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Information Systems and the Organization of Modern Enterprise

Presented to the Academic Department of the School of Science and Engineering in Partial fulfillment of the Requirements for the Award of Bachelor's Degree in Information Technology.

Atlantic International University

CONTENTS

ACKNOWLEDGEMENT

The successful completion of this research work cannot be entirely attributed the skill, duty or dedication of the writers. Much help and guidance came from many sources, individuals, groups and institutions. To this end I generally acknowledge such efforts.

I would therefore wish to acknowledge and credit of the work of my Advisor ***(Ann Murphy)*** her comments and criticisms, suggestions and dedicated guidance she offered throughout the duration of program are highly appreciated.

Also my unreserved gratitude goes to my parents, relatives and all other well wishers for their supports and assistance they rendered before, during and after the research work.

May Almighty **GOD** bless you all and reward you abundantly.

ABSTRACT

This paper, addresses relationships between information systems and changes in the organization of modern enterprise, both within and across firms. The emerging organizational paradigm involves complementary changes in multiple dimensions. The revolution in information systems merits special attention as both cause and effect of the organizational transformation. This can be illustrated by considering two key variables: the location of information and the location of decision rights in organizations. Depending on the costs of information transmission and processing, either the "MIS solution" of transferring information, or the "organizational redesign solution" of moving decision rights, can be an effective approach toward achieving the necessary collocation of information and decision rights. When information systems change radically, one cannot expect the optimal organizational structure to be unaffected. Considering the interplay among information, incentives and decision rights in a unified fashion leads to new insights and a better organizational planning. The paper addresses different facets of this interaction. Despite significant progress, our understanding of the economic role of information systems in organizations remains in its infancy in our part of the world. I conclude that successful design of modern enterprise will require further narrowing of the historic gap between research in information systems and research in economics.

The organization of work is in the midst of transformation. In many industries, mass production by large, vertically-integrated, hierarchically-organized firms is giving way to more flexible forms of both internal organization and industrial structure. Work is increasingly accomplished through networks of smaller, more focused enterprises. The resulting structure of loosely coupled sub-organizations blurs the boundaries of both firms and industries.

A canonical case in point is the computer industry. In the past, the industry was dominated by large, vertically-integrated firms such as IBM and Digital Equipment which created products and services throughout the value chain -- from the microprocessor level all the way up to the provision of solutions. The vertical structure is now being replaced by a series of layers, each of which is, in

effect, a separate industry. Value is generated by ever-changing coalitions, where each member of a coalition specializes in its area of core competence and leverages it through the use of tactical or strategic partnerships. Internally, team structures are replacing the traditional hierarchical form, and the Silicon Valley model of internal organization is emerging as a clear winner. Internal incentives are increasingly based on performance, and this further blurs the differences between inter- and intra-firm contracts. In sum, modern enterprise is undergoing major restructuring.

This paper briefly discusses the newly emerging organizational paradigms and their relationship to the prevailing trends in information technology (IT). It argues that IT is an important driver of this transformation.

CHAPTER ONE

INTRODUCTION

At the turn of the century, Frederick Taylor sought to put the nascent wisdom for successful business organization on a scientific basis. His work guided a generation of managers towards success in meshing their organizations with the technologies, markets, labor and general environment of the era. By the 1920s, Henry Ford had applied the Taylorist approach with a vengeance and soon dominated the automobile market, driving dozens of competitors under. Ironically, these same principles are almost diametrically opposed to the prevailing wisdom of the 1990s. For example, consider the following guideline from *The Science of Management [1]*

> It is necessary in any activity to have a complete knowledge of what is to be done and to prepare instructions... the laborer has only to follow instructions. He need not stop to think.

The current emphasis on "empowerment", "learning organizations", and even "thriving on chaos" stands in sharp contrast to Meyers' advice (cf. [2] , [3]). Similar contrast can be found with many, if not most, of the other principles that lead to success even as late as the 1960s. Consider, for example, the growing calls for downsizing (vs. economies of scale), focus (vs. conglomerates), total quality (vs. cost leadership), project teams (vs. functional departments), supplier partnerships (vs. maximizing bargaining power), networked organization (vs. clear firm boundaries); performance-based pay (vs. fixed pay), and local autonomy (vs. rigid hierarchy).

Milgrom and Roberts [4] make the point that the different characteristics of modern manufacturing, an important example of the emerging organizational paradigm, are often highly complementary. This complementarily, coupled with the natural tendency to change organizational attributes one at a time, makes the transition from one paradigm to another particularly difficult. Strong complementarily implies that in order to be successful, change must be

implemented simultaneously along a number of related dimensions. Organizations that adopt only one or two key components of the new organizational paradigm may fail simply by virtue of this complementarily. For instance, Jaikumar's [5] study of 95 US and Japanese companies found that the majority of US companies had failed to achieve productivity increases despite switching to flexible manufacturing technology. The reason was that they had preserved dozens of manufacturing practices such as long production runs and high work-in-process inventory levels, which complemented the old technology but kept the new technology from fulfilling its potential. Thus, the transition from the old structure to the new one is overwhelmingly complex. The switch would be easier if we apply design guided by theory instead of piecemeal evolution.

There are many possible explanations for the change in the prevailing wisdom regarding organizational design. For instance, it is common to justify calls for radical change with reference to heightened competitive pressures: although firms that applied the old principles were among the most successful competitors of their day, presumably the nature of competition has changed in some way. Others suggest that consumer tastes have changed, making customized items more appealing than they once were. While historians would argue that the taste for mass marketed items was itself something that had to be developed in the early days of mass production, increased wealth or social stratification may make this more difficult today. It can also be argued that some of the new principles were as applicable fifty years ago as they are today, but that they simply had not yet been discovered.

Although the enablers of the current organizational transformation are undoubtedly numerous and far from mutually independent, I would like to single one out for special reference-Information Technology: the rise in IT. Brynjolfsson [6, p.6] argues that IT is an appropriate candidate for explaining these changes for three reasons:

CHAPTER TWO

DEFINITION OF THE ISSUE

Each of the proceeding papers addresses a different aspect of the interplay among information, incentives and the structure of economic enterprise. In every case, insights resulted when both information and incentives were explicitly considered. Each paper contributes an additional piece to an emerging mosaic that describes not only the features of the new organization, but also gives some insight into their theoretical underpinnings.

The papers in this issue also highlight the incomplete state of knowledge in the subject area and the dearth of empirical guidance to the formulation and testing of theoretical research. This paper was started with a discussion of the computer industry as the canonical example of the new paradigm as exercised in Silicon Valley, and continued by arguing that its products actually fuel the shift to this paradigm. It is only appropriate to close the loop by examining the dictum of that paradigm as it applies to the inner workings of firms in the computer industry. Understanding these changes so that they can be harnessed for productive ends remains a central challenge for the next decade of research. The rapid progress in designing computers and communications systems contrasts starkly with the uncertainty clouding organizational design. Yet, new ways of organizing will be necessary before the full potential of IT can be realized.

Furthermore, because the new organizational paradigms involve numerous complementarities, the trial-and-error methods which were important in the rise of the organizational forms of the past century, such as large hierarchies and mass markets, may be unsuited for making the next transition. Understanding and implementing one aspect of a new organizational structure without regard to its interaction with other aspects can make the organization worse off than if no modifications at all were made. Design, rather than evolution, is called for when significant changes must be made along multiple dimensions simultaneously.

> First, compared to other explanations, the advances in information technology have a particularly reasonable claim to being both novel and exogenous. Many of the fundamental technological breakthroughs that enable today's vast information infrastructure were made less than a generation ago and were driven more by progress in physics and engineering than business demand. Second, the growth in information technology investment is of a large enough magnitude to be economically significant ... the result has been what is commonly referred to as the "information explosion"... Third, there is a sound basis for expecting an association between the costs of technologies that manage information and the organization of economic activity. The firm and the market have each been frequently modeled as primarily information processing institutions (see Galbraith [7] and Hayek [8] respectively).

Miller [9] foresaw the key features of the new paradigm as a natural outcome of the information era and the associated "economy of choice":

> The new technologies will allow managers to handle more functions and widen their span of control. Fewer levels of management hierarchy will be required, enabling companies to flatten the pyramid of today's management structure. The new information technologies allow decentralization of decision-making without loss of management awareness; thus employees at all levels can be encouraged to be more creative and entrepreneurial. The key responsibility of the CEO will be leadership; to capture the light or energies of the organization -- like a lens -- and focus them on the key strategic objectives.

The new organizational paradigm is indeed intertwined with the structure of an organization's information systems. Under the old paradigm, the firm was governed by a relatively rigid functional structure. This separation into distinct and well-defined organizational units economizes on the information and communications requirements across functional units and reduces cost and complexity. There is a tradeoff, however: the old structure is less flexible, less responsive and ultimately results in lower quality. In my view, the growing use of IT and the trend towards networking and client-server computing are both a cause and an effect of the organizational transition. Lowering the costs of horizontal communications, facilitating teamwork, enabling flexible manufacturing and providing information support for time management and quality control are key enablers on the supply side. It is equally clear that the new organizational paradigm demands new information systems: nothing can be more devastating for cross-functional teamwork than a rigid information system that inhibits cross-functional information flows. We can unify these perspectives by noting that the structure of the organization's information system is a key element of organizational transformation. Changes in IT change the nature of organizations just as changes in organizational structure drive the development of new technologies.

CHAPTER THREE

DYNAMICS OF THE ANTCIPATED SOUTIONS

Jensen and Meckling [10] provide a useful framework for studying the complementarities between information systems, incentive structures and decision rights in organizations. In their framework, the structure of an organization is specified by three key elements: (i) The allocation of decision rights (i.e., who is responsible for what actions/decisions); (ii) the incentive system, which defines how decision makers are to be rewarded (or penalized) for the decisions they make; and (iii) a monitoring and measurement scheme used to evaluate these actions and their outcomes.

According to Jensen and Meckling, informational variables are key to the structure of organizations because the quality of decisions is determined by the quality of information available to the decision maker. The co-location of information and decision rights enables the decision maker to make optimal decisions. The implementation of this co-location depends on the nature of the pertinent information. Jensen and Meckling distinguish between "specific knowledge" which is localized, difficult to represent and transfer, and depends on idiosyncratic circumstances, and "general knowledge" which can be easily summarized, communicated and shared by decision makers.

Now, there are two ways to bring information and decision rights together: (i) "*The MIS solution*": transfer the information required for the decision to the decision maker, using the organization's (possibly non-automated) information systems; or (ii) "*the organizational redesign solution*": redesign the organizational structure so that the decision making authority is where the pertinent information is. By definition, general knowledge which is useful for a decision calls for the "MIS solution" because it can be transferred at low cost. In contrast, when specific knowledge plays a key role in a decision, the best solution calls for restructuring decision rights so as to provide the decision authority to the one

who possesses or has access to the pertinent information (since the transfer of Specific knowledge is too costly).When this happens, the organization has to design its incentive system so as to induce decision makers to optimize an objective function that approximates the organization's goals. Thus agency and information problems are closely related.

Jensen and Meckling thus represent the structure of organizations as an efficient response to the structure of their information costs. But then, a change in information costs must induce a change in organizational structure. In particular, IT has changed the costs of processing and transferring certain types of information (e.g. quantitative data), but has done little for other types (e.g. implicit knowledge or skills). IT changes the structure of organizations by facilitating certain information flows as well as by turning knowledge that used to be specific into general knowledge. By developing taxonomy of information types and identifying the differential impacts of new technologies on their transferability and importance, we can take a significant step towards applying the simple insight that information and authority should be co-located [11]

Intra-organizational networks and workgroup computing facilities reduce the information costs of teamwork and hence make it a more efficient solution to the organizational design problem. Client-server computing technology lowers cross-functional (as well as geographic) barriers. IT (when applied properly) streamlines the types of information that used to be the raison d'etre of middle management -- quantitative control information -- and turns it into general knowledge that can be readily transmitted to, and processed by, people other than those who originally gathered the data. A reduction in the number of management layers and the thinning out of middle management ranks is the predictable result.

Similar considerations apply to enterprises that cross firm boundaries. As a simple example, consider the organization of trading activities [12, 13, 14] Traditionally, trading took place on the floor of an exchange, which was the locus

of numerous pieces of specific knowledge, ranging from the hand signals indicating bids and offers to buy and sell a security to traders' facial expressions and the "atmosphere" on the floor of the exchange. Under that structure, much of the information pertinent to trading is specific and localized to the floor. Thus, when an investor instructs her broker to sell 1,000 shares of a given stock, the broker transmits the order to the floor of the exchange and only the floor broker attempts to provide "best execution". The decision rights (here, for the trading decisions) are naturally delegated to the decision maker who has the pertinent specific knowledge, and since that knowledge resides on the floor of the exchange; the floor broker is best suited to have the decision rights. Technology, and in particular "screen-based" systems, turns much of the specific knowledge on the floor (i.e., bids and offers) into general knowledge. This shifts decision rights up from the floor to the brokers' screens. The inevitable result is the decline of the trading floor and the increased importance of brokers' trading rooms. The demise of the trading floor in exchanges that turned to screen-based trading (such as London and Paris) is a natural outcome of the shift in the locus of knowledge. More generally, markets -- in particular, electronic markets -- transform specific knowledge into general knowledge [15]

Ironically, even as IT has sped up many links of the information processing chain and vastly increased the amount of information available to any one decision-maker, it has also led to the phenomenon of "information overload". This can perhaps best be understood by a generalization of the Jensen and Meckling framework to include finite human information processing capacity. As more information moves from the "specific" category to the "general" category, the limiting factor becomes not what information is available but rather a matter of finding the human information processing capacity needed to attend to and process the information. Computers appear to have exacerbated the surfeit of information relative to processing capacity, perhaps because the greatest advances have occurred in the processing and storage of structured data, which is generally a complement, not a substitute, for human information processing.

As computer and communications components increase their speed, the human bottleneck in the information processing chain becomes ever more apparent.

Information overload, when interpreted in the light of this framework, can provide an explanation for the increased autonomy and pay-for-performance that characterize a number of descriptions of the "new managerial work" (cf. [6]). Economizing on information costs means that more decision rights are delegated to line managers who possess the idiosyncratic, specific knowledge necessary to accomplish their tasks. Shifting responsibility from the overburdened top of the hierarchy to line personnel not only reduces the information processing load at the top of the hierarchy, but also cuts down unnecessary communications up and down the hierarchy. This blurs the traditional distinction between "conceptualization" and "execution" and broadens the scope of decision rights delegated to lower level managers. By the Jensen-Meckling [10] framework, any such shift in decision authority (and in the associated routing of information) must also be accompanied by a change in the structure of incentives. Disseminating information more broadly is ever easier with IT, allowing line workers to take into account information that goes well beyond the formerly-narrow definitions of their job.

Meanwhile, providing the right incentives for the newly "empowered" work force is an equally crucial element of the current reorganization of work. Agency theory predicts that performance-based "pay" is necessary when decision rights are decentralized (otherwise, the agents may be induced to act in ways that are inconsistent with overall organizational goals). It therefore follows that incentive-based compensation is appropriate for better-informed workers [16]. Thus, the confluence of better-informed workers, an empowered workforce and more incentive-based pay is consistent with our thesis that IT is a key driver of the new organizational paradigm.

Furthermore, the theory of incomplete contracts suggests that the analysis can be extended to include interorganizational changes such as increased reliance

on outsourcing and "networks" of other firms for key components [17]. Here again the shift can be explained in incentive terms: one ultimate incentive is ownership, so entrepreneurs are likely to be more innovative and aggressive than the same individuals working as "division" managers. Both within and across organizations, then, changes in information systems are accompanied by changes in incentives and in the organization of work.

CHAPTER FOUR

ORGANIZAIONAL SYSTEMS - STRATEGIES AND TECHNIQUES

Systems are composed of interrelated components such that the properties of both the system and its components are changed if the system is disassembled in any way (Ashmos and Huber 1987). There are different levels of systems, ranging from the simple mechanical systems with predetermined, motions of levers and pulleys (e.g., an automobile engine) to complex social organizations acting to accomplish objectives. The systems paradigm focuses on these processes that exist among system components, and between system components and the environment. Systems may be classified as closed or open systems.

Systems may be classified as closed or open systems. For instance cybernetic or control systems of inputs, transformation processes, outputs, and feedback loops that maintain equilibrium. These system components operate within an environment as shown on the next page (figure). The cybernetic system has been used in a variety of disciplines as the general model of the systems paradigm. Cybernetic systems are closed systems, largely unaffected by the environment where they reside. By its definition, a cybernetic system is an inappropriate representation of the complex processes that occur in organizations, and particularly the strategic decision making processes in organizations. (Wiener Norbert 1948) founder of cybernetics “focusing on systems control processes”

Today, organizations exist in competitive global environments where there is strong competition for resources, markets, skilled employees, and innovations. At the same time, many organizations confront environments that are unpredictable and complex. Organizational environments are multifaceted and can be categorized in the following way:

- **The Competition:** The competitive tactics between firms in an industry or business.
- **Customers:** Includes direct sales or companies that acquire another firm's customers through outputs for resale.
- **The Technological Sector:** The development of new production techniques and methods, innovation in materials and products, and general trends in research and science relevant to the organization
- **The Regulatory Sector:** Federal and state legislation and regulations, city or community policies, and political developments at all levels of government
- **The Economic Sector:** Factors such as stock markets, rate of inflation, foreign trade balance, federal and state budgets, interest rates, unemployment and economic growth rate
- **The Sociocultural Sector:** The social values of the general population, the work ethic, and demographic trends. (Daft, Sormunen, and Parks 1988)

First, as **open systems**, organizations are highly engaged with their environments. Successful organizations develop characteristics and perform processes that allow them to adapt to constraints, threats, and opportunities. They import capability from the environment. This capability can be achieved by acquiring another organization through a joint venture; or by improving their human and physical capital; or by obtaining the information needed to transform that capability into desired outputs such as physical goods, services, or a focused set of monetary or operational actions. Next, organizations' transformation processes are cyclical in nature, that is to say they are a predictable, ordered set of processes that might be determined by a budget cycle, a sales cycle, or a growing season. These well-ordered processes create negative entropy, the resistance to disorganization. Negative entropy maintains the reliability of transformation processes in spite of changes in environmental conditions.

Open systems also have environmental scanning processes that might exist in the recruiting directorate, the market

Research department or the complaint department to provide information about the systems performance and to adjust processes within the system.

Another feature of open systems is that they operate under conditions of dynamic homeostasis, the process of preserving the character of the system through its growth. Open systems use internal processes of review to modify their environmental scanning, input, transformation, and output processes to adapt to the environment, while still staying focused on their core competency. These modifications culminate in the quantitative and qualitative growth of an organization's capability to respond to future contingencies.

The systems paradigm is a useful model of the capabilities of government agencies, particularly the Department of Defense. Defense bureaucracies process tremendous quantities of information about the external environment to produce threat analyses, implement processes that transform information about manpower and resources into combat capability, and adjust internal processes for synthesizing information to support all levels of decision making. But there's a potential problem. The Defense Department, to achieve stability, uses sets of standards, to accomplish programmable outcomes. The sets DOD has been using may not be suited to respond to potential environmental challenges.

Change rather than stability has engulfed us. There are endless calls for the reinvention of government, acquisition reform, and defense realignment, as well as cautions about the revolution in global military affairs and the growing threat of terrorism. These changes in the environment have strategic implications beyond the realm of a single decision maker or even a top management team.

- Each issue will have a unique set of environmental factors that have an impact on the organizational system. Which parts of the organization are designed to detect and analyze those factors?

- In light of these issues, can greater efficiencies be derived for obtaining inputs such as funding, raw materials, and human capital?
- Will the challenges posed by the changing environment require radically different transformation processes to generate and sustain the desired level of deterrence and combat capability?

The ability to answer these questions depends on how you frame organizational capability. If you view an organization as a **structural design** (e.g., a battalion), an organizational chart (e.g., a directorate in the Pentagon), a personnel roster (e.g., the comptroller shop) or a surrogate of military or industrial output (e.g., the 82nd Airborne or Boeing Aerospace) then you won't obtain an understanding how processes are translated into capability. You need to adjust your thinking to a **systems perspective** to bring out these dynamics.

From a systems perspective, organizations are collections of human and physical capital that exchange and process information, transform physical objects, and make decisions for the purpose of achieving some set of objectives related to their external environment. From this frame of reference, leaders can find ways to enhance existing processes in the organization, and identify the need for additional processes of environmental analysis to maintain the organization's survivability.

THE SYSTEMS PARADIGM AND STRATEGIC DECISION MAKING

Today, strategic leaders of competitive organizations face the challenge of using their organization's open systems capabilities to respond to present and future environmental challenges. This is a daunting task for any group of strategic leaders, regardless of their intelligence or experience. Leaders at this level are often overwhelmed by the quantity of environmental change. These conditions often place decision makers in situations that are beyond their expertise. In these situations, if a decision has to be rendered, leaders typically rely on their own scanning, analysis, and interpretation of data, albeit fraught with personal biases.

Some leaders are effective using this technique but most strategic issues demand more rigorous approaches towards their resolution.

For the purposes of strategic decision making, organizations can be considered **interpretation systems** (Daft and Weick, 1984). **Organizational interpretation** is defined as "the process of translating events and developing shared understanding and conceptual schemes among members of upper management." Organizational interpretation about strategic issues is more than bureaucratic "staffing". In general, members of organizations support strategic leaders' interpretations by: creating and maintaining the organization's capability to gather information about environmental threats and opportunities; and efficiently analyzing, evaluating and internally synthesizing this information to support the strategic decision making process. Organizational interpretation processes are valuable to strategic decision makers on two counts. First, they reduce the ambiguity of strategic issues by analyzing data from the environment. Next, these processes reduce the uncertainty associated with strategic issues. (For example, decentralized scanning performed by field organizations, lower level divisions, and individual specialists creates more insights to strategic issues in less time.) The ultimate benefit to strategic decision makers is that they can respond to strategic issues more quickly, with higher quality decisions.

If leaders permit their organizations to treat each confrontation with environmental change as a unique experience then, despite performance outcomes, these leaders are not deriving the full capability of organizational interpretation. When organizations develop the capability for **systematic learning** then successful and unsuccessful experiences will influence their future scanning and interpretation processes favorably.

ORGANIZATIONS AS LEARNING SYSTEMS

Learning, whether associated with people or organizations, is a set of processes that produce change. Edwin Nevis, Anthony DiBella, and Janet Gould from the

MIT Organizational Learning Center define organizational learning as "the capacity or processes within an organization to maintain or improve performance based on experience." The purpose of this section is to identify ways leaders can influence these processes to promote learning and improve strategic leadership and decision making.

Earlier in this chapter we described the features of organizations as open systems. Two features among them were relevant to organizational learning:

- The capability of organizations to internally review the effectiveness of systems' processes against the dynamics of the environment and within the parameters of its core competencies.
- Cumulative process modification that results in the quantitative and qualitative growth of an organization's capability to respond to future environmental contingencies.

The first feature highlights the importance of organizational members dedicated to **continuous process improvement**. The phrase "process improvement" is overused, but it means that people should be constantly analyzing how they think, communicate, perform and add value to their organization. The first feature also implies that members need to have an intimate knowledge of the organization's core competencies, how their work contributes to the core competencies, and the environmental factors that are related to those core competencies.

Employees' level of understanding about the organization's core competencies is initiated and reinforced by leadership messages. When leaders communicate how the organization's core competencies are linked to the activities of different organizational subunits, then employees will understand how their daily efforts are translated into organizational capability. Moreover, when leaders communicate the organization's vision, and the values and

ideology that support the organizational culture, they enhance employees' understanding of the organization's strategic objectives.

Organizational leaders must institutionalize the processes of knowledge acquisition. Knowledge acquisition includes activities such as customer surveys, research and development programs, demonstration projects, performance reviews, and the analysis of competitors' products. Informal sources for knowledge acquisition activities include trade publications, televised news and print media. The goal is for knowledge acquisition to be performed continuously as opposed to a singular response from a management inquiry. In an organizational learning system, knowledge acquisition is followed by **information distribution**. Organizational scholar George Huber from the University of Texas at Austin describes information distribution in the following way:

Information distribution is a determinant of both the occurrence and breadth of organizational learning . . . organizational components commonly develop "new" information by piecing together items of information that they can obtain from other organizational units. . . . When information is widely distributed in an organization so that more and more varied sources for it exist, retrieval efforts are more likely to succeed and individuals and units are more likely to learn.

The activity of information distribution has even greater significance when it is performed by employees who are also knowledgeable about the organization's core competencies. At its best, information distribution in learning organizations involves purposeful exchanges of information among divisions in the organization that reduces the efforts of any single division to scan the environment. For example, in learning organizations, the supply division would know what information would be important to the marketing division, the production division, and the accounts division, and would route it to those divisions. Division personnel would also know when to modify the information it distributed, and to whom they distributed it as changes occurred in the organization's environment

and in the organization's strategy. Again, **organizational leaders can facilitate these communication processes**.

Leaders can also establish interdepartmental working groups that have the assigned purpose of sharing acquired information to solve problems or develop strategies related to core competencies. Ultimately organizational leaders can make investments in human capital via training and development programs to standardize and improve "information-distribution" skills. Leaders can also invest in physical capital. They can create company-wide information systems that increase the ease and rate of information sharing among subunits.

ORGANIZATIONAL MEMORY

The second feature of open systems in learning organizations is process modification. This feature depends on organizational memory processes. An organization's capability to learn, and ultimately improve its future responses to the environment relies on processes that:

- Record organizational experiences that are relevant to strategic objectives
- Retrieve organizational experiences
- Apply those experiences to strategic decision making activities.

However, the processes that create organizational memory are frequently problematic. Many organizations have poor organizational memories because of a reliance only on employees' memories to retain, retrieve, and apply organizational experiences. This form of organizational memory is vulnerable to turnover and downsizing. Furthermore, organizations can have inadequate memories of success and failure because leaders develop processes to address immediate issues, but fail to evaluate if these processes have future value. Finally, poor organizational memories can result from the absence of organizational processes to: document and catalog organizational actions and outcomes; or, evaluate how past strategies can be applied to achieve new strategic objectives.

There are interventions that organizational leaders can make to improve organizational memory processes. For example, they have to determine how the current experiences of the organization are linked to the vision they have for the organization, the organization's core competencies, and strategic objectives. These actions help set up criteria for identifying which organizational experiences should be a part of organizational memory.

Next, leaders need to leverage their role as shapers of the organization's culture to inculcate employees' beliefs that organizational memory is a valuable tool, instrumental to goal achievement. When processes of creating memory become a part of the organizational culture they have a better chance for longevity in spite of employee turnover.

The erosion of organizational memory can also be minimized when leaders formalize processes for creating and using organizational memory. Computer-based organizational memory can range from strictly archival systems to "memory banks" that continuously process information and form networks from organizational experiences and provide rapid access via search engines.

The bottom line is that organizational memory, like human memory, gets better with use. Strategic leaders must create the conditions and find methods to increase the relevance and capacity of organizational memory, and increase opportunities for members of the organization to use that organizational memory in either supporting strategic decision making, or in their strategic decision making processes

CHAPTER FIVE

ANALYSIS OF THE ISSUE

The papers in this chapter Analyses the role of information systems in the structure of modern enterprise and the blurring of the differences between inter- and intra-firm transactions. Starting from the firm's level, Barron's paper studies how a firm determines its internal organization and how IT affects this determination. Barron considers a traditional firm, with well-defined boundaries that are endogenously determined by considering flexibility and scope of control. Ching, Holsapple and Whinston broaden the scope of the enterprise to the "network organization" -- a construct obtained by tying together a number of firms that cooperate through a well-defined communication mechanism. Specifically, they use a bidding protocol to manage the relationship between suppliers and producers. Beath and Ang examine another form of inter-firm cooperation, the relational contract, in the context of software-development outsourcing. They show how relational contracts embody a relationship that can be characterized as a network consisting of two organizations. Whang studies a more subtle form of networking information sharing between buyers and suppliers. Bakos and Brynjolfsson examine the impact of incentives and information costs on the nature of buyer-supplier relationships. They show that committing to a partnership with a small number of suppliers can be an optimal strategy for a buyer because it will maximize the suppliers' incentives for non-contractible investments such as information sharing, innovation or quality.

The papers thus present a spectrum ranging from a study of the boundaries of the traditional firm through different forms of networking to explicit buyer-supplier relationships. A common theme is the organization of work so as to reduce overall information costs not only within an organization but across them as well. The surviving enterprise is often (though not always) the one that attempts to reduce information costs while capitalizing on the comparative advantage of the participating organizations. This calls for "opportunistic cooperation" that benefits

the members of the network for as long as they cooperate. IT reduces the costs of such cooperation by facilitating communication and increasing the flexibility of the participating organizations. Using the Jensen-Meckling terminology, different network participants can make more effective use of their specific knowledge when the costs of transferring and processing general knowledge are reduced. Further, technology enables the development of markets that, by their very nature, transform specific knowledge into general knowledge. Thus, the bidding and communications protocols proposed by Ching, Holsapple and Whinston in their paper "Modeling Network Organizations" effectively transform the specific knowledge inherent in the production technology of the competing suppliers into general knowledge that encompasses not only prices but also their reputations. From this perspective, IT is key to the development of network organizations.

In his paper "Impacts of Information Technology on Organizational Size and Shape: Control and Flexibility Effects", Barron builds a stylized quantitative model to study the impact of IT on the structure of organizations. Examining flexibility and scope of control, he identifies sixteen different cases with different patterns of the actual causality between IT and firm structure. Barron shows that simplistic statements regarding the impact of IT are not as straightforward as one might imagine due to the interaction of size, scope and flexibility. His results suggest that the impact of IT is rather complex, and that further specification is necessary prior to making predictions on the impact of IT on organizational size or shape.

"Hierarchical Elements in Software Contracts" by Beath and Ang focuses on the contractual structure of outsourced software development. This is an interesting example of the new organizational paradigm because of the key role of information systems in any organization. Effective software development hinges on cooperation, communication and joint management which are at the heart of the new organizational paradigm. Beath and Ang examine the mechanisms used to govern outsourcing projects as specified in their outsourcing contracts. They suggest that the relational contract, which converts an arms-length transaction into a joint project with governance and resolution procedures that resemble

those used by firms internally, is an effective way to accomplish this. Thus, while Ching, Holsapple and Whinston view bidding and explicit reputation formation as the alphabet of the network organization, Beath and Ang view actual contract clauses as the key linguistic constructs. The paper shows how the structure of the contract is driven by the attributes of the project as well as those of the parties to the transaction.

In "Analysis of Economic Incentives for Inter-Organizational Information Sharing", Whang addresses the question of information sharing in non-cooperative buyer-supplier settings. Whang studies this question for two different models. He first shows that due to adverse incentives, suppliers will not be willing to share information regarding their costs. The situation is different when the information to be conveyed is regarding the expected delay or lead time. Whang shows that suppliers are better off disclosing lead-time information to buyers (when the demand curve for their product is convex). This result is consistent with our general thesis, whereas the former one introduces a note of caution: adverse incentives pose limits to the scope of information sharing among network organizations.

In "From Vendors to Partners: Information Technology and Incomplete Contracts in Buyer-Supplier Relationships", Bakos and Brynjolfsson start with the assumption that, in many cases, complete information exchange between two firms will be infeasible, so any contract between them will be "incomplete" in the sense that some contingencies will remain unspecified. They then explore how the interplay of IT and organizational structure can affect the role of non-contractible investments, such as innovation, quality and the exchange of information. For example, Bakos and Brynjolfsson show that when fewer suppliers are employed, they collectively capture a larger share of the benefits of the relationship, and this will increase their incentives to make non-contractible investments. As a result, even when search costs are very low, it may be desirable for the buyer to limit the number of employed suppliers, leading to a partnership-type of relationship, rather than aggressively bargaining for all the

benefits by threatening to switch among numerous alternative suppliers. Like Whang, they show that the incentive effects of the applications of IT must be explicitly considered in any model of their effect on inter-organizational cooperation.

CHAPTER SIX

CONCLUTION

In this part of the paper, I have stressed the joint determination of the location of information and decision rights. The default mechanism used to achieve this co-location depends on one's point of reference. Information Systems researchers are likely to take the locus of decision authority for granted. They will typically focus their attention on devising schemes that will efficiently organize, retrieve, sort, filter, transmit and display information for designated decision makers. In contrast, the economist is likely to focus on the allocation of decision rights and the concomitant effect on incentives. As we discussed in Section 2, transferring information and transferring decision authority are two sides of the same question. Because economics and information systems research evolved to address different problems, this complementarily long went unnoticed.

Successful organizational design, in turn, requires that we understand the flow of information among humans and their agents every bit as well as we understand the flow of electrons in chips and wires. Perhaps, then, the revolution in information processing capabilities not only calls for a change in business organization, but also a re-evaluation of the historic separation between Information Systems and Economics.

It can also be concluded that an enterprise without a sound Information System is bound to crash pending weak competitive advantage in terms of time, quality of service cost management and many other pertinent economic factors. Hence it is very vital to modern enterprises sustainability and development.

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