

THE RECIPROCAL IMPACT OF STRATEGIC INFORMATION SYSTEMS ON ORGANIZATIONAL STRUCTURE

by Andrew Aken

ABSTRACT

The age we live in has made us dependent upon Information Systems. However, developing and utilizing Information Systems strategically is still relatively misunderstood. Additionally, the impact that Information Systems have on the structure of organizations has been studied recurrently (with little consensus on what that impact may be), but the impact that Organizational Structure has on the manner in which systems are developed has received considerably less attention. This paper will combine the disparate theories on the impact of SISs on Organizational Structure and develop a new theoretical model to examine the reciprocal interactions between Strategic Information Systems (SISs) and Organizational Structure and the factors which may moderate this relationship.

Keywords: Business value of IS, Change theory, Corporate Strategy, Strategic information systems, Organizational change.

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Introduction

We currently live in the “information age” which is the current phase in society which began towards the end of the twentieth century. This phase is marked by dramatic increases in production, transmission, utilization and reliance on information and is changing our social and economic behavior as dramatically as did the Industrial Revolution (Harvard 2007). Of course, it was through the development of computers and methods of interconnecting them that the “information age” was brought about. Consequently, as Brereton noted, we are becoming increasingly dependent on substantial Information Systems (Brereton 1999). Information Systems include a variety of applications from word processors such as Microsoft Word to custom-built Enterprise Resource Planning software designed to control all aspects of the supply chain.

As a result, the development of Information Systems has become necessary for businesses to compete in today’s environment much as the mechanization of the assembly process became a necessity for organizations to be competitive in the industrial revolution. What may not be as apparent, however, is that the implementation and utilization of these systems is likely to have an impact on the structure of the organizations employing them. One would expect that this dramatic of a societal impact would result in an unequivocal modification to the very structure of organizations much as the industrial revolution modified the structure of organizations and our perceptions regarding how they function. However, no matter what importance is placed on technology, it is not the single determinant of organizational structure, nor is it a simple determinant (Jelinek 1977). Not surprisingly, some studies seem to indicate that Information Systems have had little, if any, impact on organizational structure (Fennell 1984; Robey 1981). Other studies, conversely, have been able to demonstrate significant change to organizational structure (Huber 1990; Jelinek 1977; Pfeffer 1977) as one might have originally surmised. One must assume, then, that under certain conditions there are characteristics of the firm or the deployment of Information Systems which will impact their effect on organizational structure. Alignment of IS with the strategy of an organization and user acceptance of an IS have both been identified as precursors to successful implementation of IS (Ewusi-Mensah 2003), but identification of the conditions under which IS impacts and is impacted by organizational structure has not been fully developed in the previous literature.

These organizational changes and the overall impact of Information Systems cannot be fully understood without having an understanding of the technologies involved and the organizational context in which they are being utilized (Orlikowski 2001). Given the broad interest among researchers in the relationship between IS and the structure of the organization, it is disturbing to find that researchers have yet to study what factors might influence the design, use, and consequences of using these Information Systems within or across organizations (Orlikowski 2001). In this article, we will review the existing literature to see under what conditions organizations can make effective use of Information Systems and propose a theory regarding how organizational structure, strategy, user acceptance, and Information Systems are interrelated.

Literature Review

One of the distinctive characteristics of Information Systems is that they facilitate significant changes in business processes and organizational structure (Dedrick 2003). Dedrick goes so far as to suggest that organizational changes should accompany IS development. Likewise, Pfeffer (1977) states that “information technology substantially alters the mechanisms and the nature of organizational coordination and control, and, therefore, has direct causal effects on the structure of the organization.” However, others have suggested that there is variability in the impact on organizational structure caused by Information Systems which are compatible with a variety of organizational structures (Robey 1981). However, this is not the only interaction between organizational structure and IS. IS has implications for structure and structure can also constrain innovation (Miller 1988).

Information Technology vs. Information Systems

Throughout the literature relating to Information Technology (IT) and Information Systems (IS), the two terms are often used interchangeably with little regard for defining the scope of the terms (some research also refers to Management Information Systems (MIS) as synonymous to these terms as well). As it relates to this research, Information Technology will refer to the hardware (e.g., equipment, machines, etc.) and software used in data processing, input/output, and communications (Orlikowski 1992). Information Systems, however, is a much broader construct which includes all of the facets of IT together with the information, systems, processes, and personnel within an organization necessary to utilize the technology.

Information Technology may be purchased from outside vendors or they may be developed in-house. This research will focus on those systems which are developed in-house as they will be unique to the organization employing them. Consequently, technological component of this research will be primarily concerned with the development of unique Information Systems and more specifically the effort that goes into the development of IS (Hartono 2003). IS development processes focus on the purposes of the systems, how they were conceived, and inclusion of the key stakeholders throughout the development process (Robey 1981).

Dimensions of Organizational Structure

According to Pugh, et al. (1968), Organizational Structure can be described along six primary dimensions: Specialization, Standardization, Formalization, Centralization, Configuration, and Flexibility. Although the results of the Pugh (a/k/a The Aston group study) study and the utilization of different dimensions of organizational structure have come under fire (Child 1972), subsequent studies have been conducted which reaffirm that different dimensions of organizational structure exist as in the Aston group study (Reimann 1973).

Specialization

Specialization refers to how an organization divides the labor force within the organization and how the tasks are distributed among the different positions in the organization. A highly specialized organization will have discrete tasks assigned to a specific individual or group within the organization and a non-specialized organization will have multiple tasks performed by a single individual or group (Pugh et al. 1968). The number of job titles or occupation types is often used as a proxy for indicating the amount of specialization in an organization (Damanpour 1991).

Standardization

Standardization refers to the procedures carried out by an organization. A highly standardized organization will be one in which the tasks to be performed are static and well-defined (the Bureaucratic organization). A low level of standardization in an organization would be one in which the set of tasks to be completed are variable (Pugh et al. 1968).

Formalization

Formalization refers to the documentation of the procedures required to complete a task within the organization. A highly formalized organization will be one in which regularly occurring procedures are all well documented and rules for defining how the tasks are all-encompassing. A low level of formalization in an organization would be one in which the groups performing the task are given flexibility in determining how the task is to be completed (Pugh et al. 1968).

Centralization

Centralization refers to where the locus of authority and decision-making within the organization is found. In a highly centralized organization, decisions which affect the organization are going to be handled by a small group of individuals high in the hierarchy of the organization. In a decentralized organization, the ability to make organization-affecting decisions is dispersed to more individuals at lower levels within the hierarchy (Pugh et al. 1968).

Configuration (vertical differentiation)

Configuration is measured along two different dimensions: The vertical span of control and the lateral span of control. The vertical span (or height) of control refers to the number of discrete job positions between the top management (e.g., the CEO) and the lowest level of workers (those directly working on the output). The lateral span of control relates to both the height and the breadth of the control within the organization and can be expressed in terms of the percentage of the direct-output workers to the total number of workers within the organization. The measurement for Configuration will be along the vertical dimension since as the vertical dimension decreases while maintaining the same number of personnel, the horizontal dimension will increase (Pugh et al. 1968).

Flexibility

Flexibility involves the changes in the structure within the organization. A highly flexible organization is able to adapt their structure to be able to handle new or complex tasks and an inflexible organization would be one in which the other dimensions of structure remain static throughout the task or regardless of what task is being worked on (Pugh et al. 1968).

IS Strategic Alignment

IS Strategic Alignment refers to the alignment between the corporate level strategy and their utilization of IS. Consequently, IS Strategic Alignment is a measurement of how closely aligned the Information Systems under development are to the Corporate Strategy. Those which are closely aligned can be termed Strategic Information Systems (Kearns & Sabherwal 2007).

Strategic Information Systems

Strategic Information Systems (SIS) represent those Information Systems which are designed to implement a portion of an organization's specified strategy. They are typically mission-critical systems which implement or interoperate with other applications such as customer management, inventory control, etc. SISs are also future-oriented and require the vision of senior strategists, human & financial resources, and an organizational culture which values information systems (Klenke 1993).

Strategic Information Systems Planning

Strategic information systems planning (SISP) "is the process of identifying a portfolio of computer-based applications that will assist an organization in executing its business plans and realizing its business goals" (Hartono 2003). The process of developing strategic information systems, consequently, is highly dependent on organizational size, structure, and culture and their development and adoption in this context is the focus of this research.

Strategic Information Systems and Organizational Structure

In 1981, Robey found that adoption of IS in most cases did not result in substantive changes in organizational control, but where the changes did occur it resulted in centralization of the organizational structure and decentralization of decision-making authority (Robey 1981). However, Robey (1999) later identified an inconsistency in the impact of technology on organizations which he explained as a "logic of opposition" in which forces both impede and promote change. The model that we have suggested accounts for this paradoxical arrangement. Orlikowski (1992) suggested a structural model of technology to define how it is related to and interacts with its surroundings in order to better understand how and under what circumstances IS impact organizational structure. In her proposed relationship, the forces of organizational change impact each other reciprocally.

Theory of the Reciprocal Interactions between Strategic Information Systems and Organizational Structure

In this theoretical model, we will explore how the development of Information Systems may alter each of the dimensions of corporate structure, how that effect is moderated by both the alignment with the strategy of the

organization and user acceptance of the technologies. Additionally, we will show how certain elements of the organizational structure will also have an impact on the Information Systems development processes.

Miller (1988) has suggested that innovation requires a high degree of role specialization to perform a broad array of tasks related to the innovation. This innovation will require a high degree of specialization as experts are employed to perform a wide variety of innovation-related tasks. This is further supported by other research (Burak 1967; Jelinek 1977) who found that as technical complexity increases, the complexity of the organization will increase since jobs become more specific to handle adjusting the processes and protecting the technology rather than working directly with the products themselves.

Proposition 1a: Information Systems development will cause an overall increase in the specialization of an organization as more experts are required to work with the advanced IS.

According to Huber (1990), IS has dramatically increased the methods of communication and provided significant utilities for aiding the decision process. Consequently, organizations will use care in deciding what IS to use and the number of technologies employed will increase and standardization will decrease. "This is so apparent that no proposition is needed" (Huber 1990). However, the argument for this relationship between IS development and standardization is not so apparent. It can also be argued that since IS automates many of the processes which had been previously carried out manually, standardization will increase with their implementation (e.g, the Supply Chain Management module of an ERP system may automate the process of provisioning raw materials from the suppliers based upon a set of pre-selected criteria rather than leaving it up to an individual on when and how to order the necessary supplies).

Proposition 1b: Information Systems development will increase the amount of standardization within an organization as the tasks performed by the organization become more automated.

Blau & Schoenherr (1971) have argued that technology is often used by organizations to routinize certain tasks and control the manner in which tasks that are performed by the employees. Organizations can accomplish this by using IS to document processes and procedures used to accomplish the tasks being carried out or by providing an even more rigid structure which is implemented directly from the IS. Pfeffer (1977) also argued that the reports and statistics created through the use of IS also result in more formalization in the organization. These uses of IS all result in highly formalized processes in which tasks are accomplished.

Proposition 1c: Information Systems development will increase the amount of formalization within an organization as methods for documenting tasks and procedures become easier to develop and disseminate.

The most contentious dimension of organizational structure is Centralization. Previous authors have debated what the impact Information Systems have on moving organizations towards a centralized decision-making structure or a decentralized structure (Robey 1977; Robey 1981). Some authors have contended that Information Systems lead to centralization of organizational structure since higher levels in the organization have easier access to accurate information (Blau et al. 1976; Whistler 1970). Other authors have concluded that Information Systems lead to decentralization since people at lower levels in the organization are enabled to make more routine decisions (King 1978). For those that argue that IS implementation leads to decentralization, the decision-making authority that is being pushed out to the lower levels in the organization are generally routine decisions with little long-term impact. The enforcement of control through formalization actually increases the power at the upper levels of the organization while reserving the strategic decisions at that level (Blau & Schoenherr 1971). So even though medial decisions may become more decentralized as noted in prior research, the more significant decisions are still centralized (Robey 1981).

Proposition 1d: An organization will become increasingly centralized as Information Systems development progresses and strategic-level decisions are more frequently supported by the Information Systems.

Pfeffer (1977) argued that because IS allow managers to increasing their ability to process and handle large quantities of information, they are more capable of controlling and coordinating complex organizations. Hitt (1999) expanded this view of impact of IS on organizational configuration by stating that increased use of IS decreases vertical integration and overall firm size while slightly increasing its diversification (decreasing the depth of the hierarchy while increasing its breadth). Schwarz (2002) suggests that the only way for organizations to prosper is to reduce the organizational hierarchy and IS seem to be adept at promoting this change.

Proposition 1e: The vertical depth of the hierarchy in an organization will decrease as Information Systems are developed which will allow managers to supervise more workers (increasing the lateral span of the organization).

In Pfeffer's research, one facet of the study was related to the number changes in product design and size as it relates to their measure for Information Technology. They found that as the use of IT increases, the changes in product design and size also increased suggesting an increase in the flexibility of the organizations which is required to handle these new or complex tasks. Likewise, as Information Systems become more diverse and permeate more components of the organization, the technology can be utilized on a broader range of products (Jelinek 1977).

Proposition 1f: Organizations will become more flexible as Information Systems are developed which allow them to handle new and more complex tasks.

If Information Systems are to be successful, they must integrate with the information needs of the organization as well as with management activities (Martin 1988). Failure of management to effectively integrate IS with corporate strategy limits their effectiveness (Dedrick 2003). Aligning the IS with the business' strategy dramatically increased the payoffs from those investments (Tallon et al. 2000). Although IS can be developed which increase the efficiency of an organization (e.g., data processing systems) and may consequently increase cost savings, unless they are aligned with the information needs and goals of the organization, they will not increase the overall organizational effectiveness (King 1978).

It is widely acknowledged that most implementations of IS fail to achieve their goals (Ewusi-Mensah 2003). It is estimated that about 71% of IS projects are unsuccessful. Some of the primary reasons for failure of IS projects is that they don't have managerial support or they aren't aligned with the goals or strategy of the organization (Ewusi-Mensah 2003).

Proposition 2: The effects in propositions 1a thru 1f will increase as Information Systems development becomes more closely aligned with the corporate strategy (those IS which are very closely aligned are termed Strategic Information Systems).

Another common reason found for the failure of Information Systems implementation is that the needs of the users of the systems being developed are not accounted for (Ewusi-Mensah 2003). User acceptance of technology is critical to its success and without a successful implementation of an IS, it will not likely have an effect on organizational structure.

The process utilized for developing Information Systems can go a long way towards increasing its chances of being accepted by the users. To increase the likelihood of user acceptance, developers must incorporate the involvement of all of the key stakeholders in the analysis, design, and development of the IS (Ewusi-Mensah 2003). It is in this aspect of IS development that most systems fail to meet their objectives.

In addition to acceptance of the technology, the timing of its proliferation throughout the organization is also significant in determining its ultimate successful deployment. It has even been suggested that there is only a brief time period from when a new technology is introduced to gain acceptance of the technology and utilize it to its full potential (Tyre 1994).

User acceptance can be measured utilizing the Technology Acceptance Model (TAM) developed by Davis (1989) which relates to two levels of user acceptance: perceived ease of use and perceived usefulness. It is postulated that as User Acceptance increases, the impact of Strategic Information Systems on Organizational Structure will increase. Conversely, if users are not accepting of the Information Systems, their impact on OS will be dramatically diminished.

Proposition 3: If users don't accept the Information Systems being developed, the IS impact on organizational structure will be diminished.

The same forces which lead to increases in formalization, centralization, and flexibility will drive continued development of the Information Systems which initially led to these increases. This feedback loop will result in increasingly complex IS and dependence upon the IS.

Management practices determine much of the variability in the effects of IS (Dedrick 2003). In fact, Dedrick goes on to say that the structure of an organization will have a substantial impact on the effectiveness of those IS. Damanpour (1991) states that certain facets of organizational structure lead to adoption of innovations. Innovation adoption includes among other things internally generated systems, policies, programs, or processes which consequently includes Information Systems. As one component of his meta-analysis, he theorized that as organizations become more specialized, the greater variety of specialists would provide a broader knowledge base which would facilitate innovation.

Proposition 4a: As organizations become more specialized, they will focus more on strategic development of Information Systems.

Damanpour (1991) states that innovation will be more prevalent when organizations are flexible and there is low emphasis on work rules. Consequently, he suggests that low levels of formalization will encourage new ideas and behaviors. Other researchers have suggested that organizations need a well-established, rigid purpose and clearly specified rules for the successful introduction of innovations in organizations (Ettlie et al. 1984; Evan & Black 1967)

The IS literature, however seems to support Evan, Black, & Ettlie, et al. as it relates to the specific innovation of Information Systems development. Ad hoc development practices are not unusual in IS development, but most of these systems failed to achieve their goals or are trivial in nature (Ewusi-Mensah 2003). For significant IS projects to succeed, they need a rigid, formal development process (Aken 2008).

Proposition 4b: As organizations become more formalized, they will become more capable of strategic development of Information Systems.

According to Damanpour (1991) and Thompson (1965), the centralization of the decision-making authority prevents innovative solutions. Their belief is that participatory work environments (which presumably are decentralized) will help to facilitate innovation. However, the power literature would seem to suggest that as organizations become more centralized, the decision-makers will work to retain their power. One method that IS managers can maintain their power is to increase uncertainty through the implementation of new IS.

Proposition 4c: As organizations become more centralized, they will focus more on strategic development of Information Systems.

Damanpour (1991) suggests that managers' favorable attitude toward change will lead to an environment which will improve innovation. This attitude towards change is one of the fundamental components of the flexibility of an organization.

Proposition 4d: As organizations become more flexible, they will focus more on strategic development of Information Systems.

Hull and Hage (1982) postulated that as organizations increase the hierarchical levels (become more vertically differentiated), communications between levels will become more difficult and innovations will decrease. Reducing the hierarchical levels in an organization will also make the organization more nimble which will improve its ability to strategically develop Information Systems.

Proposition 4e: As organizations become less vertically differentiated, they will focus more on strategic development of Information Systems.

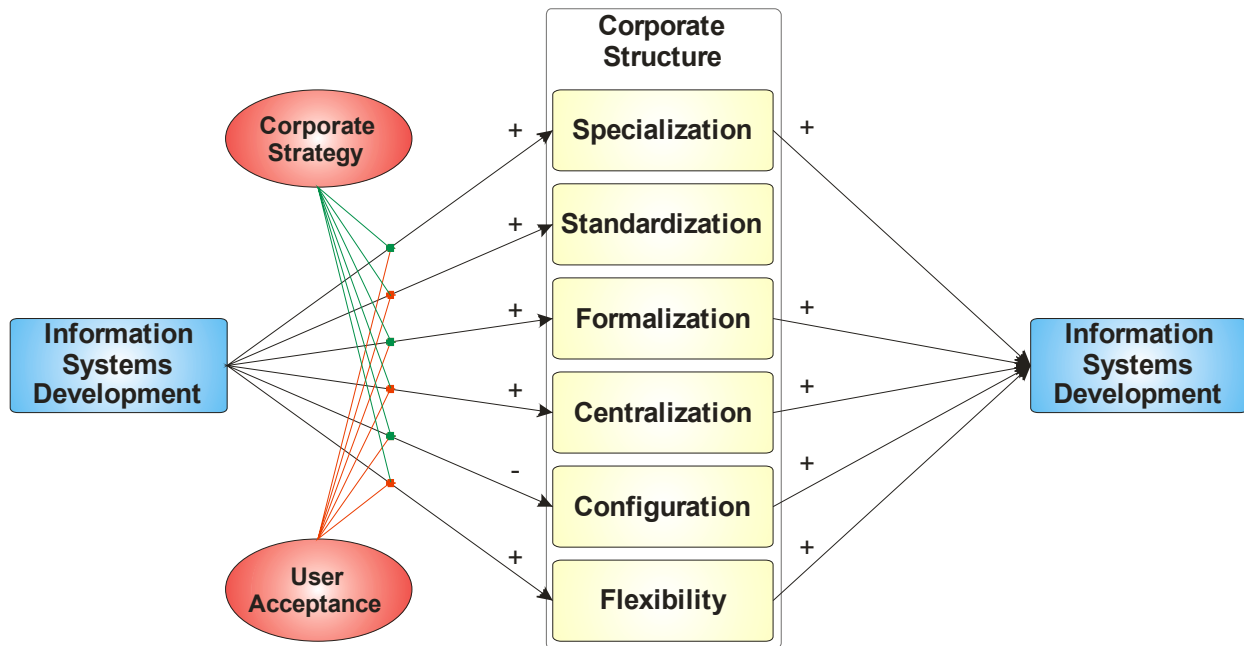


Figure 1: Theoretical Model

The consequence of this model is a traditional feedback loop (Monge 1990). The loop will exhibit exponentially decreasing self-influence as the magnitude of the change in organizational structure will decrease with each iteration following the implementation of a new Strategic Information System. A counteraction effect may exist with regards to some of the dimensions of organizational structure (e.g., Specialization), but the overall effect will be stable. According to Tushman & Anderson (1986) repeated intra-organizational technological discontinuities will exhibit successively lower levels of turbulence, thus decreasing the amount of organizational change exhibited in each cycle.

In the example of the implementation of an Enterprise Resource Planning (ERP) system, an organization may opt to initially implement the Supply Chain Management modules of the ERP system which will likely cause a significant streamlining of the organizational structure throughout the entity. Both the process of the implementation and the subsequent change in organizational structure will likely evolve over a significant period of time. Once the organizational structure has evolved, additional SIS development will ensue. Subsequent SIS implementations (e.g., adding a Customer Relationship Management module to the ERP) will likely have a significant, yet lesser impact on the organizational structure. However, because the organizational structure is now more agile, the subsequent changes will evolve over a shorter period of time. Consequently, the magnitude of the changes will diminish over time, but the frequency will increase.

Proposition 5: The reciprocal impact of Information Systems on Organizational Structure will result in a traditional feedback loop with decreasing orders of magnitude but greater frequency.

Conclusion

Not all organizations are affected equally by Information Systems. There are a number of factors involved which will determine the impact that IS have on organizational size and structure. The primary drivers on the impact that IS have on organizational structure are the incorporation of the IS into the strategy of the organization and a concerted effort to develop Strategic Information Systems.

Consequently, organizational strategy and structure also have an impact on the development of the Strategic Information Systems, themselves. If the organizational scope incorporates a strategy of being innovators or prospectors, organizations are much more likely to pursue development of and be positively impacted by Strategic Information Systems. Likewise, the degree to which an organization is formalized, centralized, and flexible (Pugh &

Hickson 1969) will also help to determine the effort involved in the development of SISs and their overall effectiveness.

This reciprocal relationship between Strategic Information Systems and Organizational structure may result in a positive (“self-reinforcing”) feedback loop (Masuch 1985) where the SISs are continually developed and modified which has subsequent impact on the organizational structure which will in turn cause a change in the SISs. This loop will eventually plateau when the organizational structure becomes as efficient as possible. This relationship is supported in Structuration Theory as well. This theory states that there is a reciprocal interaction between people and organizational structure. In Structuration Theory, individuals’ actions are both enabled and constrained by the structures of the organizations they belong to, but these structures are a direct outgrowth of previous actions by the individuals (Orlikowski 1992). In the context of the theory proposed in this paper, the Structuration Theory holds for IS as well as for people.

References

- Aken, A. 2008. CHUNK: An Agile Approach to the SDLC. *Journal of Internet Commerce* 7, 3 (2008).
- Blau, P.M., Falbe, C.M., McKinley, W., Tracy, P.K. *Technology and Organization in Manufacturing*. *Administrative Science Quarterly*, 21, 1 (Mar. 1976), 20-40
- Blau, P.M., & Schoenherr, R.A. *The structure of organizations*. New York: Basic Books.1971.
- Brereton, P., Budgen, D., Bennet, K., Munro, M., Layzell, P., Macaulay, L., Griffiths, D., and Stannett, C. 1999. *The Future of Software*. *Communications of the ACM* 42, 12 (Dec. 1999), 78-84.
- Burack, E.H. 1967. *Industrial Management in Advanced Production Systems: Some Theoretical Concepts and Preliminary Findings*. *Administrative Science Quarterly*. 12 (1967), 479-500.
- Child, J. *Organization Structure and Strategies of Control: A Replication of the Aston Study*. *Administrative Science Quarterly*. 17, 2 (Jun. 1972).
- Damanpour, F. *Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators*. *The Academy of Management Journal*. 34, 3, (Sep. 1991), 555-590.
- Dedrick, J., Gurbaxani, V., and Kraemer, K. L. 2003. *Information technology and economic performance: A critical review of the empirical evidence*. *ACM Comput. Surv.* 35, 1 (Mar. 2003), 1-28.
- Ettlie, J.E., Bridges, W.P., & O’Keefe, R.D. 1984. *Organization strategy and structural differences for radical versus incremental innovation*. *Management Science*. 30 (1984), 682-695.
- Evan, W.M. & Black, G. 1967. *Innovation in business organizations: Some factors associated with success or failure*. *Journal of Business*. 40, (1967), 519-530.
- Ewusi-Mensah, K. 2003 *Software Development Failures*. MIT Press.
- Fennell, M. L. 1984. *Synergy, influence, and information in the adoption of administrative innovation*. *Academy of Management Journal*. 27 (1984), 113-129.
- Hartono, E., Lederer, A.L., Sethi, V., and Zhuang, Y. 2003. *Key Predictors of the Implementation of Strategic Information Systems Plans*. *DATA BASE*, 34, 3
- Harvard Law School, 2007. *Glossary*. <http://cyber.law.harvard.edu/readinessguide/glossary.html> (accessed: 23 October 2007).
- Hull, F. & Hage, J. 1982. *Organizing for innovation: Beyond Burns and Stalker's organic type*. *Sociology*. 16 (1982), 564-577.
- Jelinek, M. 1977. *Technology, Organizations, and Contingency*. *The Academy of Management Review*. 2, 1 (Jan. 1977), 17-26.
- Kearns, G. and Sabherwal, R. 2007. *Strategic Alignment Between Business and Information Technology: A Knowledge-Based View of Behaviors, Outcome, and Consequences*. *J. Manage. Inf. Syst.* 23, 3 (Jan. 2007), 129-162.
- King, W.R. 1978. *Strategic Planning for Management Information Systems*. *MIS Quarterly*. 2, 1 (Mar. 1978), 27-37
- Klenke, K. 1993. *Changing roles of information systems professionals: from technical managers to strategic leaders*. In *Proceedings of the 1993 Conference on Computer Personnel Research* (St Louis, Missouri, United States, April 01 - 03, 1993). M. R. Tanniru, Ed. SIGCPR '93. ACM Press, New York, NY, 214-225.
- Lee, G. and Xia, W. 2006. *Organizational size and IT innovation adoption: A meta-analysis*. *Information Management*. 43, 8 (Dec. 2006), 975-985.
- Masuch, M. 1985. *Vicious Circles in Organizations*. *Administrative Science Quarterly*. 30, 1 (Mar. 1985), 14-33.
- Miller, D., Droge, C., Toulouse, J. *Strategic Process and Content as Mediators between Organizational Context and Structure*. *The Academy of Management Journal*, 31, 3 (Sep. 1988), 544-569.

- Monge, P.R. 1990. Theoretical and Analytical Issues in Studying Organizational Processes. *Organization Science*. 1, 4 (1990), 406-430.
- Orlikowski, W.J. 1992. The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science*, Vol. 3, No. 3. (Aug., 1992), pp. 398-427.
- Orlikowski, W.J., Barley S.R. Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn from Each Other? *MIS Quarterly*, 25, 2 (Jun. 2001), 145-165.
- Pfeffer, J., Leblebici, H. Information Technology and Organizational Structure. *The Pacific Sociological Review*. 20, 2 (Apr. 1977).
- Robey, D. 1981. Computer information systems and organization structure. *Commun. ACM* 24, 10 (Oct. 1981), 679-687.
- Orlikowski, W.J. 1992. The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science*, Vol. 3, No. 3. (Aug., 1992), pp. 398-427.
- Pugh, D.S., Hickson, D.J., Hinings, C.R., Turner, C. Dimensions of Organization Structure. *Administrative Science Quarterly*, 13, 1 (Jun. 1968), 65-105.
- Reimann, B.C. 1973. On the Dimensions of Bureaucratic Structure: An Empirical Reappraisal. *Administrative Science Quarterly*. 18, 4 (Dec. 1973), 462-476.
- Schwarz, G.M. Organizational Hierarchy Adaptation and Information Technology. *Information and Organization*, 12 (2002), 153-182
- Thompson, V.A. 1965. Bureaucracy and innovation. *Administrative Science Quarterly*. 10 (1965) 1-20.
- Tushman, M.L. & Anderson, P. 1986. Technological Discontinuities and Organizational Environments. *Administrative Science Quarterly*. 31, 3 (Sep. 1986), 439-465.