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Perceptions of information systems structures' impact on MIS success and effectiveness

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ABSTRACT

This article provides results from a study on the perceptions of information systems structures' impact on implementation of MIS success and effectiveness via organizational context variables. The focus is on the use of MIS effectiveness and success variables that are utilized in MIS research. Several hypotheses were tested to discern impact of information systems structures on MIS effectiveness and success. The results show that several of these organizational context variables are associated to various degrees, depending on the MIS structure, with MIS success and effectiveness.

INTRODUCTION

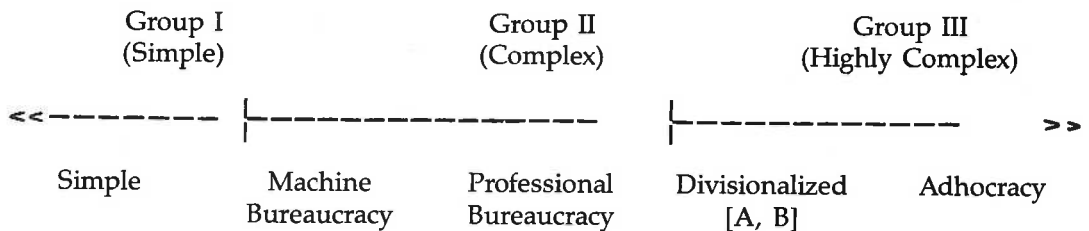
The effectiveness of the information processing activities of an organization is determined largely by the organizational placement and structure of information systems (IS) within that organization. Top industry leaders and business analysts have come to realize that effective IS is crucial in achieving organizational goals and use it as a strategic weapon (McFarlan, 1984; Lederer, 1988). Most IS executives have or are implementing systems to attain competitive advantages. Trade journals and newspapers rank companies according to their effective use of information technology on a regular basis.

This article will investigate the relationships of different structures of computer based information systems that fit various organizations' structures and IS effectiveness and success as perceived by chief information systems officers (CIO) or information systems managers. Four selected organization's context variables will be used to test the relationships of these variables to information systems success and effectiveness. Furthermore, these variables selected from Ein-Dor and Segev's (1978) compilation of organizational context variables are used by many researchers, in the MIS field, in both conceptual and empirical context situations, to explain the success and effectiveness of a computer based information system. A proposed model based on Mintzberg's (1979, 1981) organizational structures and Leifer's (1988) conceptual fit of IS structures will be used to test the investigation. Eight hypotheses will be tested to explore the relationships of IS structures and their impact on MIS effectiveness and success as measured by surrogate variables.

STRUCTURE OF ORGANIZATIONS AS RELATED TO INFORMATION SYSTEMS

Ogilive et al. (1988) point out that there are three major information processors at the organizational level: computer based information systems, organizational structure, and organizational culture. Ein-Dor and Segev (1982) found that different organizational structures correlate with different IS structures. Most organizations, as Mintzberg (1979, 1981) suggests can be categorized in five distinct groups. Leifer (1988) proposed a typology of IS uses in five types of organizational structure.

Figure 1. A Modified Conceptual Organization's Structures*



* Adapted from Leifer (1988)

Table 1 depicts a modified organizational structure (see Figure 1) for three distinct groups. Lucas (1977) studied Nolan's (1973) stage hypothesis of IS growth by grouping organizations in three groups by the level of IS sophistication or hardware use. Therefore, reducing Mintzberg's five organizational structures to three groups, and aggregating the data, is methodologically appropriate in this case because of the paucity of data that fit all five organization's structures. The first group can be labeled as simple organizations with a single product or service, without separate divisions or profit centers. Generally, the requirements of IS for such organizations are stand alone microcomputers and often-times a minicomputer. The major information system activities are in word processing, accounting, spreadsheet and an assortment of other productivity software to help run the organization. The second group of organizations are complex bureaucratic organizations with several different products, divisions, and profit centers and with complex integrated information systems needs. Their IS needs are generally configured by centralized and distributed computer systems. The third group of organizations are highly complex, large bureaucracies with divisionalized form and adhocracy and with scores of divisions and profit centers. Their IS needs comprise a mixture of all three types of computer systems configuration: decentralized, centralized, and distributed systems (Leifer, 1988).

Table 1. Fit Between Organizations' Structures and Information Systems Structures*

Type of Organization Structure	Type of Information Systems Structure			
	PC Systems	Distributed Computer Systems	Centralized Computer Systems	Decentralized Computer Systems
Group I	X			
Group II		X	X	
Group III		X	X	X

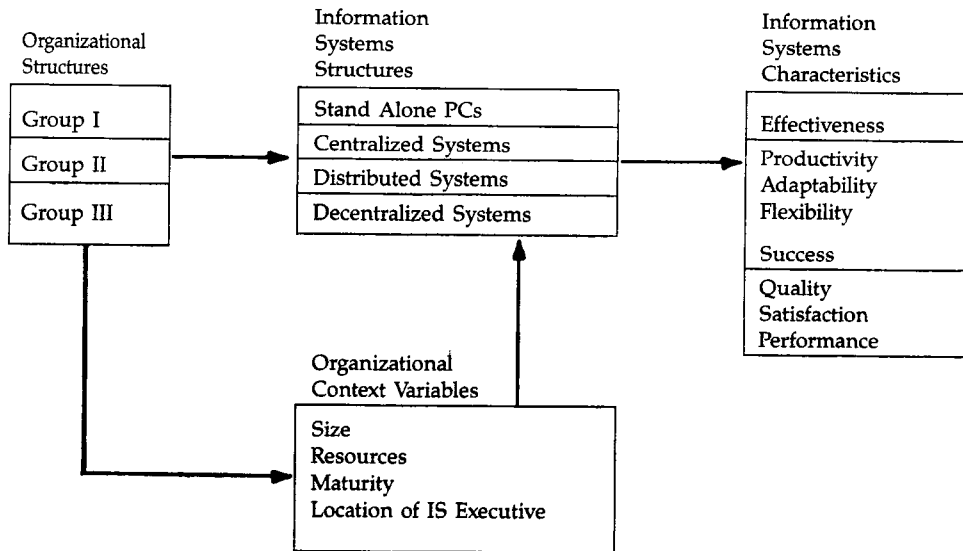
* Adapted from Leifer (1988)

THE MODEL

The organizational context variables selected from Ein-Dor and Segev's (1978) survey of key organizational context variables are: size, resources, maturity, and location of the IS executive in the organization's hierarchy. The surrogate variables used to measure MIS effectiveness and success include: productivity, adaptability, flexibility, quality, performance, and satisfaction. To validate if effectiveness is explained by the independent variables of productivity, adaptability and flexibility a linear multiple regression of the form $Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3$ was conducted. A similar linear multiple regression for the dependent variable of success was regressed using the independent variables of quality, performance, and satisfaction. The model obtained for information systems effectiveness was: $EFFE = 0.027 + 0.46PRO + 0.20ADAP + 0.34FLEX$, with r-square of 0.62 and with significant F value of 16.12 at the 0.05 level. The multiple linear regression model for information success variable gave the result of: $SUCC = 0.42 + 0.16QUAL + 0.59PER + 0.20SAT$, with r-square of 0.93 and with a significant F value of 132.28 at the 0.05 level. Therefore, the two dependent variables information systems effectiveness and success were significantly explained by their respective independent variables as the regression results show.

The study investigated different IS structures' impact on IS effectiveness and success, in three groups of organizations, as perceived by IS executives and managers in 101 manufacturing and service organizations. Mintzberg's (1979, 1981) structures of organizations is used as a foundation and then modified in this research context to: Group I (simple organizations), Group II (complex organizations), and Group III (highly complex organizations). Furthermore, Leifer's (1988) four conceptual IS structures are used to fit the various organizations' structures of the research sample.

The research model is depicted in Figure 2. The discussions of the organizational context variables will follow next.

Figure 2. Research Model

STRUCTURE

Structure, as Mintzberg (1979, 1981) and Galbraith (1977) pointed out, relates to the systems of communication, authority, and work flow of organizations. The degree of centralized or decentralized decision making and the formalization of communication of work flow can be an indirect measure of the structure of an organization. Leavitt and Whisler (1965) argued that organizations with a centralized decision making structure tend to favor a computer information system based on a centralized corporate database. There will be three organizational structures used for this research purpose which fall within the continuum of the simple to adhocracy of Mintzberg's (1979, 1981) classifications. The related IS structures for this research are: simple PC systems, centralized systems, distributed systems, and decentralized systems. The IS structures for the sample are obtained through survey questionnaires. Obviously, there are overlaps between the structure designations. However, for data analysis purposes the dominant IS structure, as selected by the respondents of the questionnaires, is used.

SIZE

Organizational size is an important variable that is used to shed light on the structure of organizations (Burn, 1989; Lind, et al., 1989; Yap, 1990). Many researchers (Delone, 1981; Galbraith, 1977) have found a direct relationship between organizational size and the complexity of task coordination, and therefore, the use of information technology is likely. The size of the organizations were measured in total annual sales and number of employees (Ein-Dor & Segev, 1978, 1982; Ein-Dor, et al., 1984). These were obtained from commercial

published sources. The number of IS employees and IS budget were obtained through questionnaires. Care was taken that the sample contain sufficient numbers of the types of organizations proposed in Figure 1.

RESOURCES

Allocation of sufficient resources to IS related activities is a critical factor if IS is to meet the organization's goals. Different researchers have found mixed results between the relationships of large resource allocation to IS and user satisfaction and usage rate (Ein-Dor and Segev, 1982). Raymond (1985) advocates increased allocation of resources, in terms of more powerful hardware and software and highly skilled personnel, if IS sophistication is to be attained in the organization. Data for IS resources allocation in the sample was obtained through questionnaires.

MATURITY

Maturity according to Raymond (1990) and Ein-Dor & Segev (1978) is the level of standardization of rules, processes, and management practices in organizations. Raymond (1990, p. 7) pointed out that "formalization requires that organizational processes be well understood, if explicit rules, procedures, instructions, and communications are to govern them. Increasing the maturity of the organizations' IS function can lead to increased formalization, as this necessitates more formal data and models of the object systems that this function aims to support." Maturity in this research is not exactly used as Nolan's (1973) six stages hypothesis of IS growth. It is closer to Ein-Dor and Segev's (1978, 1984) concept of standards of rules and procedures in the organization.

LOCATION

The location or placement of the MIS executive/director in the organizational hierarchy can be measured by the number of levels below chief executive officer (Ein-Dor & Segev, 1982). Furthermore, Ein-Dor and Segev (1982, p. 57) pointed out that "the likelihood of successful MIS effort declines rapidly the lower the rank of the executive to whom the MIS chief reports and is virtually negligible if the executive responsible is more than two levels below the chief executive of the particular organization which the MIS serves." High level involvement of management in MIS functions and a separate department can reduce dependency of MIS in any particular functional area which can be relegated to noncritical functions of the organization.

INFORMATION SYSTEMS EFFECTIVENESS

The process model assumes effectiveness to be related to internal organizational well-being, efficiency, productivity and smooth internal processes and procedures (Scott & Norman, 1981; Steers, 1977). Yuchtman & Seashore (1967) perceive organizational effectiveness to be a multidimensional construct, in which the "extent to which the organization meets the problem of its internal subsystems and copes with its external environment is the extent to which the organization performs effectively." The three surrogate variables selected to measure effectiveness will be defined next.

PRODUCTIVITY

The ratio of output to input generally is a measure of the relative efficiency which is commonly known as productivity. Mott (1972, p. 17) defined productivity as "employee's perception of the quantity and quality of work done in their division or departments as well as the efficiency with which the work is done." Productivity in an information systems context can be measured by lines of code per day or using function points per day. Generally, most IS departments do not have a formal and consistent way of measuring productivity. The measure used for this research was purely the perceptions of survey respondents.

ADAPTABILITY

Adaptability is the act or process of change to conform to new needs and requirements. Mott (1972, p. 8) defined adaptability as "employee's perception of their organization's ability to anticipate problems, and find good solutions."

FLEXIBILITY

Flexibility is the capability to deal with unexpected situations and cope with them on an ad hoc basis. In an information system's context the failure of particular hardware or software because of poor design, for example, may incapacitate the system. However, well trained information systems' personnel who are innovative and flexible, will be able to find temporary solutions, and will be key in planning and avoiding a prolonged down time of the system.

INFORMATION SYSTEMS SUCCESS

The primary purpose of IS is to attain organizational goals as efficiently as possible. How does one measure IS success? IS success can mainly be measured indirectly by measures such as return on investment (Yap, 1990), system usage as proposed by Ein-Dor and Segev (1978), and user satisfaction (Raymond, 1985, 1990). In this research investigation the variables selected as surrogate to success are: quality, satisfaction, and performance. Further discussions of these variables follows.

QUALITY

Some of the distinguishing characteristics of successful organizations are the quality of service or products rendered. In an information systems context, in order to achieve quality, all information systems' personnel are expected to be responsible to the quality of the work they do. Computer operators, system analysts, programmers and database administrators are key personnel in their technical expertise to bring about quality and the success of the information system in the organization.

SATISFACTION

Satisfaction is primarily the perception of information systems users toward their systems. As Raymond (1990) argued, satisfaction is sometimes used as a surrogate measure of IS success. Mahmood and Becker (1985), Tait and Vessey (1988) found mixed results as to the correlation of IS satisfaction and system utilization. In this research context satisfaction will be used as a proxy measure of IS success.

PERFORMANCE

One of the characteristics often found to be relevant in organizations is performance. Performance can be measured in many ways. Yap (1990) measured performance in terms of average return on capital employed and growth of business activities in terms of market share. It could also be measured by a company's stocks' performance on the market, which is an indirect measure of a company's performance. In this investigation performance is simply the perceptions of the respondents as to the extent to which information processed contributed to the realization of organizational objectives.

HYPOTHESES

Hypotheses related to the preceding variables and the research model in Figure 1 are aggregated into effectiveness and success characteristics for the three types of organizations and their respective IS structures as described in the model. The hypotheses are stated as follows:

H1: Organizational size is perceived to impact on IS effectiveness; or the hypothesis more operationalized—

H1a: impacts on IS productivity

H1b: impacts on IS adaptability

H1c: impacts on IS flexibility

H2: Organizational size is perceived to impact on IS success; or the hypothesis more operationalized—

H2a: impacts on IS quality

H2b: impacts on IS satisfaction

H2c: impacts on IS performance.

H3: Organizational maturity is perceived to impact on IS effectiveness; or the hypothesis more operationalized—

H3a: impacts on IS productivity

H3b: impacts on IS adaptability

H3c: impacts on IS flexibility

H4: Organizational maturity is perceived to impact on IS success; or the hypothesis more operationalized—

H4a: impacts on IS quality

H4b: impacts on IS satisfaction

H4c: impacts on IS performance.

H5: Organizational resources are perceived to impact on IS effectiveness; or the hypothesis more operationalized—

H5a: impact on IS productivity

H5b: impact on IS adaptability

H5c: impact on IS flexibility

H6: Organizational resources are perceived to impact on IS success; or the hypothesis more operationalized—

H6a: impact on IS quality

H6b: impact on IS satisfaction

H6c: impact on IS performance.

H7: Rank and location of executive responsible for IS function in an organizational hierarchy is perceived to impact on IS effectiveness; or the hypothesis more operationalized—

H7a: impact on IS productivity

H7b: impact on IS adaptability

H7c: impact on IS flexibility.

H8: Rank and location of executive responsible for IS function in the organizational hierarchy is perceived to impact on IS success: or the hypothesis more operationalized—

H8a: impact on IS quality

H8b: impact on IS satisfaction

H8c: impact on IS performance.

The above eight hypotheses were tested for Group One to Three organizations with their respective information systems structures. Table 4, Appendix 1, and Appendix 2 summarize the hypotheses tests using correlation analyses.

RESEARCH METHODOLOGY

The sample data for the research consisted of 101 service and manufacturing firms in the U. S. The firms were randomly selected from a proportional stratified sample. This was determined by firm size, annual sales and number of employees, and other information about the firms from commercial publications. Of these, 27 were categorized as falling in Group I organizations, 34 in Group II, and 40 in Group III type organizations. Their respective IS structures as modeled in Figure 2 were determined from the questionnaires. In some situations, some firms' IS structure fell in more than one category structure. By using the 80:20 rule their dominant IS structure was categorized based on the responses of sample participants. The data were collected through a mail survey administered to IS vice-presidents or IS directors in the sample organizations. The respondents are assumed to be knowledgeable on the use of IS and its impact on organizational effectiveness and success. In general, IS executives/managers are familiar with technological and business issues such as the strategic value of IS (Lederer & Mendelow, 1988).

Table 2. IS Budget by Categories*

STRUCTURE	MEAN	S.D.	MEAN % OF REVENUE
Group I	2721	327	1.6
Group II	22082	3172	3.7
Group III	54028	4800	2.6

* (x1000)

DATA ANALYSIS

The response rate, within a ten-week period, on completed questionnaires was 33% (101 valid responses out of 300 survey questionnaires sent). The questionnaire measure used for this research has content validity because of previous usage of the research variables by other researchers in similar research contexts (Ein-Dor et al., 1984; Mott, 1972; Raymond, 1990; Yap, 1990). The reliability of the survey instrument was tested for consistency with a value of Cronbach's alpha equal to 0.82, a generally acceptable level.

Table 3. Descriptive Statistics of Research Variables

Variable	Group I (n=27)		Group II (n=34)		Group III (n=40)	
	Mean	(std. dev.)	Mean	(std. dev.)	Mean	(std. dev.)
Size*	6.99	(1.19)	8.32	(1.46)	9.04	(1.32)
Maturity†	3.11	(0.89)	3.76	(1.23)	4.00	(0.45)
Resources**	4.83	(0.79)	5.10	(0.43)	5.15	(0.71)
Rank***	2.33	(0.83)	3.09	(1.03)	2.65	(1.07)
Effectiveness†	3.26	(0.66)	3.62	(1.04)	4.33	(0.47)
Productivity†	3.44	(0.70)	3.79	(0.88)	3.93	(0.86)
Adaptability†	3.48	(0.69)	3.50	(0.90)	3.75	(0.98)
Flexibility†	3.40	(0.85)	3.44	(1.05)	3.95	(0.99)
Success†	3.15	(0.77)	3.85	(0.99)	4.33	(0.80)
Quality†	3.33	(0.96)	3.82	(0.87)	4.03	(0.77)
Satisfaction†	3.00	(1.15)	3.35	(1.12)	3.80	(0.91)
Performancet	3.56	(0.70)	3.73	(1.11)	4.22	(0.77)

† Variable measure interval scale of 1 (low) to 5 (high)

* Size = log (annual revenues)

** Resource = $\text{Log} \frac{\text{Annual IS Budget}}{\text{Number of IS employees}}$

*** Rank of IS executive = 6-(no. levels away from CEO)

RESULTS AND DISCUSSION

Table 4 represents correlation results between organizational contexts variables and MIS success and effectiveness. Hypothesis 1 was supported by the result as shown in Table 4. Group II and III organizations showed a slight positive association between organization size and MIS effectiveness. If we further scrutinize the hypothesis using the independent variables for MIS effectiveness as shown in Appendix 2, size is positively associated with MIS productivity for Groups II and III. Size is also associated with adaptability for Group II organizations, and finally there is a slight positive association between organization's size and MIS flexibility for Group II organizations. Therefore, one can safely infer that there is a significant correlation between organizational size and MIS effectiveness for large and medium size organizations which use computers regardless of the IS structure. Here a note of caution has to be stressed: we are only discerning associations between selected variables and no causality between the variables in any of the hypotheses should be assumed.

Table 4. Correlation Results Between Organizational Context Variables and MIS Success and Effectiveness

Variable	Group I (n=27)		Group II (n=34)		Group III (n=40)	
	Mean	(std. dev.)	Mean	(std. dev.)	Mean	(std. dev.)
Size	0.31*	0.05	0.25*	0.19*	0.50***	0.23 *
Resources	-0.09	-0.07	0.24*	0.25*	0.21*	0.26 *
Maturity	0.13	0.16	0.82***	0.73***	0.57***	0.30 **
Rank of IS Executive	0.72***	0.75***	0.28*	0.18 *	0.05	0.58***

* Significant at $p < 0.1$

** Significant at $p < 0.05$

*** Significant at $p < 0.001$

Hypothesis 2 was supported because of significant association between organization size and MIS success for all three types of organizations. Further analysis for the independent variables of MIS success showed slight positive association between size and performance overall. Negative correlation between size and quality for Group II organizations, and slight correlation between size and IS satisfaction for Group II organizations was observed.

Hypotheses 3 and 4 were supported by the positive correlation between organization maturity and MIS effectiveness and success for Groups II and III organizations. The independent variables of effectiveness and success were also significantly correlated with organization maturity for Groups I and III.

Hypotheses 5 and 6 dealt primarily with the relationships of organizational resources available for MIS function with success and effectiveness of MIS. The resources variable was not correlated for the smaller (Group I) organizations. However, there was a positive association between resources and MIS effectiveness and success for Groups II and III organizations. This might be explained by the limited resources availability in Group I organizations in general. Mean percent expenditure of resources on MIS activities to total revenue, according to the sample, shows that Group II organizations collectively have the highest average percent of IS expenditures to total revenue generated (see Table 2). To sum up, the above two hypotheses gave a mixed result: two groups of the data supporting the hypotheses and one refuting the hypotheses.

Hypotheses 7 and 8 were supported for Group I (significantly), Group II organizations (slightly). Group III organizations with scores of profit centers and divisions showed no correlation between the rank and location of MIS executive and MIS success and negative correlation between rank and effectiveness. The explanation might be that MIS executives in large organizations may be too removed physically to have any psychological and organizational benefits and may even manifest bureaucratic tendencies.

CONCLUSION

This study attempts to make a case on the importance of using organizational context variables to measure MIS effectiveness and success. The selected organizational context variables from Ein-Dor and Segev's (1978) conceptual framework gave mixed results in measuring perceived MIS effectiveness and success for different organizations' size with different MIS structures. Out of the eight hypotheses in the study the variables resources and maturity failed to show associations with MIS success and effectiveness for the small or Group I organizations. This may be due to the cross-sectional character of the study. However, the organizational context variables selected for this study were correlated to IS effectiveness and success to substantial degree for Groups II and III organizations with the exception of lack of correlation between rank and effectiveness for Group III. The inconsistency of some of the findings, across different groups of organizations with different MIS structures, may be due to the fact that there is no best way to structure MIS indiscriminately solely by the size and complexity of the organization. The results obtained in this study have strong implications for both researchers and practitioners. MIS effectiveness and success is probably situational — contingent upon other behavioral and institutional factors — and it may not be possible to measure completely and globally by the perceptions of organizational context variables and discern causality of variables. Nevertheless, this study provides additional evidence to support prior conjectures on the importance of organizational context variables to understand information systems success and effectiveness.

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APPENDIX 1

Correlation Results Between Organizational Context Variables
and Independent Variables of MIS Success

Variables	Group I (n=27)	Group II (n=34)	Group III (n=40)
Size/Qual	-0.22	-0.33*	-0.2
Reso/Qual	0.17	0.17	-0.11
Matu/Qual	0.017	0.76***	0.59***
Rank/Qual	0.58***	0.09	0.29**
Size/Sati	-0.24	0.11	-0.21*
Reso/Sati	-0.01	0.29**	-0.19
Matu/Sati	0.79***	0.11	0.50***
Rank/Sati	0.61***	0.03	0.21*
Size/Perf	-0.33**	-0.12	-0.40**
Reso/Perf	0.04	0.173	0.23*
Matu/Perf	-0.16	0.45**	0.30**
Rank/Perf	0.46*	0.21	-0.31**

* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$

APPENDIX 2

Correlation Results Between Organizational Context Variables
and Independent Variables of MIS Effectiveness

Variables	Group I (n=27)	Group II (n=34)	Group III (n=40)
Size/Prod	0.17	0.34**	0.35**
Reso/Prod	-0.007	0.18*	0.25**
Matu/Prod	-0.018	0.47**	0.53***
Rank/Prod	0.73***	0.05	0.03
Size/Adap	-0.083	0.31**	-0.04
Reso/Adap	-0.25	0.28*	0.27**
Matu/Adap	0.19	0.66***	0.69***
Rank/Adap	0.73***	-0.35**	-0.11
Size/Flex	0.12	0.30*	0.20
Reso/Flex	-0.25	0.25*	0.21*
Matu/Flex	0.20	0.70***	0.69***
Rank/Flex	0.76***	-0.23*	0.22
* p < 0.1 ** p < 0.05 *** p < 0.01			

