level of expertise has a positive effect on the frequency of new policy adoptions $(t(p<0.30))$. This mutual dependence suggests that if duties are designed to handle changeability then this leads to an increase in the level of expertise, and again, to an increase in the frequency of new policy adoptions. One might speculate that there exist an upper and lower bound of the frequency of new policy adoptions and the level of expertise which are determined by the degree of changeability (or uncertainty).