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Abstract: The paper presents different approaches to the field of information systems (IS) research and organization theory. In the field of IS, much of what is written deals with practical frameworks for IS development and use, but there is also some theory building and causal models. In organization theory, there are several well known paradigms like rational organization models, institutional theory and transaction cost theory. In typical organization theory, little is said of the use of information technology (IT) and how this technology influences the organization. In the field of IS, a view of the organization as rational has been dominating. System developers have not been cultural sensitive, and this has resulted in many failures.

The foundations of Computer Science(CS) has historically been mathematical. In Norway, the term Informatics became the most common name of academic departments devoted to the mathematical models of CS. The theoretical foundation has been dominated by the science that invented computers and software and previously this science had not been challenged by other sciences. Instead, traditional computer scientists, well aware that their technologies were applicable in organizational environments, developed their own self-defined view of organizations, based on a rather simplistic rational theory of organizational behaviour that suited their technology. According to Kling, Scherson and Allen (1992), a remarkable fraction of CS-professionals described organizations as hyper-rational and under-socialized systems with relatively clear and simple goals. People were portrayed as obedient and cooperative participants in highly structured systems where they followed the rules of organization. The computer system was considered adequate and often portrayed as the focal element in organization - and most of all - in organizational change. This Systems rationalist perspective still infuses many accounts of computer systems, design, development, and use in diverse application domains. Even though there is a wide range of representative models of organizations, the CS-community seems to have adopted only a few and prefer to focus on their own self-defined issues related to more subordinate perspectives related to these theories.

However, I recent years there have been an increased focus by computer theorists on interaction between computer systems, man, organization and society as a whole. During the relatively short history of electronic computing, computers have become entwined with the lives of the people who use it. Those people live their lives in the social world and scientists have been encouraged to envision their new technologies in the social context they will be used. We can look at the social nature of computing from at least three perspectives (Agre 2003):

(1) Design is a social process, with a variety of players and issues, and the design process is becoming more complicated as more considerations are brought to bear on designers' choices.

(2) Computer use is a social process, and the process of computer use is becoming more complicated as security problems proliferate and users form themselves into advanced communities.

(3) Computers mediate social relationships, and Web-based tools are capturing and supporting those relationships in more detailed ways.

In these ways and more, system designers are already sociologists; it is just a question of becoming better sociologists by drawing the social content of computers and their design and use into the open. Several research movements have arisen to serve this need, such as social informatics, participatory design, computer supported cooperative work, and economic and legal analysis.

Increased *usability* can best be obtained if we expand our conception of the theoretical foundations of the disciplines. The theoretical foundations of effective computer interfaces and extensions (Chiborra 1996) are human and organizational and the CS-community has now realized the necessity of diverse and sound theories of human and organizational behaviour. Increasingly, these ranges of subjects are becoming core subdisciplines of CS.

IS, human and organizational behaviour

Conventional wisdom was that computers would improve productivity. However, research by among others economist showed diverse results and their conclusions was that there were no automatic link between computerization and productivity. The obtained gains using computers was in many circumstances to scarce to exceed all of their costs, including training of staff, maintenance and support, at least in short terms.

According to a recent paper by Erik Brynjolfsson and Lorin M. Hitt (Brynjolfsson and Hitt 2002), a return on investment in information systems must be seen in a long range. I a short term perspective, the return on investment is scarce, but in the long range, it can be substantial. The reason for this is that "the observed contribution of computerization is accompanied by relatively large and time-consuming investments in complementary inputs, such as organizational capital, that may be omitted in conventional calculations of productivity". To reduce the costs and improve organizational performance, it is necessary to analyse the system within the social context in which they will be used. Effective organizational analysis goes beyond accounting for formal tasks and rational behaviour. It must include informal behaviour, resource control and interdependencies between people, groups and organizations. This also means that general theories of computer performance must be supported by empirical case studies of organizational behaviour. Kling (1980) points out that there is an enormous range of human behaviour which lies outside the predictive frame of system rationalism and this behaviour will differ among organizations according to type, size, environmental settings, professionals, cultures and situations.

In the same way as economics, social sciences and organizational theory has to become a more integrated part of CS research in recognition of the need to enhance organizational performance through better interaction between computer systems and human and organizational behaviour. Even though much progress is done, there is no specific body of organizational theory which can easily be specialized for "the case of computing". According to Kling (2002) the best research on Organizational Informatics draw upon di-

verse theoretical and methodical approaches within the social sciences with a strong effort to select those which best explain focal aspects of computerization. The development of OI during recent years of research envisions a wide spectre of theoretical approaches ranging from organizational psychology, sociology, institutional and political theory. The field of CS research needs more efforts and resources to create a reliable and sound body of organizational science. Cooperation between sociologists, organizational scientists and the traditional CS-community may be difficult because there are diverse traditions often wide apart both scientifically and in terms of organizational boundaries within the academic community.

However, progress is made. Within the field of integrated CS and organizational research, two distinct perspectives have emerged and experienced development and growing acknowledgement during later years. These are MIS and HCI. Both perspectives are rooted in well known rational theories on organization and psychology. Organization theory in terms of studies on the group, coalition, organizational and environmental level is more disperse. For instance, there is no special branch of research dedicated to institutional theory neither to natural perspectives of organization. It is obvious that CS might benefit from research on more representative models of organizations. Also, the need for research on non-formal aspects of organizational and human behaviour should be intensified. In addition, more focusing on an open systems approach would bring the CS-research a step forward in understanding, for instance, how complex organizational networks and computer network may interact more efficiently.

The name of the game

In the beginning was Computer Science (CS), dealing with the construction of processors and computers, and with the programming of them. CS is still a major discipline. In many European countries, the name of informatics is now used for the hardware- and software-oriented studies. The study guide for NTNU (the Norwegian Polytechnic University) defines informatics as "Informatikk er i denne sammenheng læren om innhenting, tilrettelegging og bearbeiding av data, informasjon og kunnskap ved hjelp av moderne datateknologi og om hvilke konsekvenser slik datateknologi har eller kan ha for menneske og samfunn" (NTNU 2001). The definition of informatics as done by the Norwegian universities is indeed identical to the definition of Computer Science as made by Denning (Denning 1989). He defines CS by its contents, that is what part disciplines it consists of:

- algorithms and data structures
- programming languages
- architecture
- numeric and symbolic computation
- operating systems
- software and systems development
- data bases and information search
- artificial intelligence and cybernetics
- human-computer interaction

This is virtually identical to how the University of Oslo defines informatics.

Apart from systems development, there is not much here that has anything to do with organizations.

There are, however, other academic institutions that are dealing with IT use on an organizational level. Most prominent among these are Business schools, where the discipline is called Management Information Systems (MIS) or Information Management (IM). These disciplines focuses on improving businesses by the use of IT, and deals with both strategic use of IT, process improvement and decision support. There are no precise definitions of the discipline names, and for all practical purposes they can be said to be the same discipline (Currie 1999).

Closely related to MIS/IM we have information science. The institute of Information Science at the department of Social Sciences, University of Bergen, defines Information Science as "the study of theories and methods related to information systems and the object systems they are serving" (Andersen 1992). The institute's web site gives a more comprehensive definition: "Information science is the study of information and communication technology (ICT) in relation to individuals, groups, organisations and societies" (http://www.ifi.uib.no/).

At the Gothenburg School of Business, however, informatics is defined in the same way as information science in Norway (Ljungberg 1999).

In the USA, the definition of Information Science is a little different from the European definition. The emphasis is information itself (Vickery 1987), and the discipline is typically taught at Library schools. The Norwegian Polytechnic University also have courses in this tradition, for example a course in information retrieval. At Oslo University College there is a study in Library and Information Science in the same tradition.

Social Informatics is yet another name for a discipline that closely relates to the Norwegian definition of information science. Social Informatics is defined by Kling (Kling 1999) in this way: "A serviceable working conception of 'social informatics' is that it identifies a body of research that examines the social aspects of computerization. A more formal definition is the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts". Organizational Informatics is a subset of Social Informatics, concentrating on the use of IT in organizations. Kling (Kling 1994) defines Organizational Informatics as "a field which studies the development and use of computerized information systems and communication systems in organizations. It includes studies of their conception, design, effective implementation within organizations, maintenance, use, organizational value, conditions that foster risk of failures, and their effects for people and an organization's clients".

There is now a tendency to use Information Systems as the name of the discipline of studying use of information technology. In publications like MIS Quarterly and The Journal of Management Information Systems, IS is used more than the original MIS. Information Systems is a broader discipline name, incorporating both MIS, IM, Social Informatics and Organizational Informatics, as well as the Scandinavian Information Science.

Typical of the disciplines is that they are strongly fragmented, with research in a series of areas (Banville 1989). Central research areas in MIS are:

- Organization models based on the use of IT
- Types of management
- Models of market interactions
- Electronic commerce
- Strategic use of information technology

- Use of the internet
- Information systems management
- Databases and information retrieval
- Human-computer inteaction
- Systems development
- Artificial intelligence

Some of these research areas we also find in informatics. The difference is that in informatics the focus is on the *development* of new technology, while in IS the focus is mainly on *use* of the technology.

IS research has been seen as a synthesis discipline; theoretical and practical contributions are within the combination of organization, management, marketing and technology, and in addition reference disciplines as sociology and psycology. However, it can be argued that the discipline has now itself grown into a reference discipline (Baskerville 2002). As A.S. Lee, former editor of MIS Quarterly, puts it (Lee 2001): ”research in the information systems field examines more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact”.

Vessey et al. (Vessey 2002) states that “The IS discipline derives certain of its theories from computer science on one hand, and from organizational behavior and organizational theory on the other. Further, the design and development of IS requires problem solving; hence, theories in cognitive psychology are also applicable. Furthermore, IS affects, and are affected by, society.”

As a discipline, Information Systems is young. Checkland and Holwell (Checkland 1998) says this: “In a well-established field it would be possible to describe the field in terms of the history of such a learning cycle. But as soon as this is attempted for IS, by going to its literature, confusion reigns, with many contradictory positions and approaches adopted, often without acknowledgement of the existence of alternatives”. Other authors, as Galliers (Galliers 1999) states similar views. One main problem is the lack of modern organizational perspectives into IS research.

Practical frameworks versus theory building

As stated, the discipline of MIS/organizational informatics is young, and as such to a certain extent immature. This shows up in the contents of published work in the field: the majority of published papers in MIS deals with practical frameworks, only a minority with empirical testing (Banville and Landry 1989). ”a brief set of ideas for organizing a thought process about a particular type of thing or situation. Any useful framework helps make sense of the world’s complexity by identifying topics that should be considered and showing how topics are related” (Alter 1996). A framework is thus a model of the real world, made for practical purposes. A theory on the other hand, is “a coherent set of propositions, used as principles of explanation of the apparent relationships of certain observed phenomena” (Zikmund 1997). A theory thus is not only a model of the real world, its objective is to explain it, making predictions possible.

Common practical frameworks in organizational informatics

There are a lot of well and lesser known frameworks in the literature of organizational informatics. We will give a short review of some of these:

- The EEC model
- Models of organizational levels
- Mintzberg's organization types, with additional IT-integrated types by Jan Groth
- Work-Centered Analysis (WCA)
- Porter's value chain model
- Business Process Reengineering

Framework 1: the EEC model
The EEC model is a model of IS use, operating with three different stages of an organization's use of information technology (Christiansen, Grønland, Methlie 1999). EEC is an abbreviation for Effectiveness, Efficiacy, Competitiveness, whitch are the three phases in the model. The phases represents a timeline.

- In the effectiveness phase, the organization use IT to become more cost effective. The practical consequence of this is IT is use to automate processes, resulting in less cost per produced unit.
- In the efficiacy phase, IT is used by management to make better decisions.
- In the competitiveness phase, IT is used to compete in a market in other ways than by cost effectiveness or better decisions. Typically this can be by presenting new products based on the use of IT, or by doing things in ways impossible without IT.

The model represents a historical timeline, both in general use of IT in western societies, and for an organization. When organizations started using IT in the 1950's, they used the new computers to automate production. Since then, almost all tasks that can be automated, has been, resulting in a dramatic decrease in the demand for low-skill workers. In the 1950's and 60's, there was a firm belief in the potential for automating administrative work, thus replacing office workers with machines in the same way as low-skill workers were replaced in production. However, this proved to be difficult, and it is no exaggeration to say that the number of office workers are higher today than ever before. There was, in other word, a limit to automation.

In administrative and management work, the decisions made proved to be more important. From the 1970's to this day, great interest has been in this kind of IT use. In the beginning, the objective was to build large information systems containing all the information needed for management, the Management Information Systems (MIS). The ambitions were soon brought down to Earth, and the focus now shifted to make different types of systems for different types of administrative and managerial work. From the 1970's we have Decision Support Systems, form the 1980's Executive Support Systems, and from the late 1980's Data Warehouses.

IT as a competitive weapon has been a hot topic since the mid 1980's, when Porter and Miller (1985) published an article in Harvard Business Review titled "How Information gives you Competitive Advantage". The literature in this field is huge, and still increasing. Many authors have a background in strategy and marketing study, like Porter.

Framework 2: Organization models
Classic organization models are the line organization and the organic organization. The line organization has a hierarchic structure, with clearly defined tasks for every employee, and a equally clearly defined chain of command. The organic organization is the opposite: no clearly defined tasks and a rudimentary chain of command. Taylor's Scientific Man-

agement, Weber's Bureaucracy and Fayol's Administrative Management are all examples of line organizations.

A common model of the organization used in textbooks shows the organization as a pyramide with three levels: the operative, the administrative and the strategic level. These levels represents different types of managers with different types of decision making. The executives at the strategic level makes strategic decisions, that is long term decisions of products and markets. The managers on the administrative level makes decisions on how to get resources and monitor their use. On the operative level, where values are created, supervisors makes decisions on the daily use of the resources.

The pyramid model is frequently used in IS literature. The focus is on the demand for information and information systems on the different levels. The information is used for decisions and control. Information technology is also used for automation of tasks. The important thing is that the demands for information are different at the three levels. Some authors, like Laudon and Laudon (2000), extends the pyramid with a forth level, the knowledge level. This level has two sublevels: data work, that is work with existing knowledge, and knowledge work, that is the production of new knowledge. They then end up with these levels:

- The operative level
- The knowledge level
- The management level
- The strategic level

The resulting pyramid is shown in figure 1.

Figure 1. Organization pyramid according to Laudon and Laudon

On each level, different types of information systems are used. A usual way of classifying these systems is this (ibid.):

- Transaction processing systems (TPS): Systems doing transactions like orders, invoicing and accounts. These systems supports the business processes, and we find them mainly on the operative level.

- Office automation systems (OAS): Software used in office work. Typical examples are word processing applications and e-mail. Office automation systems are used in data work, that is work with existing knowledge in the organization.
- Knowledge work systems (KWS): applications used in the production of new knowledge. A typical example is computer assisted engineering software (CAE) and applications for statistical analysis.
- Management information systems (MIS): Systems supporting managers demands for information for structured decisions and control. The term can be a bit confusing, since MIS is also used as the name of a discipline.
- Decision support systems (DSS): Systems used in semistructured decision making. They can be model based, using a model language, or data based, using techniques for analysis of large amounts of data.
- Executive Information Systems (EIS): Also called Executive Support Systems (SS), these are systems used by the executives at the strategic level. They are typically used in semistructured and unstructured decision situations, as well as in overall control of the organization.

Framework 3: Mintzberg's organization types
A new information system will often have a change in organization structure as a consequence. Organization design is therefore an important part of a system development process (Bjerknes and Dahlbom 1990). A popular model for different ways of structuring an organization is Mintzberg's organization types. The model deals with different organization structures, based on a general pyramid structure. The model has no reference to information systems, but is often used in IS literature. The reason for this is that the model is based on one basic variable: the way work is coordinated.

Mintberg's original model is based on five different types of coordination:
- mutual adjustment
- direct supervision
- standardization of work
- standardization of results
- standardization of skills

Based on these five types of coordination, Mintzberg identifies five types of organizations:
- The entrepreneur organization: characterized by direct supervision
- The adhocacy: based on mutual adjustment
- The Machine beurocracy: Based on standardization of work
- The Divisionalized organization: based on standardization of results
- The professional organization: based on standardization of skills

The different types of organizations have different central actors:
- The entrepreneur organization: the top management is the central actor
- The adhocracy: the supporting staff is the central actor
- The Machine beurocracy: the technical staff is the central actor
- The divisionalized organization: the management is the central actor
- The professional organization: the operating core is the central actor

According to Mintzberg, there is no ideal organization. What kind of organization will be the most effective. In our context, different organization types will have different information systems.

An interesting extension of Mintzberg's model has been made by Lars Groth (Groth 1999). His starting point is that all future organizations will be based on the use of Information Technology. In Groth's model, there are five organization types based on different uses of information technology. Of these types, three are an extension of Mintzberg's types, while two are completely new.

The different types of coordination of work that Mintzberg uses, are also the basis for Groth's organization types. Mintzberg's divisionalized organization is not part of the model, but will, according to Groth, still exist. The same goes for the professional organization. Both will use It to be more effective, but will not be fundamentally changed. Table 1 presents the new model.

IT-based organization type	Mintzberg type as basis	Characteristica
Joystick Organization	Entrepreneur organization	• Automating work tasks central • Needs an advanced technostructure • Simple, dynamic environment • Small and medium sized enterprises
Flexible beurocracy	Machine beurocracy	• Strong degree of automatization, used in a manner that gives flexibility • Information allows for swift desicion making • Organized for markets in stead of function • Big enterprises
Interactive adhocracy	Adhocracy	• Project oriented and organic • Knowledge work systems basis for work tasks (for instance CAD). These are also basis for coordination • More effective than adhocracy because o fuse of IT
Meta-organization	None	• Two or more independent, but closely knit organizations • Automates the coordination of processes across organizations • Vertical integration in distribution chain
Organized cloud	None	• Two or more independent organizations, integrating some functions • Automates the coordination of processes across organizations • Travel agencies and airway companies using systems like Amadeus and Sabre is one example

Table 1 Groth's new organization types

Framework 4: Work Centered Analysis – WCA
Steven Alter (Alter 1996) presents a framework for the use of IT in organizations. This framework, called Work Centered Analysis or WCA, is centered about the business processes of organizations. A business process is, in Alter's definition: "A business process is a related group of activities that use people, information, and other resources to create value for internal or external customers. Business processes consist of steps related in time and place, have a beginning and end, and have inputs and outputs".
For a business process, we can identify the beginning and end, input and output. The use of IT will in some way or another support the processes.

The WCA consists of six elements and their relations:
- Internal and external customers of the process
- The output of the process
- The steps in the process
- The actors in the process
- The information used by, or created by, the process
- The technology used by the process

The WCA framework is shown in figure 2.

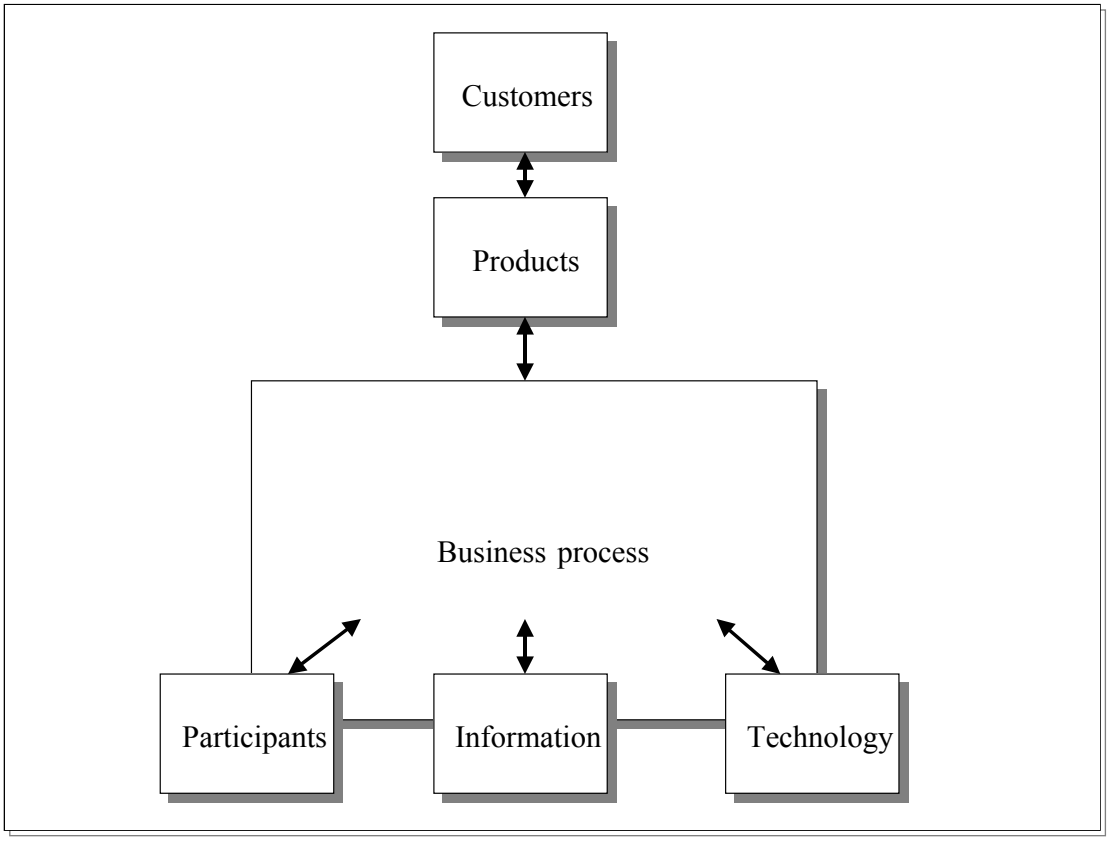

Figure 2 The WCA framework

The WCA framework is a recipe fir how an organization ought to work with the development of information systems. The framework shows which elements that needs closer analysis. From such analysis, the organization can decide on which systems it needs, and what properties they must have.

Framework 5: The value chain
Michael Porter's (Porter 1985) value chain model is popular in the field of IS. The model is used as a starting point for a strategic analysis resulting in an IT strategy for the organization. Value chain analysis is based on value adding activities. As part of the strategy process, the organization must decide if these activities should be done by the organization itself, if activities could be bought, or if they can be done in cooperation with other organizations.

The reason the value chain model is popular in the IS community, is partly that the activities can be made more effective by use of IT, and partly that communication between activities can be more effective by the use of IT. In addition, communication between the value chains of different organizations can be made more effective.

There is a strong relationship between Porter's value chain model and Alter's WCA framework.

Research in specific areas of use
There are several areas of research in specific use of information technology. Internationally, research in electronic commerce has a huge following. In Norway, research in telemedicine and governmental use of information technology is important. Most of this research is aimed at development of practical solutions.

Theory building in the field of IS
While the frameworks are practically oriented, the objective being to help developers end decision makers in their work, there is also theory building in the field of IS research. Theory building aims at both explaining and forecasting phenomena in the field, identifying dependent and independent variables. We will take a closer look at two such areas for theory building: theories of IS success and information systems infrastructure.

IS success
This is an important area for theory building in IS. One classical model for explaining what causes IS success was presented by DeLone and McLean (DeLone and McLean 1992), with later extension by Seddon (1997). These models are examples of causal models used in theory building.

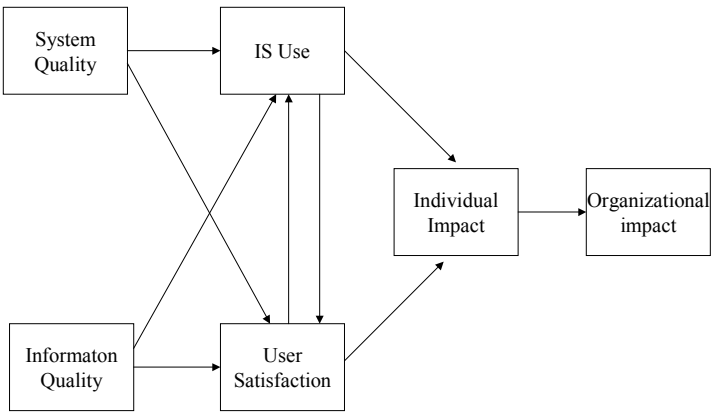

Figure 3 DeLone and McLean's model of IS success

In DeLone and McLean's model, system quality and information quality are the initial variables that regulates use of IS and user satisfaction. These are themselves variables that regulates the system's impact on the organization.

IS use is by DeLone and McLean defined as the degree to which an information system is used. This model is often used as an explanation model for IS success (Rai, Lang, Welker 2002).

Seddon's model is based on another conception of the role of IS use. IS use is a consequence of IS success, not a variable regulating this. The use of IS is not the only criterion of success; but the *benefit* is.

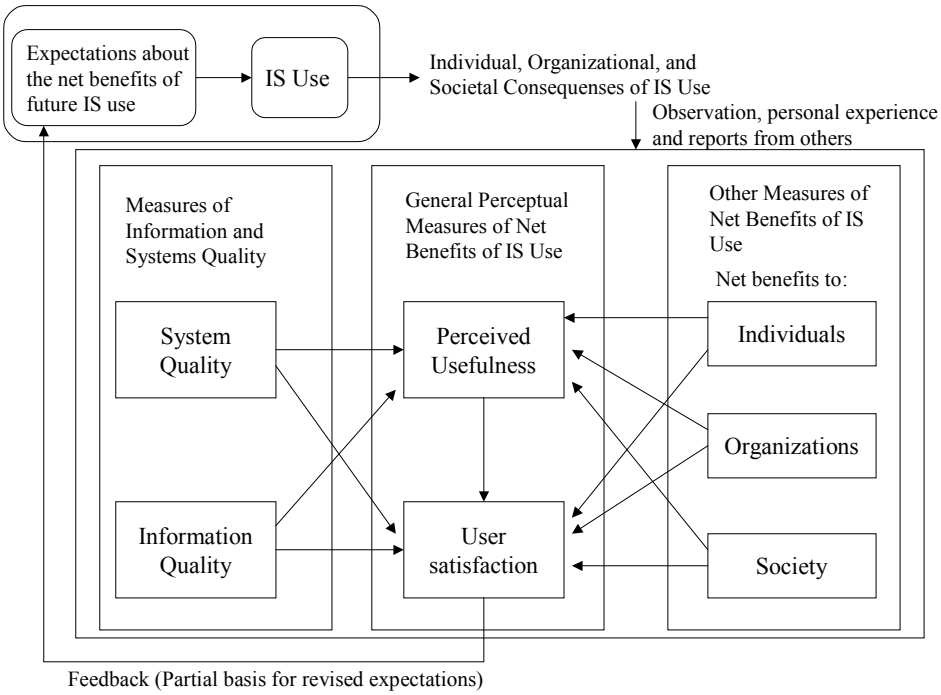

Figure 4 Seddon's modell of IS success

Both models are tested empirically (Rai 2002), and both are found to have explanatory power. However, there is room for further improvement of the models.

Information infrastructure and drift

Information infrastructure and drift are relatively new areas of research. The background for this is the high frequency of failures in system development projects. Drift is defined as the deviaton from planned system delivery and use (Ciborra 2000). The explanations for this deviations can often be found in the existing information systems infrastructure.

Stephen Alter defines IT infrastrukture as "the shared technical and human resources used to build, operate, and maintain information systems included in the firm's IS architecture" (Alter 2002:448). Information systems infrastructure (IS architecture) is defined as "the basic blueprint showing how the firm's data processing systems, telecommunication networks, and data are integrated" (ibid.:444). Alter also defines an information infrastructure as "codified information that is shared across a company" Alter (ibid.:74). All infrastructures are resources that are shared by the organization.

In Norway, research in information systems infrastructure is done at the universities both in Oslo and Bergen. Anders L. Opdahl at the University of Bergen defines information systems infrastructure as how the organization has organized its information processing (Opdahl 2003). The IT infrastructure consists of several elements:

- applikasjoner and databases in use
- informasjon and operations on information
- communication between applications
- responsibility for applications, databases, information, operationsand related activities
- relations between applications, databases, information operations and other organizational factors

The IS architecture is composed of the technological components and the human infrastructure. Weill and Broadbent (in Ciborra 2002) uses a model for IS infrastructure composed of four layers:

- IT components
- Human infrastructure (people, skills)
- Shared IT resources
- Shared applications

The research in IS architechture aims at explaining how the *installed base*, that is the existing infrastructure in the organization, together with the human infrastructure, influences the success of new system projects.

A new order of organizational analysis in CS

CS is associated with organizational theory because computers interact with people and because computer systems have extensions operating within organizational structures and boundaries – both formal and informal. Organizations are linked together by computers regulating the flow of information both between their various departments and divisions but also towards external organizations or organizational networks. How computer systems should be designed and operate is as much a question of how system extensions are shaped and its user interfaces as of technological nuances. The functionality of the system is also a question about perception and legitimacy. It is therefore necessary to bring in a broader range of organizational theories and focus more attention on social and environmental perspectives in the field of CS.

The rational perspective

The term rationality used in the narrow sense of technical or functional rationality describes organizations as instruments designed to attain specified goals. The efficiency of this instrument depends on the concept of rationality of structure. The structure organizes a series of actions in such a way that it leads to predetermined goals with maximum efficiency when implemented.

The behaviour of organizations is viewed as actions performed by purposeful and coordinated agents who applies according to the principle of rationality; that is, an organizations actions relies on knowledge to select appropriate means to reach resignated ends.(Thompson, 1967). The function of knowledge in an organizational action, for example a decision or a transaction, is to determine which consequences follow upon which of the alternative strategies available at the moment: it thus helps to shape expectations of

future consequences, and simulate them, the expectations being based upon known empirical relationships and information about the existing situation(Simon, 1976).

However, these agents are limited by their cognition and decisions will take place within clearly specified limits. Goals are conceptions of desired ends and rational system theorists stress goal specificity and formalization because each of these elements makes an important contribution to the rationality of organizational action.

The natural perspective

The natural perspective emphasises that organizations are, first and foremost, collectives and that they have rational characteristics as well as characteristics associated with social groups.

Organizations are both marked by formal structures and actual behaviour and by formal and real goals. Natural organization analysts do not deny formality, but they question its importance. They pay more attention to behaviour and the complex interconnections between the normative and behavioural structures of organization. In this view organizations are more than goal attaining instruments, they are social groups trying to adapt and survive in their particular circumstances by devoting energy to support or self-maintenance goals (Perrow, 1970).

Organizational participants are viewed as individuals with personal characteristics and resources that influence their behaviour, for instance different values, ideas, interests and abilities. Decisions are modified in order to structure participant expectations and to prevent conflict. Thus the focus is on what is done rather than what is formally planned will be the focus of a natural CS-analysis.

The open perspective

While a closed model focuses on the organization or individual itself and ignores or minimizes the boundaries and opportunities posed by connections to a wider environmental system, open perspective analysts emphasizes that organizations are systems themselves or parts of larger environmental systems. Also, from an open perspective point of view, there is a close connection between the conditions of the environment and the characteristics of the system within it. This makes theories in the range of open systems interesting for analysing computer-networks, especially in complex organizations.

According to Scott, all systems are characterized by an assemblage or combination of parts whose relations make them interdependent. The parts vary from being quite simple to very complex, from being highly stable to highly variable, and from being highly influenced to highly unaffected by system forces. Along a line from mechanical, through organic and finally to social systems the parts, which systems consist of, become more complex and variable. In social systems, such as organisations or groups, the interacting parts become very loose. Social organizations with mechanical structures become "loosely coupled systems"(Ashby, 1968).

Open systems are capable of self-maintenance on the basis of throughput of resources from the environment. In this view organizations cannot isolate themselves from the environment or defend themselves against it, but have to interact with the environment. However, this does not mean that organizations do not have boundaries. Interaction also means they use recourses both to preserve and to expand boundaries. Because of the openness of

organizations it will be difficult to determine their boundaries – for instance, which tasks belong to the organization and which to the company maintaining its computer system?

	Closed systems		*Open systems*	
Level of analysis	*1900-1930 Rational models. Type1*	*1930-1960 Natural models. Type 2*	*1960-1970 Rational models. Type 3*	*1970- Natural models. Type 4*
Social psychology	**Scientific Management.** Taylor (1911)	**Human Relations**. Roy (1952) Whyte(1959)	**Bounded ratonality.** March &Simon(1958) **Agent theory** Alchian&Demsetz(1972)	**Organization** Weick(1969) **Negotated Order.** Strauss et al.(1963). **Organizational Learning.** March and Olsen(1967)
Structural	**Bureacracy** Weber(1921). **Administrative theory.** Fayol(1919)	**Cooperative systems.** Barnard(1938) **Human Relations**. Mayo(1945) Dalton(1959)	**Contingency Theory** Lawrence and Lorch(1967) **Comparative Structure.** Udy(1959) Blau(1970) Pugh et. al.(1969)	**Sosio-technic systems** Miller &Rice(1967) **Strategic dependence.** Hickson et al. (1971) Child(1972).
Ecological			**Transaction Cost Theory** Williamson(1975) Ouci(1980)	**Population ecology** Hannan&Freeman (1977) Aldrich(1979) Resouce dependency. Pfeffer and Salancik(1978) **Marxist theory.** Braverman(1974) Edwards(1979) **Institutional Theory.** Selznick(1979) Mayer and Rowan(1977) DiMaggio og Powell(1983). Scott and Meyer(1994) **Postmodernism.** Foucault(1977) Cooper&Burrell(1988).

Table 2 Review of dominant Theoretical Models and Representative Theorists for Four Time Periods

System theorists stress that complex systems tends to be hierarchical in that they forms clusters and levels. Organizations are made up of roles contained in different levels of organization – administrative units, workgroups and divisions. Combining the notion of hierarchy with loosely coupled systems we note a common feature of complex systems – the connections and interdependencies within a system component are likely to be tighter and greater than those between system components. This means that interaction between organisational departments within an organisation is more frequent and tight than between departments belonging to different units or divisions of an organization. Within systems there are strong and week connections, variable connections as well as missing connections.

Table 2 (Scott, 1992), lists some representative theories associated with the three types of perspectives we have discussed above.

Rational Perspective

The discipline of MIS has traditionally had a rational perspective built on the idea that people engage in basically consistent value-maximizing calculations. The organizations it was designed to serve was hierarchical, centralized, structured and their arrangement of specialists relied on a fixed set of standard operating procedures to maintain routine mass production. In decision making it prescribes technological solutions where an individual identifies goals, ranks and all possible alternative actions that constitutes the most to the goals. Information technology provides a tool for managers to carry out their roles, allowing them to monitor, plan and forecast with more speed and precision to respond more rapidly to organizational requirements.

Up to now information systems have been most helpful to managers to perform informational and decisional roles; the same system has been of very limited value for other managerial roles. Laudon and Laudon (2001) argues that contemporary systems has become more flexible, and have more options in the sense of having multiple and intuitive models for handling data and the ability to keep track of many alternatives and consequences. Future systems will better reflect underlying personality dispositions(cognitive styles), understanding of group and organizational processes in decision- making, and will be more sensitive to the bureaucratic and political requirements of organizational systems. This is important in order to cope with information challenges in complex organizations with less hierarchical decision making structures in an increasingly global and changing environment.

There is a growing interdependence between business strategy, rules and procedures on one hand, and information system software and hardware on the other. Changes in one part of the system will require changes in other parts. A second change results from the growing complexity. Early systems produced largely technical changes to the organization. To days integrated human resource systems will potentially affect the institutional core activities of the organization – its goals, structure, work design, values and decision-making not only locally but in its divisions and its network. From being an office system under managerial control, the data are now available to hundreds of employees of various professions in every level of organization and its divisions.

In this respect the perception of MIS is that it has the potential to shape the organization and that it in a sense is normative. Even though to days and future systems more than ever need to be designed for the organization it will serve, the systems become more all-embracing and will have an increasingly impact on organisational work, structure, specialization and decision-making.

If we look closely, the foundation of CS has links to the a vast majority of major organizational perspectives, which, if taken more into account, could give explainatary force to efficiency problems far beyond the reach of the more “traditional” rational and psychological perspectives.

Open system perspectives

Open system perspectives have become more interesting due to present environmental circumstances that require organizations to be flexible and to radically change their boundaries. A more frequent redesigning of the firm's boundaries, communication and networking become necessary in a more complex and global environment. The traditional ways for firms to gather information are being challenged by the continuous redefinition of industries to become more service oriented and fragmented. Economic processes are speeding up and what matters for organizations is adaptive capability in the face of environmental discontinuities. The introduction of team based production and new decision making procedures based on "make and buy", make incremental adjustments to change more pressing. In such an environment a firms computer system cannot be just a replica of the centralized hierarchy with all its constraints. A management information system designed for centralized hierarchies, administrative overheads, control systems, execution of routines and procedures and a leadership style strictly impersonal and bureaucratic do not have the necessary built-in features for flexible "redesign" that is needed to support all levels of organization and its network as changes occur. Computer Systems must be able to absorb environmental variety and complexity as it expands across the firm boundaries. A high degree of connectivity between different information systems is needed and extensions must be rapidly adapted to the structural configuration of the organization itself and its diverse subunits and network of external partners. But even more important than bridging channels of communication are the impact of familiarity with the computerized tools on the work oriented behaviour by the members of organization. The actual work oriented behaviour will often be somewhat different from formalized rules of behaviour, and thus, different from the computerized network design. Such disjunctions might result from greater complexity that take the norm of recognizing new types of goals or techniques served by organizations.
This reconfiguration puts in doubt the role and efficiency of information systems developed within a framework of a closed (type I) perspective.

In general, external alliances create an environment of inter-organizational connections that is characterized by relations across organizational borders, which must be identified in order to structure the relationship. Typically, administration will rely on contractual agreements in addition to intermediary organizations in the form of task forces and leadership-teams that are set up to coordinate tasks and decisions. The distribution of information within the system will involve computer systems that are highly compatible but also capable of processing and routing information across the borders of organizations.

Ciborra (1996), notes the physical *extension* of the computer network and its architecture which in turn identifies the potential community of users. On the organizational system level, extension, and the possibilities and boundaries of extensions within the context of organizational systems should be paramount to computer network designers. Ciborra (ibid.) gives some potential effects or impacts of network technology that will enhance organizational performance by adding better computer network infrastructure and routing, better capacity and design that allows team and group activity, increased focus on learning processes and new ideas and visions as a outcome of interaction between workforce and information systems. The new information technologies provide a solution to some of these problems by trying to fill the gaps of existing flexibility shortcomings by applying specialization and splitting the organizational hierarchy into autonomous units connected through networks. Across the network, leadership can be sustained by the use of computerized communication (e-mail) and knowledge sharing at all levels can be enhanced by relying on multimedia workstations, synchronous communications and systems to support

teamwork such as groupware. In general, external tools such as e-mail and organizational design strategies support traditional programs and computer systems.

Strategic information systems

A variety of interpretations of strategy exist, most of which have a great deal to do with competition between corporations. Chamberlin's theory of monopolistic competition sees corporations as being heterogeneous, and competing on the basis of asset differences, such as technical knowledge, reputation, ability for teamwork, organisational culture and skills, and other 'invisible assets' (Chamberlin 1933, Itami 1987). Competition therefore means cultivating unique strengths and capabilities, and defending them against imitation by other firms. Another alternative sees competition as a process linked to innovation in product, market, or technology (Schumpeter 1950). Important strategy framework teories are the competitive strategy framework by Porter (1980, 1985), and the transaction cost theory put forward by Williamson(1975).

During the last 15 years, an area has developed within the Information Systems discipline which is generally referred to as 'strategic information systems'. It concerns itself with systems whose importance to the organisation extends beyond merely assisting it to perform its existing functions efficiently, or even just effectively. The context within which SIS theory emerged was based on industrial organisation economics and theories of market strategies and strategic framework models.

A strategic information system is instrumental in the organisation's achievement of its competitive or other strategic objectives. During the 1980s, an additional potential was discovered. It was found that, in some cases, information technology (IT) had been critical to the implementation of an organisation's strategy. The dominant sense in which the term is used is that a strategic information system (SIS) is an information system which supports an organisation in fulfilling its business goals.

An alternative interpretation of the term is that it is not necessary a particular IS, but rather the combination of those parts of an organisation's cluster of information systems which provide information into its strategic planning processes (Higgins & Vincze 1993. p.93). The functions involved include the gathering, maintenance and analysis of data concerning internal resources, and intelligence about competitors, suppliers, customers, government and other relevant organisations.

Transaction cost theory

Williamson(1975) argues firms exist precisely to reduce the costs of negotiating, monitoring and executing transactions that are necessary when acquiring goods and services in the open market. His term *transaction costs* refers to these costs. He distinguishes between markets and hierarchies in terms of the economic location of production. The term *hierarchy* is used to refer to the case of in-house production, with economic decisions made by managerial fiat, while the term *market* refers to cases of production that requires transactions between organizations. Complexity of product information has also been related to opportunism and search costs (Malone et al., 1987). When a good is highly complex, it may be harder for a buying firm to know whether or not the selling firm is engaging in opportunistic behaviour. Moreover, it may be harder to communicate the

good's features in the marketplace with enough precision to enable adequate matching of needs.

Malone and colleagues (1987) argue that the use of electronic communication links between firms can reduce both the costs of coordinating economic transactions and the costs of coordinating production. Coordination of both sorts consists of communicating information and processing it. Because modern information technology lowers the costs of both communication and information processing, Malone and his colleagues hypothesize that "the result of reducing coordination costs without changing anything else should be an increase in the proportion of economic activity coordinated by markets. (p. 489)." That is, they expect that these lowered coordination costs would encourage more out-sourcing by enabling firms to buy goods and services less expensively than to produce them in-house (Malone, 1987; Malone et al., 1987; Malone et al., 1989). To the extent that the cost of communication and information processing are reduced, the cost disadvantage of out-sourcing, market transactions and network cooperation in production is also reduced.

Institutional theory

The perspectives presented up to this point have been infused with rational interpretations of informatics in organizations. Alternative views have emerged that threat organizational proceedings on informatics as a conformation to institutionalised beliefs rather than detailed rational assessments.

According to the new institutional theory (Powell and diMaggio, 1991), organizational structures and technology within a sector, derives from a common cultural ideology, dominant organizational forms, including the structures and boundaries of collective action that are relatively standardized. In this sense, organizations within a sector are to be seen as ritual enactments of broad based cultural prescriptions rather than the rational responses of concrete problems that the rational theories purport them to be.

Information technology is not only a tool that provides solutions to specific problems, the creation of “cultural schemes” defines why they are valuable, what they should look like and what they are and not are to do. Environmental patterning is not only narrowly economic, but broadly social and cultural in character and effect. Thus, computer systems their design and functionality are affected by professional norms and environmental pressure or influence.

Thus they become a product of meaning systems rather than of purely internal technical and functional rationality. Local functional requirements are not the central source of computerized systems, and they are not likely to be fully consistent with it. What matters, are system requirements that are consistent with state legislature and stable rights, culture and legitimacy in the eyes of organizational professionals or dominant actors in the organizations environment(Scott and Meyer, 1994). From this point of view these enactments tend to homogenize and thus create standardized perception on computing and computer systems.

New computer network design will probably fail if it is not in accordance with current practices and employs a wide range of media. This is because people who use the design will translate it into an existing institutional order – an existing set of complex social roles.

Institutional perspectives can explain several aspects of modern organizations' use of IT. Many organizations have been forced to implement systems they did not feel they needed, simply because other organizations in the same industry had them. When the first bank introduced ATMs, other banks could not ignore them. They had to have ATMs, too. Today, we have the same drive for internet bank services.

Another example is standard software solutions like Enterprise Resource Planning systems (ERP), today dominating the software portfolios of most large corporations. In these software solutions, vendors have implemented "best practices", aquired from studies of successful businesses. This gives us a standardization of business practices, predicted by institutional theory.

Summary and conclusions

Information technology is dramatically changing the organizational landscape. It significantly affects organizational options and creates opportunities and issues that organizations need to take into account in many aspects of their activities.

Drawing the lines from the discipline of Computer Science(CS) which in its infancy dealt with the construction of processors and computers, and with the programming of them, to the much broader definition of Information Technology(IT) and Information Systems(IS) which derives theories both from computer science and from organizational behaviour and organizational theory, illustrates the complexity of the phenomena and the difficulty to establish general definitions of its different aspects.

Based on our definitions the IS field examines more than just the technological system, the social system, or the two side by side. It also investigates the interaction between the two. Thus, this paper puts a sharp focus on the fruitfulness of applying contemporary organizational theories as a means to understand how in the design of computer network systems should be and their implications for organizational behaviour, activities and structure.

The theoretical foundation of information technology has traditionally been dominated by rational theory of human and organizational behaviour. The computer system was portrayed as the core element in organization, designed to shape organizational structures and norms. Thus IT was believed to be the most important element in organizational change. The organization should adapt to the rationality of the computer system, not the other way around.

The CS-community has now realized the necessity of more diverse and sound theories of human and organizational behaviour. Increasingly, these ranges of subjects are becoming core sub-disciplines of CS. There has been an increased focus by computer theorists on interaction between computer systems, man, organization and society as a whole. Several research movements have arisen, such as social informatics, participatory design, computer supported cooperative work, and economic and legal analysis.

It now seems clear that IT enables a greater variety of structures. In particular it enables both large and complex, and more flexible and fluid structures. Therefore it becomes necessary to apply a wide range of social and organizational theory to get a fuller understanding of how IT-systems should be adapted to organisational activities and organizational structures.

The better the adaptation and interaction between organization and computer system is, the more efficient the organization. In a situation where many companies become larger and more internationally dispersed, there will be significant changes in the way information flow around organizations, and between them and their customers and suppliers. It will hasten the development of a more organic approach to system architecture, to a larger extent based on open systems perspectives and natural, cultural and institutional influences. Experience has shown that systems may fail to become accepted by their users, because the systems developers have not been *culturally sensitive* to the department or group ware, in which the new systems are to be used.

The major contemporary theoretical approaches to understanding organizations summarized and discussed in this paper, will give a good idea about how organizational and social theory may add a significant contribution to the development of computer software as well as the architecture of large computer networking systems.

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