



Organizational uncertainties and the Computers Support An Analitical Approach

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Abstract : *Computer as new and more advance technology have become available to organizational management information system the role of information technology (IT) in organizational has been changing. The historical analysis of evolution of IT in organization helps to identify major technological paradigms. Each of these paradigms can be further associated with a metaphor to describe the predominant use of this technology and its ability to reduce a specific type uncertainty. One of the major lessons that can be drawn from this analysis is the need to study particular appropriations of IT in organizations, in order to distinguish between successful uses of IT & failed attempts to take advantage of this technology.*

Keywords: *Incompleteness, Irrelevance, Incommensurability, Metaphor*

Introduction

This research work uses all these three paradigm, metaphores and narrations at the same time to analysis the social construction of computer based management information system in organizations. Although some of the researchers construct and design the computer based MIS through paradigm [e.g.33, 37,47], through metaphores [e.g. 33,31], through narrations seprately. However the concept of paradigm is made popular by [33]. Technological paradigm describes the evaluation of IT in organizations then the specific methaphore are used to describes how these paradigm are used in organizations. Significance of each metaphore is further evaluated based on the organizations ability to reduce a particular type of uncertainty. Two research propositions can be used to evaluate the research questions raised by this study. One possible way to test IT-appropriations and the reduction of uncertainty in organizations would be to perform a content analysis of the existing IT literature. The examination of the relevant articles published in the top Information Systems journals in the last decades would help to evaluate if the description of the technology and its uses confirms the claims of Table 4. Other authors have successfully employed this research method to examine different aspects of the Information Systems field [e.g. 1,14,20,23,51] Therefore,

Case 1: A content analysis of the IT literature regarding concrete applications of IT in organizations will provide evidence of the existence of the IT-paradigms and their appropriation.

To address the second research question, it is necessary to study stories (narratives) of successful and unsuccessful IT appropriations. In fact, some authors [e.g. 13,23] argue that the most commonly employed empirical strategy in Information Systems is the case study method of research, to learn the state of the art and generate theories from practice [15]. Thus, a compilation of narratives of IT appropriations in organizations over the past decades would help to identify the key elements that determine the success of IT in some organizations.

Narratives derived from case study research would highlight the specific processes by which particular organizations adopt and adapt IT. Hopefully, a collection of narratives will help to identify the crucial factors that contribute to the different social constructions of IT in organizations, and will shed some light to the key elements that help some firms to choose the right technologies and radically alter the "industry recipe".

Case 2: The compilation and analysis of actual narratives of IT in organizations will help to identify the key elements that make IT successful in some organizations.

Each proposition suggests a specific course of action to address the research questions raise by this study. The first proposition is based on the review of published experimental research in the field. The second proposition is grounded on the case study method of research and consists of compiling and analyzing narratives of IT appropriations in particular organizations.

Broad Outlines Of The Work

IT in organization is due to one of the main propositions of organizational theory is that firms process information in order to reduce uncertainty. Traditionally, uncertainty's associated with the lack of information, the difference between the amount of information required and the amount of information already possessed by the organization [18]. To deal with uncertainty,

organization must collect, gather and process information [15,49]. [48] uses the term incompleteness, or ignorance of what can be known, to label the most common interpretation of uncertainty (i.e. absence of information). This type of uncertainty assumes that the information exists somewhere but there is a gap between the information needed and the information already available. This gap can be reduced if more efforts are devoted to collecting and gathering missing data [15,48]. Another type of uncertainty arises when the information is available but its meaning can not be grasped precisely. [48] used the term irrelevance, to refer to situations in which the analyst is unable to comprehend the meaning of the data at hand. To counteract this type of uncertainty, better acquisition methods and more powerful analytic tools must be developed. These two notations of uncertainty 1- Incompleteness and 2- Irrelevance presume that the necessary information exists and can be obtained, but there is some kind of gap that prevents its complete mastery, a possession gap in the first case, or an understanding gap in the second case. Both concepts presume a knowable reality that can be grasped. However, sometimes the problem is more complex than just acquiring or interpreting existing information. In some cases, the information is simply not available at any cost. [48] Distinguishes two other types of situations in which uncertainty arise because the world is not completely knowable. The first case is indeterminacy, or the presence of unpredictable persons whose actions cannot be anticipated. The second case is incommensurability, which refers to the limited and fragmented nature of the information.

Indeterminacy arises because of interactive relationships or interdependencies of the organization with other actors in the environment, such as customers, suppliers or competitors. The degree of dependence among them sometimes calls for game theory allocations to figure out the possible outcomes of the interaction and to proceed later with a rational optimization. When the game becomes more complex, the best alternative is to "negotiate these interactions under conditions of incomplete knowledge "[48].

Incommensurability arises with the difficulty of -

1. Comparing different objects "apples and oranges",
2. Assembling fragmented data extracted from multiple sources.
3. Fitting together different types of information.

To deal with this type of uncertainty, leaders and managers are forced to make sense of the reality using their judgment and intuition, and enact their environments [52]. This type of uncertainty, more than any other, creates a place for managerial judgment and strategies choice in the analysis[12].

Table 1. Summarizes the typology of uncertainty developed by [48].

Sno.	Type of uncertainty	Definition
1.	Incompleteness	Absence of knowledge or Difference between Information at hand and Information needed.
2.	Irrelevance	Information is available but its meaning can not be understood.
3.	Indeterminacy	The presence of unpredictable persons whose action can not be anticipated.
4.	Incommensurability	Limited and Fragmented nature of the information.

The organizational literature recognizes the value of IT because of its potential to reduce or counteract uncertainty.

Primary Work Done On The Lines

Information technology (IT) and its applications in organization have changed dramatically in the last decades. IT has evolved from strictly supporting role is the back office to a competitive weapon in the market place [28,39,40] and a new channel for conducting business [16,30]. The combination of increasing capabilities to process information and the decreasing of this technology has resulted in a broader range of computer application in organizations. In 1960's, mainframe computer were introduced in large organizations to take over many operational routine tasks. Their role was to automate the paperwork, especially in accounting and recording functions. These tasks were previously performed entirely by clerical personnel. In this period, the computer was like a heavy duty calculator entirely operated by computer professionals. As the cost and size of computer decreased and their power and capacity increased, many companies and departments installed mini and micro computers to automate their daily works. Computer progressively assumed some middle management functions, such as decision making, coordination's and control. Most of the information users in organizations had computers on their desks and access data needed to carry out their jobs at the time when required not at the end of month. These personnel computers offered independence from the mainframe but constrained the user with limited memory and processing speed. Further developments in network allowed firms to link their own computers with computer outside the organizational boundaries, establishing links to other companies in the environments such as buyers and suppliers. Today, recent advances

in communication technologies in particular the internet and the world wide web have opened up new possibilities for organizations to influence their environments by linking them directly with the final consumer of their products or services.

TABLE 2 :

Period	IT Paradigms	IT Metaphors
1960s	Mainframes	Automation of routine & repetitive tasks (accounting & record keeping future)
1970s-80s	Mini & Micro	Middle management functions (Decision making, coordinations & control)
1980s-90s	Network	Interfirm linkages.
1990s-2004	Internet & www	Direct connections with the Consumers.

In the mainframe era, IT was incorporated into organizations to automate clerical and repetitive tasks, to perform the accounting and record keeping function more efficiently and effectively than traditional manual methods [2]. Transactions processing systems (TPS) and management information systems (MIS) were arised at "numbercrunding" and providing large quantities of accurate and updated data to managers. The next generation of applications was focused on decision support systems [32] and group decision support system [29]. There systems provided decision makers with powerful models for analysising information and improving decision quality. [17]. The development of networks mode possible the advent of a new type of system - Inter Organizational System (IOS) - aimed at tackling this problem. IOS's are computer based information systems shared by two or more companies that automate the flow of information among them. [28,46]. They enable the organization to communicate more easily and less expensively across time or geographic location, to communicate faster and with more precision to targeted groups, and to keep track of the content and nature of the communication [24,26]. Recently, the explosive growth of the Internet has allowed many organizations to effectively influence the environments, altering their product or service mix, changing the relationship with outside partners and customers [16] and modifying the rules of competition in their industry. Through their web sites, organizations can directly access their final customers, by passing traditional intermediaries or distribution channels and collecting a wealth of information about actual and prospective customers [30]. Many organizations are dramatically redefining their traditional environments by using their web sites on the Internet. [47] argument of different eras dominated by different technologies or "technological paradigms" can be adapted to the realm of IT in organizations .

Four different IT-paradigms (hardware & software) can be identified from the above historical analysis. Table 3 summarizes these paradigms.

TABLE 3 : IT PARADIGMS

Period	Artifacts (H/w)	Application (S/w)
1960s	Mainframes	Automation of transactions (TPS) and aggregation of Information (MIS).
1970s	Minis & Micros	Models of support decision making (DSS & GDSS).
1980s	Networks	Links between organizations (IOS).
1990s	Internet	Organizational web sites.

Consistent with [36] two step approach, this work uses different metaphors to highlight IT appropriation, and then the importance of each metaphor is evaluated in terms of its contribution to the reduction of uncertainty in organizations.

Metaphor of First IT-Paradigm : In the first IT-paradigm, computing was viewed as a tool or an appliance, as a piece of equipment like a hammer to , drill or a saw, which extended and enhanced the capabilities of a person in a particular task" [50]. Tools can be used to get the jobs done, and someone (users or IT staff) determines what purpose need to be accomplished with what tools.

Computer ---> tool or appliances

Metaphor of Second paradigm IT:

As the technology developed, the computer demonstrated its ability to stand alone to inform ate, automate [52] and "supervise" production processes.

In this second paradigm, IT was more like a machine because computer were working by themselves, emancipated human operators, and even replacing many human workers [7].

The distinction between tools and machine is based on [38] argument that the tool is as extension of the user, while the machine display more autonomy of operation

Metaphor of Third paradigm IT :

In the third paradigm, IT was used as a strategic weapon to gain competitive advantages over actual and potential competitors [28]. It was used to raise entry barriers, or to lock in customers and suppliers or to change the very nature of the business by introducing new or related products [39,40].

The weapon metaphor emphasizes that the IT focus was on gaining competitive strength, not on improving the internal operations of the organizations [7]

Metaphor of Fourth paradigm IT:

The internet and the increasing degree of its connectivity at all levels of society are amplifying the role of IT from a mere weapon to a brand new channel to exchange information and to conduct business.

The internet provides the infrastructure for an electronic market place in which buyers and sellers meet and carry out their transactions [30]. The web can seen as a distribution channel, a medium for marketing communications and a market in and of itself [25].

Outcomes of Study:

Linking the typology of uncertainty to the previous analysis of IT paradigms and metaphors, some analogies can be drawn.

IT - As a tool is used to reduce the informational gap produced by incompleteness-type uncertainty.

IT -As a machine, is used to provide sophisticated analytic tools and technique to enhance the managerial ability to analyze data, in order to reduce irrelevance-type uncertainty.

IT - As a weapon tries to reduce the indeterminacy level of uncertainty.

IT - As a channel, reduces the incommensurability aspect by enacting the environment.

Table 4 presents the paradigms the typology of uncertainty and the metaphor.

Table 4 :

IT paradigms	Metaphor	Type of uncertainty reduced	Organizational response
Mainframe (1960's)	TPS, MIS	Incompleteness	Gather more Information tools.
Minis &Micros (1970-80)	DSS, GDSS:	Irrelevance	Development of sophisticated models
Networks (1980-90)	IOS	Indeterminacy	Bridging strategies weapon.
Internet (1990-till now)	Web based	Incommensurability	"Enactment" of the Systems environment channel

Although the paradigm and metaphor may be similar across organizations, the specific practices and implementations of IT are different in each firm, according to the strategy, structure and culture [8]. When the same computers are found in different companies, their use and meanings may be different from one company to the next. Computer systems can be crucial for the flow of production in one company, a status symbol in another or the hobby of an engineer in a third [43]. Each firm will appropriate IT in its own and unique way. IT as any other technology is embedded in organization's cultural systems, which determines how technological artifacts are constructed and interpreted [9, 27]. Since IT is constructed at the organizational and individual level, it may mean different things to different people and to different organizations. Even in firms belonging to the same industry, the same IT paradigms may render very different results. Due to differences in their cultural systems, what appears to be a successful IT application in one firm may be a failing technology in another [10]. The question is what makes an organization successful in its use of IT? Truly successful IT appropriations are those that radically alter the competitive rules in some industrial sectors. For example, when the ATMs were first introduced in the banking industry, the innovator" constructed" a new reality and changed the competitive environment. Likewise, the developers of the first automated reservation systems in the airline industry changed their environment. Similar cases are now happening in cyberspace. Several entrepreneurial companies have found a tremendous success for being the first ones to use their Web sites as a vehicle to conduct busing Pioneer companies such as Amazon.com, or greetstreet.com, the electronic greeting card firm, have changed the competitive landscape in their respective industries [7,30].

The power of successful IT appropriations resides in their ability to modify the industry pattern of managerial beliefs ("industry recipe" in [21], which is developed according to the competition and the characteristics of the industry hence new IT applications change the rules of the game, the commonly held " industry recipe" is no longer valid.

Evidences Through Metaphor Significances:

These IT -metaphors can be interpreted effects to reduce different types of uncertainty defined by [48].In the first IT-paradigm the computer was used as a repository of information hoping to alleviate the information gap produced by incompleteness -type uncertainty. The assumption behind TPS and MIS was that the greater the quality of data and accuracy of information the better the ability of the managers to make decisions [17]. In other words, if the information were available, managers would be able to analyze it. Indeed, these better informed managers began to experience information overload and to discover their own cognitive limits to process information. Then the managerial problem was no longer data availability but data modeling. To overcome this deficiency, DSS were developed to enhance the managerial abilities to counteract the irrelevance-type uncertainty. TPS, MIS and DSS shared the positivistic assumption that the reality is knowable, and the need was for more and better tools for grasping it. However, most of the problems faced by organizations are not always due to the

lack of data or models but to the impossibility of anticipate the actions and consequences of multiple actors in the same competitive space. The use of inter-Organizational Systems (IOS) addresses this problem [6].

IOSs span or shift the organizational boundaries to include elements of other organizations, creating "bridges" between an organization and other organizations in its environment (Scott_ [46]. "The typical solution to problems of interdependence and uncertainty involves increasing coordination, which means increasing the mutual control over each other's activities" [41]. In fact, by reducing the freedom of maneuver of organizational actors, these systems lead organizations to work together, to co-operate, for their mutual benefits. Bridging strategies through IOS may be viewed as a response to increasing organizational interdependence, and consequently as an attempt to reduce the uncertainty produced by many actors interacting in the same space-indeterminacy- [48]. After resolving the indeterminacy level of uncertainty, managers are faced with the challenge of "enacting" their environment. Enactment requires that organizational members not only selectively perceive but also directly influence the state of their environments through their own actions [52]. One of the ways in which organizations can enact their environment is appropriately selecting their domains. An organization's domains consist of the claims it makes with respect to products or services provided and populations served. These claims relate the organization to a number of other organizations (suppliers, customers, competitors) that affect its behavior and outcomes [45]. Information systems are key to select organizational domains [45] and to define or re-define environments [35].

Seeking innovative applications of IT through the use of Web sites and the internet helps organizations to enact their environments. By doing so, organizations are counteracting the incommensurability dimension of uncertainty.

Conclusion:

Through the analysis computer based evolution of IT in organization. This paper identified different configuration of H/W and S/W and defined four major IT paradigms. The practices associated with these paradigms were described using four metaphors, namely: tool, machine, weapon and channel. The importance of each metaphor was evaluated in terms of the ability to reduce uncertainty in organization. In fact the difference between IT and other types of technology is its power to reduce uncertainly that organization faces based on the topology of uncertainly mentioned above. This paper proposes that each IT paradigms reduces a specific type of uncertainly. If the relevant information exists but is not at hand (incompleteness), IT in used to collect the missing pieces of data, if the information is available but its meaning is not grasped (irrelevance), IT is used to apply the appropriate methods to interpret the information. IT because of unpredictable of other (indeterminacy), it is used to create responses to never formulated questions. If the information in not available simply due to ambiguity, confusion and conflictive interpretation (incommensurability), IT is used to act the environment.

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