THE DISCIPLINE OF INFORMATION SYSTEMS: ISSUES AND CHALLENGES

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Abstract

This paper explores challenges of the evolution of the concept of Information Systems (IS) and its implications on IS as a discipline. The concept of IS has come a long way since the first 'computer applications' that automated routine, repetitive tasks, up until today's organisation-wide IS, groupware systems and Internet-based IS that mediate communications. Gradually, IS have penetrated into all organisational processes and all aspects of organisational social life and inter-organisational relationships. As a result IS are coming to be considered as social systems, a component of the much wider domain of human language and social interaction. By addressing this dramatic shift from the first idea of the IS as a 'technical system' to the idea of the IS as a 'social system, technologically realised, the paper aims to contribute to the understanding of the emergence of the IS discipline.

Keywords: IS concept evolution, IS discipline, IS body of knowledge, IS research methodologies

Introduction

Many of us in Information Systems (IS) — researchers, teachers and practitioners alike — are concerned with the actual state and future development of IS as both a scholarly field and a domain of practical activity. What is an Information System and what does the field of IS comprise? What is it that IS professionals *do* and what should they *know* to be good at doing it? What are IS research issues and what methods of inquiry are appropriate for them? By addressing these questions from a historical perspective, this paper aims to contribute to the understanding of how IS is emerging as a distinct discipline while at the same time defying the traditional notion of a 'coherent scientific discipline'. The emergence of the IS discipline, as will be shown, have practical implications on both the academic status of IS and on the knowledge IS graduates bring to companies where they build and implement systems.

Information Systems has become an attractive professional field, if we judge it by job advertisements and industry positions, the number of IS courses and departments/schools that include IS in the title, IS academic positions, research and professional journals in IS, international and national IS associations (eg. AIS, UKAIS,) and conferences (eg. ICIS, ECIS, PACIS, AMCIS) etc. Judging from these sources, one could get the impression that the field of IS is booming in every respect. It would therefore, be difficult to explain to the uninitiated that in academia IS struggles for its academic identity and recognition, and that it is starved of research funding.

This paper will attempt to explore some critical issues that may be responsible for the fate of IS in academia and to identify challenges IS faces as it emerges as a discipline. Firstly, a brief outline of the short history of IS will be presented following the evolution of the idea and the concept of IS. Secondly, from this perspective, it will be discussed how the body of knowledge required of IS professionals has changed as the notion of IS has changed. Thirdly, this is followed by the discussion about the consequences for IS when it is defined as a 'multi-disciplinary field of study' as opposed its constitution as a 'discipline'. Finally, the discussion is extended to IS research methods focusing on how the understanding of appropriate research methods has changed as IS concepts have evolved. Some future challenges of the emerging IS discipline are discussed in the concluding section.

Evolution of the Idea of an Information System

The idea of an information system that collects and processes data to produce information was born in the early '50s when the first computers were used for calculation and accounting purposes. This notion of IS mimicked a factory production process: input data (row material) were processed by a computer resulting in a production of output information (final products), and was thus called a *production model of IS* (see Fig 1). This model equates IS with computer data processing, rendering IS an exclusive province of technology. The focus of IS designers was on the efficacy of data processing systems that automated routine processes and made possible their efficient (ideally optimal) control.

The first two decades of IS history witnessed the rise and sophistication of the production model of IS, mostly due to rapid advancements of computer technology and improvements of IS development (ISD) methodology. As database technology became commercially available and central computer systems enabled data collection via remote terminals, we saw successful implementation of large transaction based IS in accounting, sales, purchasing, personnel and payroll, etc. Interestingly, the most innovative applications of the production model of IS prompted the most serious criticism of the model itself. The key issues raised in practice were: there was a need to make clear distinction between data and information (not only at the syntactic level) and consequently between 'data processing' and the 'use of information' aspects; computer professionals that developed and maintained IS became aware that managers cannot be ignored, that they have (information) needs that they expected IS to fulfil; that ISD should involve users. In order for these issues to be considered, the production model of IS had to be extended to at least involve users of information. While the production model of IS has gradually improved (primarily technologically), it still presumes the technical nature of IS and emphasises the role of IS in efficient monitoring and control of processes in organisations. Such thinking has persisted till current times, especially in academic, scientific-engineering circles.

The next model in the evolution of IS concepts is the *interactive model of IS* (Fig 2). Users in this model are not passive recipients of information as in the production model, but active participants that interact with the system to provide data (eg., their assumptions, expertise), to specify their requests and to get required information. For example, Decision Support Systems (DSS) enable managers to apply (analytical or statistical) models to a set of data from the database to get information they need for decision-making. Similarly, Expert Systems (ES) enable acquisition of knowledge from a human expert and the storage of this knowledge in a so-called knowledge base. By applying an inference machine the knowledge is processed and made available to other users in their problem-solving and decision-making situations. The purpose of these systems was to increase efficiency and effectiveness of decision makers—individual managers or other professionals.

Innovations in Artificial Intelligence and advancement of technologies for ES and DSS in the last two decades or so have enabled more intelligent and more efficient systems to be built. In the interactive model of IS there is an appreciation of the specific and subjective nature of users' needs and the discovery of the human-IS interface issues. While IS are still considered in essence technical systems (that have some intelligence to work in 'symbiotic' relationship with users) their human and social consequences have been fully recognised and understood.

Further technological developments, powerful mini, micro and personal computers, communications and computer networks, databases and IS development methodologies and tools, stimulated the design and implementation of ever more complex IS that spanned functional areas and management levels. While decentralisation of computer resources resulted in proliferation of stand-alone IS serving specific business functions, processes or activities, the use of computer networks enabled their interconnections and encouraged (once again) organisation-wide considerations. Both the understanding of the information needs of organisations from a more holistic perspective and the availability of adequate technologies enabled a conceptual move to the *networked model of IS* (Fig 3). Conceptually it meant reflecting interconnectedness among business functions and across management levels. In practice it meant (often painful) building of links between existing (legacy) IS, reducing redundancy and improving consistency and accuracy of data across systems. Whoever has experienced, for instance, the implementation of an Executive IS (EIS) often retains not-so-pleasant memories of tedious negotiations and frustration while attempting to establish flow of data from various functional IS (Financial IS, Human Resources IS, Production planning IS, Sales IS, Marketing IS, etc.) to feed EIS.

In contrast to specific functional or process oriented IS, the aims of the networked IS are to improve coordination and cooperation among different business functions and processes, to enhance company performance. Many companies spent huge resources and many failed in their attempts to implement organisation-wide networked IS, often blaming technological problems and disregarding social and political ones. More recently, a new impetus for the networked model of IS, came from the client-server architecture. The latest breed of integrated IS, based on ERP software (such as SAP), has boosted hopes that the ideals of the networked model of IS can be achieved.

The nature of IS in the networked model has not changed appreciably from earlier models. It was believed that if we could technically realise the flow of data between specific (typically functional) IS and aggregate data to produce information relevant

for the organisational level, then we would get a networked model of IS. As this turned out to be a big illusion, new ideas to overcome the narrow technical view of IS came into vogue. A socio-technical approach has been suggested as a promising approach. Companies specialising in the implementation of ERP systems seem to have partly adopted the philosophy of the socio-technical system (more research on this topic is needed).

With the use of electronic data interchange (EDI), intranets, extranets and the Internet the networked model of IS expanded to include linkages with suppliers, partners and consumers. The growth of the Internet and developments in electronic commerce resulted in the emergence of the new concept of *inter-organisational model of IS* (Fig. 4). The distinct feature of the inter-organisational IS is that it integrates people, processes, assets and systems of one company with those from other companies enabling unified process management across multiple companies (such as supply-chain management systems, just-in-time integrated production systems). While early systems, such as EDI, exemplified the technical nature of IS, new inter-organisational IS, typically Internet-based, required a change in perspective and adoption of the socio-technical system view. However, in managing electronic commerce and inter-organisational IS, companies increasingly struggle with organisational, social, political, legal and personnel issues and challenges (rather then predominantly technical and technological) that are far too complex and interrelated to be successfully dealt with within the socio-technical approach. This is an area of research where IS academics can provide leadership in multi-disciplinary investigations of these issues and thus promote IS as a reference discipline for other disciplines as Baskerville and Myers suggested (2002).

A significant new wave of organisational computing emerged recently with the applications of groupware technologies (such as Lotus Notes), Computer Support Cooperative Work (CSCW), computer conferencing and other Computer-Mediated Communication (CMC) technologies, often implemented via the Internet. The essence of these applications is not data processing (as is in other models) but rather mediation of communication and collaboration among people. This is a radically new idea of IS as a particular mode or mechanism of social interaction. As a result the new model of IS emerged recognising the social nature of IS. More precisely IS are understood as *social systems* (Fig 5) which use Information Technologies (IT) to perform certain functions. This represents a fundamental shift in thinking about what an Information System is. IS are perceived as part of organisational processes/activities that are made up of and performed through linguistic interaction of actors, which takes place against an assumed background knowledge. By enabling and mediating social interaction beyond space-time constraints of face-to-face interaction, IS become embedded in social systems thereby transforming communications and potentially enhancing mutual understanding, coordination and cooperation among individuals and groups.

Interestingly, thinking of IS as social systems enabled by IT has been gaining recognition beyond groupware and CMC applications. In a more generic sense any information system can be seen as part of social interaction. Some researchers have claimed for many years that IS are actually social systems, a component of the much wider domain of human language, linguistic and social interaction. (Klein and Hirschheim, 1983; Boland, 1985; Markus and Robey, 1986; Lyytinen and Hirschheim, 1988). But only recently has the model of IS as social systems gained wider acceptance.

Changing Views on IS Professional Body of Knowledge

The evolution of the idea of what an Information System is, from the production model of IS to IS conceived as social systems enabled by IT, has had considerable implications as to the way IS were developed, the methods used for the development, and consequently the body of knowledge required from IS professionals. Depending on how the boundary of the IS field has been (re)drawn, the concept and content of the professional body of knowledge in IS have changed.

In the early days of IS history, when the production model of IS was established, professionals, usually located in computer centres, were responsible for the design and implementation of files and data-processing systems that 'produce information'. Issues considered were computer hardware and software, memory size, CP utilisation, processing speed, efficient processing of reports etc. As technical problems dominated, it is not surprising that IS drew its intellectual roots from Computer Science and Engineering. Skills of IS professionals were not different from those of computer professionals.

Later, in the '70s, it became evident that processed data (computer output) are not information until users understand and interpret them. An Information System could not thus be confined to a data processing system but should have included users and the consideration of their information needs. The resulting extension of the production model of IS marked the first crossing of the boundary, drawn around data and technology, allowing for consideration of some aspects of management, and tasks and responsibility of managers. Consequently, ISD methods taught in the '70s and '80s recommended analysis of business systems to precede information analysis and specifications of data processing. Similarly, the body of knowledge in IS has gradually changed, and apart from computers, programming, databases and software engineering, has included ISD methods and fundamentals of management. This is evident from the first IS curricula in business schools in the US.

When the interactive model of IS arrived on the scene the role of information in decision-making came into focus. The developers of, for example, DSS, had to understand decision-making processes and the needs of the individual managers making the decisions. The boundary had to be crossed again, this time to tap into Decision-Making Theory and Management Science. The IS body of knowledge that still had computer and software engineering as its core, was further extended by the addition of Decision Theory and Management Science.

The introduction of data communications and networked IS, however, stirred the field considerably more. IS proliferated into all business functions and levels of management, not as isolated islands but as comprehensive structures that reflected the needs of an organisation as a whole (at least as an ideal). Indeed in practice there were no functional areas or management problems in which IS did not play some role. Consequently the body of knowledge required from IS professionals tended to expand in every direction. Apart from computer and communication technologies, software engineering and ISD methodologies, IS specialists were expected to be familiar with management, accounting, finance, marketing, sales, resource and production planning, etc., as well as decision-making at different levels. Furthermore, IS managers and professionals implementing electronic commerce and inter-organisational systems had to deal with new management, legal, operational, and security issues. They had to have enough knowledge from all these areas to be able not only to deal with specific systems, but also to resolve integration issues, overlapping of responsibilities, inconsistencies of data, coordination and control of activities/processes within and between organisations. In its victorious march Information Systems (read IT) seemed to be crossing all boundaries. The scope of IS as a professional field broadened so much that this undermined its very recognition as a distinct and a cohesive professional field. The question arose - Couldn't management, accounting, marketing, operation research or other experts with a little bit of computer training do the same (or even better) job as IS professionals do?

At the same time, the introduction and widespread use of e-mail and other CMC, groupware and workflow systems, that emphasise communication, social interaction, sharing of knowledge, collaboration, brought the realisation that IS are in essence social systems. This encouraged yet another push to study sociological, behavioural, political, semantic, linguistic, and some other impacts of IS. These impacts cannot be explained without drawing from the Social Sciences. The question then arises as to how it is possible for the IS body of knowledge to incorporate so many disparate sources of knowledge from various, often called reference disciplines, and for the IS professionals to embrace the fast expanding body of knowledge.

IS as a 'Multi-Disciplinary Field of Study' vs IS as a Discipline

The evolution of IS concepts and a shift from the notion of IS as a technical system to IS as a social system, as briefly presented above, put pressure on the field of IS to include ever more domains of knowledge from Management/Business disciplines and Social Sciences, apart from IT. As this is generally perceived as a good thing, and no single discipline has ever achieved it, many claim that Information Systems is in fact a multi-disciplinary field of study (Currie and Galliers, 1999). For instance, in an attempt to obtain recognition of IS in a research assessment exercise in the UK, the UK Academy for Information Systems wrote: "The study of information systems and their development is a multi-disciplinary subject and addresses the range of strategic, managerial and operational activities involved in the gathering, processing, storing, distributing and use of information, and its associated technologies, in society and organisations" (UKAIS, 1995). Defining IS as *a multi-disciplinary field* instead of *a discipline* is not just a linguistic matter but a substantive issue for the IS profession.

Firstly, by defining IS as a multi-disciplinary field that draws from various *reference disciplines*—such as computer science, management, organisation studies, marketing, accounting, finance, economics, social psychology, sociology etc.—emphasises the notion of IS' body of knowledge as an assemblage of various segments of knowledge from these disciplines. This understanding of the IS does not explain how such an assemblage of knowledge can be productively applied in practice. Secondly, by defining IS as a multi-disciplinary field, it is denied a status of a discipline. Unlike vaguely defined *fields*, *disciplines* have their clearly defined domain, a core body of knowledge, and typically strive to achieve a degree of uniformity in research paradigms and methods, based on which they acquire recognition and standing in academia and research granting bodies. Defining IS as a multi-disciplinary field and not as an academic discipline, as is done officially in the UK and unofficially in many other courtiers and universities, has had adverse effects on its position in academia, funding for both its teaching and research, and the assessment and promotions of IS academics. Furthermore, defining IS as a multi-disciplinary field justified the claim that anybody can be an IS professional as long as one can acquire some knowledge from IT and a few other ('proper') disciplines. Some university departments have accepted such view of the field of IS and offered IS programs by combining IT -related and ISD subjects from technology departments with a selection of Management, Business/Commerce or Social Sciences subjects. The major problem with such offerings is the lack of comprehensive understanding of IS in organisational, business and social contexts, a very narrow view of the core body of knowledge (typically including ISD methodologies, data structures and databases and other IT –related subjects), and inability to genuinely integrate relevant knowledge from reference disciplines to deal with issues specific to IS.

If this approach is rejected, which is suggested here, what then is an alternative? Is there a distinct, unique IS discipline emerging with its focal domain of study and the body of knowledge that is different from an assemblage of knowledge from numerous disciplines? First, the argument put forward here is that there is a distinct, unique character to IS that is revealed in the interaction of and permanent interplay between the social (in its broadest sense) and the technological. Second, this particular interaction of the social and the technological creates a unique domain that by far exceeds the individual discipline domains of any of Business/Management, Social Sciences, Engineering or Computer Science. In this IS-specific domain, organisational/ social/technological interactions give birth to emergent changes and novel phenomena in the workplace, organisations and society, often with unforeseen implications. An IS body of knowledge that purports to explain these intrinsic IS issues (interaction of the technological, organisational, management, business and social, and ensuing changes in organisations and society) has been evolving, despite all odds. While it is still fragmented, lacking a consensus on what it does or should include (Banville and Landry, 1989), the IS body of knowledge is getting recognition from other disciplines (eg IS researchers publish in their top journals).

Note here that there is no question that the emerging IS discipline needs to draw and will continue to draw from *reference disciplines,* thus preserving its multidisciplinary sources. However, by 'borrowing' systematically, selectively, methodically and reflectively in the creation of a new IS-specific knowledge, IS researchers contribute not only to the IS discipline but potentially to these reference disciplines as well. Most difficult of all, however, it will also imply an integrative capability, a capacity for understanding in the first place, then evaluating and synthesising.

Changing Methods of Inquiry

As the body of knowledge in IS changed (following the evolution of the notion of IS) so too did the methods of inquiry used to create this knowledge. While IS resided in the province of technology under the umbrella of Computer Science, contribution to knowledge in IS came from Engineering, especially Software Engineering (eg., computer-based tool for ISD). In addition descriptive accounts of how particular IS were developed in practice using common sense, provided relevant knowledge but with no rigor. From the very beginning the research subject and the research methods in IS showed diversity and complexity (Klein, 1999).

The evolution from the production model of IS to the interactive and networked model of IS have been paralleled by the rise of research contributions aimed at rigor and the scientific foundation of an IS discipline. For instance, the famous 1970s Minnesota experiments (Dixon et al. 1977) "substantially increased the requirements for methodological rigor, but at the same time the practical relevance of this type of MIS publications decreased" (Klein, 1999, p. 17). In the following two decades rigorous, scientific research, characterised by narrow epistemological assumptions of Positivism, flourished (eg during 1983-88, 97% of IS research articles used a positivist framework, Orlikowski and Baroudi, 1991).

A positivist line in IS research, however, has been criticised as inappropriate for understanding the social nature of IS and their social and political impacts (see eg. Klein and Lyytinen, 1985). In particular, exploration of complex, conflicting and emergent phenomena of IS (and ISD) in different social and cultural contexts has challenged traditional positivist IS research. IS phenomena, as Lee and Liebenau pointed out, "have posed serious problems to traditional research approaches in the development of scholarly knowledge about IS. These phenomena have defied the power of traditional research approaches to explain how individuals, groups, organisations, nations and society as a whole can harness computer technology to serve humanity." (1997, p. 2).

It is not surprising that the shift toward the model of IS as social systems and the orientation toward interpretive research approaches coincided. The purpose of research is to understand organisational context and social life where IS are being developed and to explain how organisational members adopt IS, and use IS to share their understanding and construct social meanings. While positivist IS research is still a majority, interpretivist research papers are on the rise (Klein, 1999; Ngwenyama, et al., 1999; Lee, et al., 1997; Walsham, 1995).

Another non-positivist approach in IS methods of inquiry is influenced by Critical Social Theory (CST). The major contribution expected from critical methods of inquiry is theory building and creation of normative knowledge (Klein, 1999). The major obstacle for the application of the CST approach is the lack of critical theoretic intellectual tradition in the IS community. Nevertheless, the voice of critical researchers, however tiny, has been heard and did make a disproportionate contribution to knowledge (Lyytinen and Hirschheim, 1988; Hirscheim, et al.,1991; Hirscheim and Klein, 1994; Klein, 1999; Cecez-Kecmanovic, 2000). With the evolving nature of IS and dramatic changes in the IS-specific domain of inquiry, the currency and recognition of interpretivist and critical research approaches within the IS community is likely to raise.

Future Challenges

The discipline of IS does need to further build its body of knowledge. This body of knowledge may draw from relevant theories and models from other disciplines concerned with similar phenomena in organizations but from different perspectives (such as sociology, social psychology, organisation theory, semiotics, linguistics and others). In this way IS professionals may gain better understanding of human and social issues and deal more competently with organisational complexities. This body of knowledge, however, is not just a sum of concepts, models and theories from different disciplines, as the notion of IS as a multi-disciplinary field may imply, but rather a systematic and innovative creation of its own.

The paper explained why conceiving IS as a multi-disciplinary field is problematic. However, multi-disciplinarity of sources, in the case of IS, may mean openness to contributions from other disciplines, necessary to deal competently with the heterogeneity and complexity of IS phenomena. It may also mean developing cooperative relationships with other disciplines and establishing constructive dialogues, thus potentially becoming a reference discipline for others (Baskerville and Myers, 2001).

A distinctive contribution that IS research can make in the future is first, to nurture conceptual and theoretical foundations open for valuable contributions from other disciplines; second, to develop research methods pertinent to the unique nature of IS phenomena; and third, to conduct empirical studies focusing on the distinctive domain of IS. Furthermore, IS researchers have to take advantage of their uniqueness—their deep understanding of IT and their interaction with organisational and social contexts. Moreover, they have to pay more attention to IT as a foundation of IS (Orlikowski and Iacono, 2001). IS researchers have a unique opportunity and indeed an obligation, to study not only organisational and social impacts of IS, but more importantly, the *needs* of individuals, groups, organisations and society so that this understanding drives and motivates future IS (and IT) development.

This paper attampts to contribute to the debate on the nature and foundations of IS as a discipline, that has been going on in AMCIS. This debate is still necessary, not so much to push for the unity of IS as a discipline (though some unifying views would not hurt), as to explore its uniqueness whilst understanding its diversity and heterogeneity.

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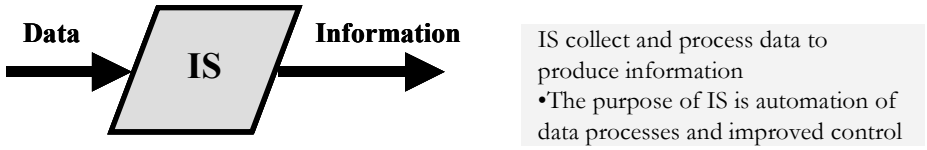


Figure 1. Production Model of IS (Eg. Transaction based IS)

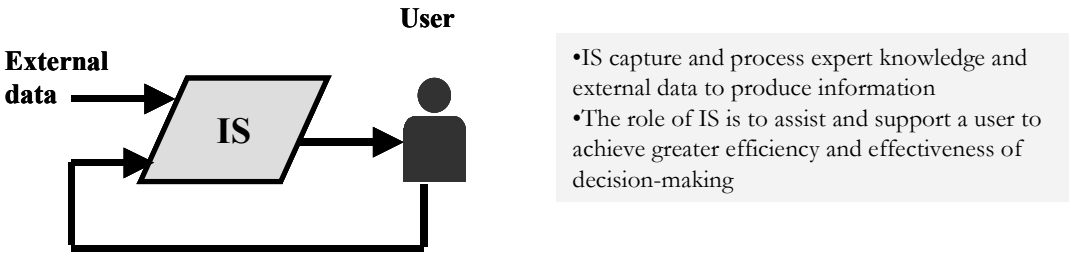


Figure 2. Interactive Model of IS (Eg. DSS, ES)

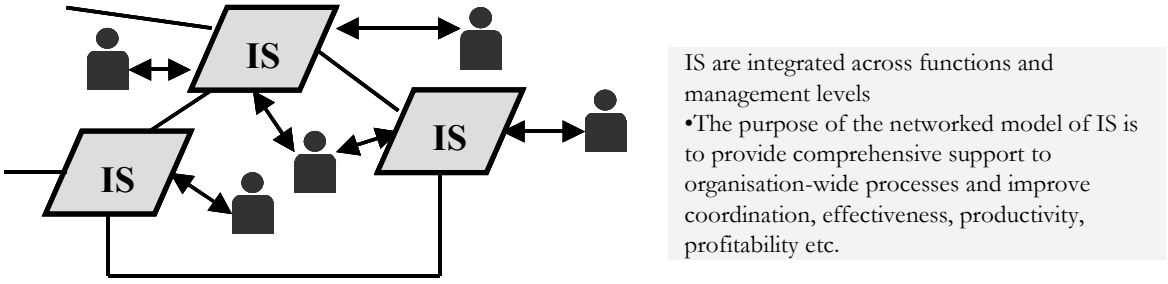
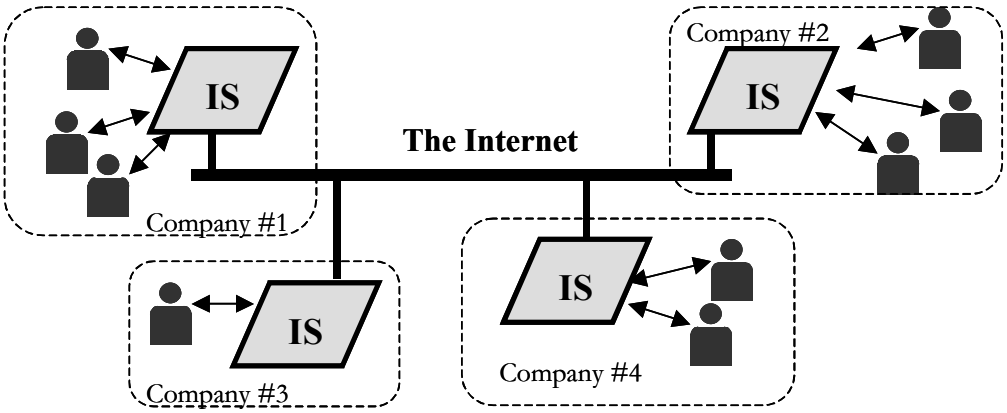
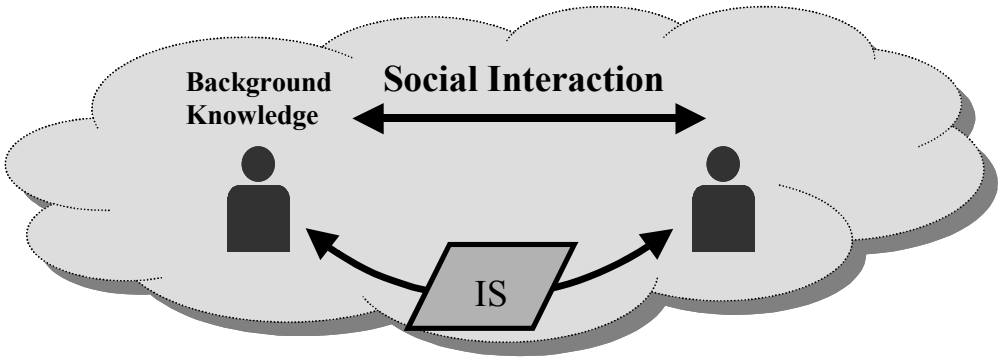


Figure 3. Networked Model of Organisation-Wide IS (Eg. MIS, EIS, ERP)



The inter-organisational IS is integrate people, processes, assets and systems of one company with those from other companies enabling unified process management across multiple companies (such as supply-chain management systems, just-in-time integrated production systems).
•In managing electronic commerce and inter-organisational IS, companies increasingly struggle with organisational, social, political, legal and personel challenges rather then solely technical and technological.
•In developing, implementing and managing the inter-organisational IS companies adopted the socio-technical system view.

Figure 4. The Model of Inter-Organisational IS



•IS are social systems based on Information Technology that mediate social interaction
•IS enable new ways of interacting, acquiring, capturing, storing, communicating and sharing information and knowledge
•They lead to the emergence of new domains of interaction between individuals, within and between groups and organisations

Figure 5. IS as a Social System Mediating Social Interaction