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ScienceDirect
Journal of High Technology Management Research 18 (2007) 15–30
THE JOURNAL OF HIGH TECHNOLOGY MANAGEMENT RESEARCH

E-technology and the emergent e-environment: Implications for organizational form and function

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Available online 11 May 2007

Abstract

The advent of the Internet and e-commerce in the mid-to-late 20th century, has been instrumental in changing the landscape of the business environment. This has led to new management approaches and practices, mediated by advances in technology that are revolutionizing the workplace and continue to impact organizational structures and strategies.

In this paper, we develop a taxonomy for IT and organizational theory from which we identify a pressing need for a conceptualisation of this rapid development in technology and its impact on organizational form. We introduce the concept of the e-environment to define the new and problem domain in which organizations are now operating as a consequence, particularly, of new technologies and the Internet. We explain how as the complexity of the technology increases, the ability to manage and appropriately exploit this e-environment under a traditional organizational form becomes more difficult. Currently, organizations are in the process of re-structuring to address this issue and facilitate continued strategic technological take-up to remain competitive. We posit the need for developing suitable organizational forms comprising both functional and technological specialists. We argue that the resulting forms are best explained by an extended model that can be seen as a composite of the existing forms. Finally, we present an executive reporting structure that will provide long-term top-level support for organizational decision making to manage the dynamic domain that is the e-environment.

Keywords: E-technology; E-environment; Organizational forms

1. Introduction

The response of successful organizations in the 21st century to intense competition, globalisation, the Internet and e-commerce, is to operate responsively with flexibility and agility (Aaker & Mascarenhas, 1984; Krijnen, 1979; Volberda, 1997). These operational strategies are having a profound influence on management information system (MIS) provision and the very nature in which organizations conduct commercial activities, an example of organizational function affecting IT. The advent of the Internet, the widespread availability of low cost computing power, bandwidth and networks, which we term e-technology, coupled with the introduction of e-commerce have revolutionised the structure and workings of organizational value chains and business models (Affuah & Tucci, 2001; Porter, 2001; Tassabehji, 2003). This is an example of IT affecting organizational function and form.

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doi:10.1016/j.hitech.2007.03.007

E-technology can be viewed as a new and continuously evolving platform from which an organization can exploit new opportunities. A recent direction is the drive for integration of MIS to facilitate unity and synergy of information, and information sharing capabilities, which is essential for e-commerce (Fingar, 2000; Gattiker & Goodhue, 2004, 2005; Goodhue, Wybo, & Kirsch, 1992). This is achieved by enterprise integration software that is fundamentally reliant on Internet technology. E-commerce can therefore be seen as the exploitation of opportunities that have arisen from e-technology, transforming businesses and marketplaces alike. In this paper we posit that e-technology combined with e-commerce, leads to a domain that we term an e-environment. We develop a taxonomy citing organizational theories associated with IT and corresponding form and function, where the main organizational objectives are identified, as are the major limitations, where relevant. We suggest that e-environments have moved organizational theory beyond Giddens' (1984) structuration theory, to an extended structuration theory that must also incorporate the features of the new complex and dynamic domain we have termed the e-environment.

With e-environments inevitably becoming substantially more complex, a further tenet of this paper is a pressing need for organizations to re-structure their management hierarchy. This is necessary to both control and to fully exploit the opportunities arising from the resulting e-environment, thus enabling them to remain competitive (Anderson, Meyer, Eisenhardt, Carley, & Pettigrew, 1999; Brown & Eisenhardt, 1998; Hamel & Prahalad, 1994; Sigglekow & Rivkin, 2005). We suggest tangible ways in which this complexity will arise and posit that organizations operating in an e-environment need to undergo a re-structuring process in order to introduce an alternative management paradigm, tailored to the requirements of this new environment (Harris, De Long, & Donnellon, 2001). The new structure will be populated by technical managers (e-TMs) with knowledge and understanding of the fundamentals of e-technology and e-commerce and functional specialists (FSs) from the previous line functions of the organization. We argue that the introduction of these e-TMs and the deployment of the FSs is so crucial to the successful take-up and exploitation of the technology, that they should be core in the proposed structure if the limitations and failings of the past are to be circumvented (Epstein, 2005; Gattiker, 2002; Mahoney, McDonald, & Raskino, 2004), and new business opportunities realised.

2. The research approach

In a review of organizational theory studies from the past to the present, Davis and Marquis (2005) stress that organizations are not susceptible to "a theory" but that the most productive approach for conditions in our current volatile era, is in the discovery and refinement of mechanisms employed as tools for explanation, that incorporate the field rather than individual organizations. They favour "progressive theories that are capable of accounting for observed regularities while making novel predictions", as being the most appropriate for organizational research, currently and in the immediate future. Here, we adopt a similar approach, but while we do not generate a theory we will draw on extant organization theory as it relates to technology and the environment as a tool for enhancing understanding and explanation of observations of the field, or e-environment, in which organizations are currently operating. From this we will make predictions of how organizations can structure their forms and functions to manage this e-environment most effectively. The approach adopted in this paper is summarized in Fig. 1.

3. From contingency to structuration theory: a critical review

In this section some of the major organizational theories and research on IT and organizational form and function over the past few decades, are reviewed and critically evaluated. The evolution of technology and the corresponding seminal research and emergent theory of the impact of IT on organizational form and function, is summarized in Fig. 2 and will be discussed in more detail.

3.1. Contingency theory

The early research on organizational form and function and IT was based on a technology that focused on functional and operational means of working. In the 1960's and 70's information technology was largely limited by its hardware and software. It focused on operational, highly technical and functional applications where complex work was limited to experts and information and systems were removed from the end users. Drawing on Anthony (1965) and Nolan's (1973) attempt to chart the evolutionary stages of business information systems and technology, Ward and Peppard (2002) identify this period as incorporating the "era of data processing" and the "era of management information

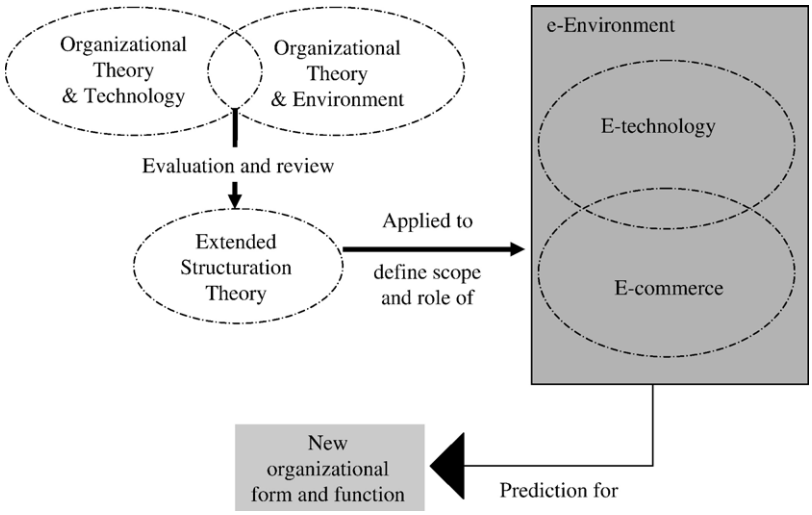

Fig. 1. The research approach.

systems", acknowledging that the evolution is neither linear nor sequential but is erratic with many overlaps. It does however remain generally representative of the trend of technology development and implementation in organizations. It was in this climate that Woodward (1965), Perrow (1967) and Thompson (1967), developed their seminal works on organizations and information technology where they identified a link between technology, organizational structure and organizational performance.

Woodward (1965) and Perrow (1967), adopted a process and knowledge based perspective respectively, identifying improved organizational effectiveness as a product of best fit between technology and organizational structure. Thompson (1967) developed a relationship between task interdependence and co-ordination, classifying technology according to the interdependence between processes as a major factor for creating organizational complexity, with the aim to reduce complexity and costs by reducing interdependence. Galbraith (1977, 1980) building on the work of Thompson, identified a relationship between the type, quantity and interrelatedness of types of information and the organizational structure needed to process it.

Hickson, Pugh, and Pheysey (1969) further place the technology of the time in its historical context by defining it as "operations technology, materials technology and knowledge technology" (1969, p.380), whereas Woodward's and Thompson's research was based on operations technology and materials technology with the technology having "characteristics of the [techniques and] materials used in the workflow" (Hickson et al., 1969, p.380). Perrow's research was considered to be knowledge technology exploring the characteristics of the knowledge used in the workflow, emphasising the operational and functional state of technology at the time. Mohr underlined the fact that these studies focused on technology for mass-production industries and centred around the "idea of predictability of operations" (1971, p.446). That is not to say that these seminal works are no longer valid. Indeed, the criteria that were identified by contingency theorists and the impact on the structure of organizations have been validated and extended by other subsequent studies (Galbraith, 1980; Gerwin, 1981; Gerwin & Christoffel, 1974; Hickson et al., 1969; Sor, 2004).

3.2. Socio-technical and structuration theory

As information technology developed further from the mainframe era to the micro-processor era, the use of IT throughout the organization increased and networks became more important from the 1980s. Research into IT and organizational form and function progressed from the early days of "technological imperative" where technology was seen as having a deterministic impact on organizational dimensions such as structure, size, performance, productivity; through to "socio-technical approach" where the focus was on the human action aspect of technology, and technology was seen as a product of shared interpretations and intervention (Kling & Lamb, 1999; Zuboff, 1988); and then to structuration theory (Davis & Taylor, 1986; Markus & Robey, 1988; Orlikowski, 1992). The tenets of Giddens's (1984) structuration theory were extended and applied to the study of contemporary organizations, where technology is seen to

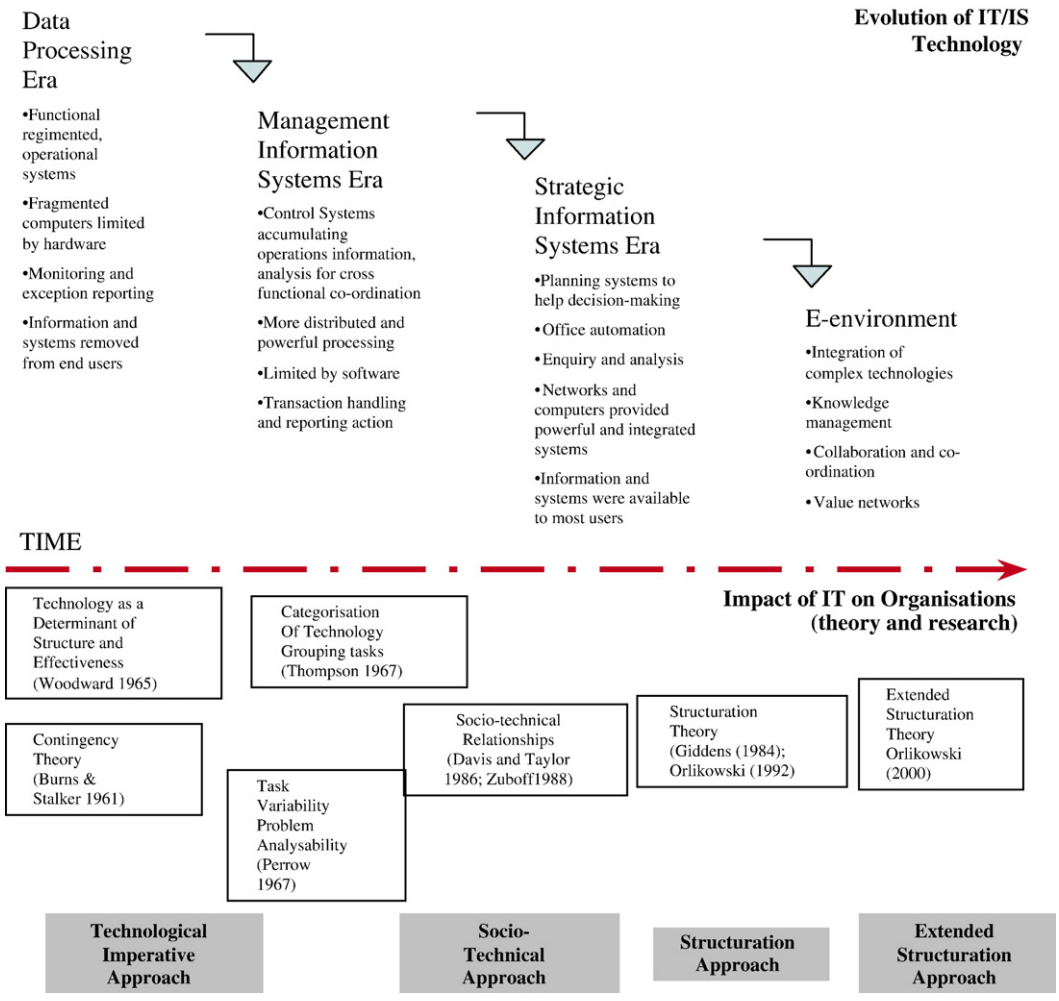

Fig. 2. Emerging technology and organizational theory.

have an impact on organizational structure as a catalyst in the relationship between human agents and organizational structure, and is heavily dependent on the different users and contexts of use (Barley, 1986; Majchrzak, Rice, Malhotra, King, & Ba, 2000; Orlikowski, 1992, 2000). We term the work of Olikowski "extended" structuration theory.

A major criticism of the organizational theories cited above, is the presence of an implicit assumption of homogeneity within categories of variables that define technology and organizational structure that is unrealistic. This is further compounded by ambiguous representation of the definitions and measurements of technology and its impact and role in organizations in differing environments (Hrebiniac, 1974; Lynch, 1974; Mohr, 1971; Orlikowski, 1992; Stanfield, 1976). Lynch (1974) emphasises the necessity for clearly defined boundaries of technology to enable valid and reliable comparisons between studies where technology has been recognised as a predictor for organizational characteristics. Orlikowski advocates the need for reconstructing the concept of technology emphasising the concept of "*scope* — what is defined as comprising technology, and *role* — how is the interaction between technology and organizations defined" (1992, p.399).

In his critical appraisal of organizational structure and technology literature, Gerwin identifies some limitations of previous studies, claiming an " … emphasis on pattern finding versus explanation, trying to understand the units being studied without considering their components, the belief that structure and technology are completely independent concepts and lack a design orientation" (1979, p.41). Despite the fact that Giddens's theory has been used extensively to understand organizational phenomena, the main limitation is that conceptually it is complex and operates at a "high level of abstraction" which leads to sometimes opposing and varied interpretations (Held & Thompson, 1989; Jones,

1997; Jones & Karsten, 2003; Pozzebon & Pinsonneault, 2005). This also leads to problems applying structuration theory empirically, where Giddens himself admits, "structuration theory is not intended as a method of research or even as a methodological approach" (1989, p.989).

By charting the relationship between the three dimensions of technology, organizational form and function and the socio-environment (including the human impact) in Fig. 3, we can begin to see the difference each of these factors were found to have had on organizational form and function, by the respective organizational theory school of thought. The cubes in Fig. 3 represent the volume of certainty within the three dimensional space and between the three dimensions identified. With contingency theory (A) there is a direct relationship between technology and organizational structure with little uncertainty; in socio-technical theory (B), the direct technological impact is less emphatic, the human impact is greater and the impact on organizational structure is less than for contingency theory; for structuration theory (C) the direct impact of technology on organizational structure is the lowest, and the perceived human impact is greatest but the predicted organizational structure is weakest and uncertainty is greatest.

A summary of the constituent theories of technology and organizational form derived from the literature is presented in Table 1.

From the evaluative taxonomy in Table 1, we can see that there are limitations to the extant theory, but that it has developed and progressed in line with technological advances. In the remainder of this paper, we will use Orlikowski's extended structuration theory as a framework for evaluating and subsequently recommending an organizational form and function to best manage opportunities and threats in the new domain of the e-environment. More specifically, we will be focusing on the scope and role of technology and organizations.

4. The emergence of e-technology

In the previous section, we identified that one of the main limitations of existing organizational/IT theories was the absence of a focused definition of relevant technology. Here we will introduce the concept of e-technology and provide a working definition of its scope and role using the distinction of technology as "artefact (the bundle of material and symbol properties packaged in some socially recognisable form, e.g. hardware, software, techniques); and the use of technology, or what people actually do with the technological artefact in their recurrent situated practices." (Orlikowski, 2000 p.408). This definition is obtained from observations and a review of current trends in the provision, implementation and use of technology in leading large organizations such as, Intel, Deutsche Bank and Toyota Motors to name a few.

In this instance the e-technology is categorised according to its constituent technological artefacts and the intended use of technology by organizations in order to achieve their strategic objectives. The fundamental emergence of e-technology is reliant upon the integration of management information systems and its associated data, legacy hardware and software, and more recent Internet based components. This integration makes the data visible to the extended e-technology infrastructure. For the successful management and exploitation of e-technology, it is therefore

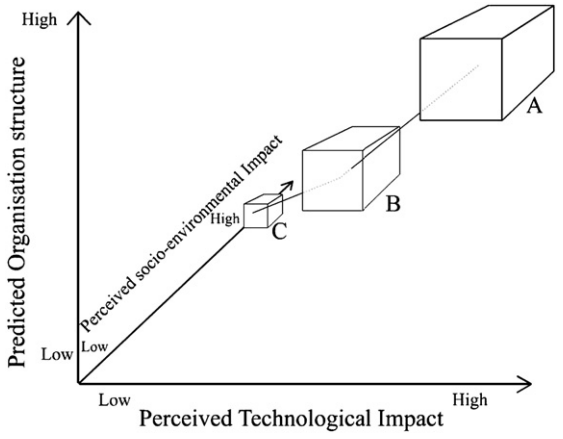

Fig. 3. The impact of technology and the socio-environment on organizational form: A=contingency theory; B=socio-technical theory; C=structuration theory.

Table 1
Theoretical foundations of IT and organizational form and function

	Technology classification	Structure of the organization	Organizational objectives	Limitations
Woodward (1965):	Production technology: • Complexity • Sophistication	Organic Mechanistic (Burns & Stalker, 1961):	Effectiveness is achieved through best fit between technology and organizational structure	Applied only to manufacturing organizations (Applebaum, 1997):
Perrow (1967):	Knowledge technology: • Task variability • Problem analysability	Organic Mechansitic	Efficiency and profitability is achieved through a better fit between organizational structure and technology	Does not deal with the role of environment, power and individuals in bureaucratisation adequately (Diel–Taylor 1997):
Thompson (1967):	Technology categories to classify organizations' task interdependence and co-ordination based on processes: • Long-linked (sequential): • Mediating • Intensive	The nature of interdependence between activities enables a prediction of the structure of organizational units	Technology determines the selection of a strategy for reducing uncertainty and that specific organizational structures can facilitate uncertainty reduction	Is used only in a specific environment and focuses on operational processing and workflows
Galbraith (1980):	• Degree of uncertainty of task requirement • Number of elements necessary for decision-making • Degree of interdependence among elements		"Variations in organizations forms are variations in the ability to process varying amounts of information" (Galbraith, 1980,p.532):	
Gerwin, D (1979, 1981):		Complexity Formalisation Centralisation Configuration	There is a link between technology and the four structural organizational categories	
Giddens, 1984, 1989; Orlikowski, 1992:	Duality of technology: • Technology is created and changed by human action • Technology is used by humans to accomplish some actions	Interaction of technology and organizations is a function of the different actors and socio-historical contexts	Artefacts are potentially modifiable throughout their existence. Human interaction with technology has design mode and use mode	Does not facilitate empowerment of individual actors; the complexity of the whole is overlooked by interaction of units/groups.

crucial that organizations are able to integrate disparate hardware and software components (Lee, Siau, & Hong, 2003). Such integration of e-technologies can be internal, exclusively within the organization, or external, linking to the systems of stakeholders within the supply chain, outsourcers and shared data (Themistocleous, Irani, & Love, 2004).

The trend towards such integration is evidenced by the current demand for enterprise integration software, where the application integration, middleware and portal markets are predicted to grow from $5.1 billion in 2001 to $10.5 billion by 2006 (GartnerGroup, 2001). In 2004, the Enterprise Application Integration (EAI) industry consortium found that 75% of total spend on IT was being used for EAI software in organizations across all sectors from automotive, banking, chemicals, financial services, industrial manufacturing through to utilities and government. Furthermore, consolidation, re-alignment, mergers and acquisitions within the EAI software provider market, such as JD Edwards' merger with PeopleSoft and their subsequent merger with Oracle, indicate a trend towards a standardisation of the EAI software itself. This in turn will lead to the increased pace of e-technology adoption and implementation in the majority of organizations operating in complete value chains and networks.

Table 2 defines selected e-technology artefacts drawn from our observations of new technology developments. The broken lines in Table 2, indicate the relationship between e-technology artefacts, their integration and how these, as an integrated whole, are to be used by organizations. The relationships across the columns are essentially

Table 2
Artefacts and organizational use of e-technology: selected e-technological artefacts, the way these are integrated and their functional/organizational use

Selected e-Technology Artefacts	Integration of e-Technology Artefacts	Function/ Organizational Use of e-Technology
MIS: associated data; legacy and current hardware and software. Networks: Internet; advanced LANs and WANs; wireless Web Technologies: semantic web; XML; websites; Communication Technology: e-mail; groupware; Mobile phone technology Specialist asymmetric massively parallel processing technology Internal and external databases (terabytes in magnitude): High capacity data warehouses Data mining	Enterprise Integration (EI): uniform integrated software platform; operates across and within functional disciplines and conventional IS in the form of: • Enterprise Resource Planning (ERP): adoption of conventional business processes across functional units introducing internalisation in the organization. • Enterprise Application Integration (EAI): automates integration process more seamlessly (than ERP):; can connect disparate ERP systems enabling externalisation. e.g. with supply chain partners. Increased volumes of data and transactions: (from more and differing new technology media clients):. More intelligent, interoperable interfaces needed to provide more integration between web content, MIS, and EI platforms. Integrated architecture needed to support intensive processing, mining and storage of data.	Integration of e-technologies can be internal, exclusively within the organization, or external, linking to the systems of stakeholders within the supply chain and shared data To enable, support and optimise Customer Relationship Management; supply chain management; balanced scorecards and performance management. Integration of e-technology artefacts leads to the strategic objectives of flexibility, agility and responsiveness in exploiting business opportunities offered by the e-environment.
Super-computers, Parallel or distributed systems, Vector and distributed array processors (DAPs): Neural and Bayesian network modelling, Cellular automata, Expert systems and other Artificial Intelligence (AI): approaches	Artefacts seamlessly incorporated into integrated MIS via advanced LAN and WAN infrastructures.	Computationally intensive problems to improve pattern recognition, general simulation for risk assessment and other management information

lateral, as indicated by the arrows, but the boundaries between them are fuzzy with the potential for overlap. For example,

a) To support existing and newly designed business processes: Enterprise Integration through Enterprise Resource Planning (ERP) and Enterprise Application Integration (EAI), are used to integrate organizations' legacy systems with new technologies, to develop uniform information architectures comprising "frictionless" components (Brynjolfsson & Smith, 2000). "*ERP … supports a centralized business strategy while EAI naturally accommodates decentralized business processes.*" (Lee et al., 2003 p.55) Successful multinational organizations such as Intel, Deutsche Bank, Dow Corning, Nissan Motors, SBC-Pacific Bell, Toyota Motors, and Sprint, have adopted such approaches.
b) To solve computationally intensive problems in real-time with the results accessible to a whole range of internal and external stakeholders: e-technology architectures would need to be incorporated seamlessly into an organization's integrated MIS via advanced LAN and WAN infrastructures making them important components of e-technology.
c) To manage substantial growth in volumes of electronic data and transactions With the proliferation of mobile telephone technology and the impending explosion in mobile computing (Glover, 2004), "m-commerce" is expected to become the dominant mechanism in support of e-business (Tassabehji, 2003). The revolution in "m-commerce" will span several years and there is a need to manage that change process within the e-environment throughout this period.

These are a few examples of the scope of e-technology, and from this, we can see that the emerging scene is thus one of a highly complex, dynamic domain — e-environment, comprising loosely and tightly coupled hardware and

software systems that span the organization's value chain. There will consequently be a need for organizations to structure their forms and ensure they have highly qualified personnel in the appropriate positions to implement and manage this e-environment. We will return to this theme later.

4.1. E-technology — the current reality

Despite its rapid uptake by organizations, there are also problems associated with the implementation and exploitation of e-technology. Several high profile instances of problematic projects in the private sector include FoxMeyer Corp., W.W. Grainger Inc., Hershey Food Corp., Jo-Anne Stores Inc. (Vogt, 2002). Whilst these failures are extreme, other organizations perceive a lack of success in the implementation process, largely as a result of not understanding how to manage the exploitation of the resulting e-technology per se (Robbins-Gioia, 2002). Some organizations reported a delay of some 9–12 months after the implementation of e-technology, before the new technology was seen to have had an impact. In a study of ERP implementation in a large government department, Boudreau and Robey (2005) observed how users of the new ERP system initially avoided using the system and later found new ways of "working around system constraints in unintended ways *(reinvention)*"(p.3). They observe social network and human agency theory at work and introduce the concept of improvised learning rather than formal training and posit this as being not only a positive and effective way of spreading knowledge among the user community but maybe even a necessary way of ensuring technological initiatives thrive. This demonstrates the need for organizations to recognise unique management issues as a result of e-technology implementation.

5. The e-environment

Having defined e-technology and its scope, we must also define the scope of the emergent new and complex domain in which organizations are now operating. We see the creation of corporate specific "e-environments" as a result of the combined interaction of developments in and implementation of, e-technology and e-commerce. In this environment, new opportunities arise from the increasing sources of data captured by alternative and different technologies and the wealth of information these can yield. For example, e-technology integration will lead to the creation of internal and external databases, some terabytes in magnitude, which will be accommodated by high capacity data warehouses within the e-environment. E-commercial activities, such as customer relationship management and value chain optimisation, can be executed by specialist asymmetric massively parallel processing e-technology. Consequently, the e-environment provides the organization with full visibility across the value chain and more internal visibility and control. In his book, *Business @ the Speed of Thought*, Bill Gates (1999) presents the idea of an organization becoming a digital nervous systems " providing well-integrated flow of information to the right part of the organization at the right time. [It]... consists of the digital processes that enable a company to perceive and react to its environment, to sense competitor challenges and customer needs and organize timely response" (1999, xx). We envisage possibilities from these richer data sources, for creating business–intra-business (BiB) markets, where internal markets can be set up to optimise trading, across and within the value network, for resources such as personnel, materials, capacity, logistic facilities etc., that was not previously available prior to the generation of e-environments. This will lead to optimal efficiencies in support of lean, flexible, responsive and agile operations, providing organizations and value networks with substantial competitive advantage.

6. Traditional organizational structures within an HQ environment

Having defined the scope of e-technology and e-environments, this section will draw on organizational theory to define the role of IT and organizational form and function. From organizational theory it is known that a corporation's organizational structure reflects its logical topology (Daft, 2003). Burns and Stalker (1961) identified different types of organizational structure being suitable to different types of environmental condition. Lawrence and Lorsch's (1967) field research also observed different environments produced different organizational forms and structures. These differences were observed not only between organizations in the different sectors studied, but also within the organization itself where each department had its own specific "task" environment. Organizational success was found to be linked with the degree of adaptation of each department to its environment. Traditionally, organizations were designed with the main objective of providing stability and predictability of meeting demand for large volumes of

standardised products (Weick, 2004). Scholars identified a range of alternative structures, such as mechanistic or organic, flat or hierarchical; integrated or differentiated to name but a few. However as we have moved into a more volatile, unpredictable e-environment with new rules of competition and a rapid pace of change, the major challenge is for organizations to create a constant stream of novel and unique solutions for their customers in order to survive and thrive in this milieu. While there have been alternative designs suggested for more complex corporations such as divisional, matrix, or composite hybrid models (Harris & Raviv, 2002; Mintzberg, 1988); "network based structure" (Nohria & Eccles, 1994); "ambidextrous organizations" (Tushman & O'Reilly, 1997); and "front-back hybrid supported through matrix" (Galbraith, 2002), we believe these do not address adequately the unique needs of the new e-environment.

With the creation and continuing development of the e-environment, organizations will inevitably increase further in complexity. This will lead to organizations whose business processes are predominantly driven by e-commercial activities within the e-environment. The HQ or strategic decision-making centre for the organization will consequently need to become more focused on its e-environment. Managing this HQ will become more problematic under traditional organizational structures. Some of the major issues are:

6.1. The impact of e-commerce led globalisation

E-corporations typically conduct international commerce from a single site location, potentially supporting multiple virtual organizations. This presents a conundrum for organizations with traditional structures; a single functional unit would be supported under a functional model whereas a distributed geographical organization would be accommodated under a more sophisticated geographical/divisional matrix or hybrid model. It is not evident which organizational structure would now be the most appropriate (Tassabehji, 2003; Turner, 2000).

6.2. The optimum utilisation of new wealth creating assets

The e-environment creates assets that are often different to those from traditional commercial environments. These assets include information, knowledge and intellectual capital/property. Traditional commercial practices are generally inappropriate for optimising the value gained from these new assets. For example, information underpins e-commercial activity but is also used to optimise the functioning of the infrastructure. In both cases, human and technology overheads are associated with these processes and should ideally be reflected in the organizational structure. Furthermore, this structure should have jurisdiction over several traditional functional units, thus creating potential dichotomies and strategic conflicts.

6.3. Creation of internal markets

Due to the e-environment, industry value chains will be fully visible and accessible to achieve agility, flexibility and responsiveness. We have suggested that to optimise efficiency, corporations and their virtual partners are likely to establish internal markets to introduce, what we term, BiB activities. There is a need for specialist skills to manage these BiB markets effectively and a supporting organizational structure.

6.4. Consequences of universally integrated systems

Legacy systems were often standalone, managed locally and not seen as an integral part of IT provision. However, with integration these have become accessible components within the e-environment and need to be managed centrally. This has implications for managing resources across an expanding value chain/network or when enhancing the e-environment. Furthermore, one of the key drivers of the e-environment is customer relationship management (CRM) that is best supported by end-to-end integration and visibility of the complete value chain (Fingar, 2000; Schaller, Piller, & Reichwald, 2004). For this to be achieved, channels need to be integrated and "competence at managing collaborations have become key drivers of a new logic of organizing" (Powell, 1998 p.231). Schaller et al. (2004) observe, "… the lack of channel integration directly correlated to lack of customer satisfaction and low customer loyalty" (Schaller et al., 2004, p.124), again demonstrating the need for seamless management across the e-environment.

6.5. Changing employment demography

The emergence of new functional units, perhaps virtual some of the time, due to "dynamic switchable membership" may not fit naturally into previous functional units or divisions, as a consequence of e-commercial activities (Travica, 2005). This could necessitate changes in skills requirements, competencies and lead to mobility of personnel across organizational boundaries (Landry, Mahesh, & Hartman, 2005). The actors within these units will exert differing degrees of social and political influence, perhaps even creating political allegiances to enhance their influence over decision-making. Organizational reporting structures will need to reflect this (Child & Faulkner, 1998; Lipnack & Stamps, 1997).

These issues highlight some of the mismatches between traditional organizational structures and the e-environment in which they will operate. In order to introduce responsive, agile and flexible operations efficiently and to achieve seamless integration for optimum value chain visibility, there is a need to establish an organizational structure with a core component in support of e-business. Traditional structures such as matrix and hierarchy evolved to suit information and communications, which were limited and costly. The foundation of the e-environment is a cost effective infrastructure where information is plentiful and highly perishable and communication networks extensive. Within the e-environment, decision-making cycles are compressed into hours, minutes and seconds rather than days weeks and months. These new operating conditions thus demand new organization design (Friesen, 2005).

6.6. Drivers of success in the e-environment

The need for re-structuring organizations and roles within it to support and drive e-commerce strategies has already been recognised in a study of 32 large North American corporations involved in e-commerce. By analysing the organizational structure being adopted in these corporations, Pinker, Seidmann, and Foster (2002) identified "weak virtual" and "strong virtual" approaches to e-business strategies. A "weak virtual" approach was found to be relevant for an e-environment that is incrementally changing, with e-commercial activity being distributed and managed locally across the organization with centralised co-ordination. In contrast, the "strong virtual" approach was found to be more appropriate for an e-environment that is being transformed and is driven by strong centralised management. Both of these approaches were reported as being used by corporations when establishing their e-environments. The motivation, at the embryonic stage, was to introduce a rudimentary e-environment in a climate of intense activity and competition from rivals. Indeed pervasiveness of change and immediacy of threat were the two factors used (Pinker et al., 2002) to highlight the distinction between the "co-ordinated" virtual weak and the "initiator" strong virtual approaches. Both these management approaches evolved from a volatile commercial environment where the take-up of e-commerce was considered critical, but it is still too early to determine which is the most successful strategy for organizations to adopt.

In order to better understand the implications of organizations operating in an e-environment, we have analysed the potential strengths, weaknesses, opportunities and threats they might have experienced when the e-environment was still in its infancy. By generating a high level SWOT analysis for corporations operating in an e-environment, it is possible to chart the changing management and structural organizational requirements they must undertake for the

Table 3
SWOT analysis for the e-environment

Corporations	e-Environment	
	Infancy	Future
Strengths	E-business strategy and established infrastructure	Mature infrastructure and appropriate organizational structure. Supply network integration. Flexible, agile and responsive.
Weaknesses	Lack of e-knowledge and established management practices	Retention and recruitment of skilled staff. Mismatch between e-environment and managing capabilities.
Opportunities	More agile, flexible with an increased rate of responsiveness	New e-mediated commercial opportunities (e.g. m-commerce, BiB):. Increased responsiveness.
Threats	Increasing e-commercial competition	More efficient competitors Missed opportunities

future. A list of some of the major opportunities and threats that motivated corporations to initiate e-business, and those that are likely in the future, are summarized in Table 3.

From the strengths detailed in the SWOT analysis, organizations can be seen to have been reacting to e-commercial competition in the early stage of the e-environment. In the future, organizations will be able to be more proactive due to flexible, agile and responsive operating, underpinned by the e-environment. This will enable them to capitalise, more appropriately, on the new commercial opportunities arising from the e-environment.

7. E-technology and organizational form and function

The major question that corporations need to address is how best to structure organizations to provide the match to their e-environment. With consolidation of provision for e-commercial activity, organizations will typically experience the growth of numerous logical functional units focusing on the e-environment. The obvious organizational structure to support these will be the functional model, representing contingency theory and seen locally in the weak virtual approach used in major corporations (Pinker et al., 2002). It is too early to determine what the optimum organizational forms for managing the e-environment are, however research from Gartner (Mahoney, 2005) asserts that a "new organization type is emerging …" and, the management role focusing on the e-environment (the e-centred role), will be split into business technology leadership and business network leadership, with other e-environment focused management components being distributed throughout the organization. This latter view is further reinforced by Pinker et al. (2002), who suggest that no single functional area should lead e-commerce initiatives.

The functional units focusing on the e-environment will be both technologically and commercially complex, typically comprising legacy hardware and software, integrated platforms, advanced network and data infrastructures and new developments in e-technology. To distinguish the job of the e-environment expert supporting each functional unit from that of an e-manager per se, introduced by Harris et al. (2001), we call these e-technology managers, denoted eTMs. This will require dedicated, high calibre eTMs with advanced technological expertise and e-business knowledge to support the FSs in their functional roles. There is also a need for an executive decision maker, the e-Executive Officer (eEO) to drive the e-strategy forward, similar to the strong virtual approach (Pinker et al., 2002). The eEO will be expected to liaise at the senior executive level and receive commitment and support at Board level. A summary of each of the roles is given in Table 4.

Traditionally, the role of managing corporate information technology and systems was performed by the CIO and/or CTO, who reported to the CEO (Feeney, Edwards, & Simpson, 1992). We hypothesize that the combined previous roles of the CIO and CTO would ideally be partitioned to accommodate new roles in the expanding e-environment. In a report by Gartner (Samuels, 2005), they observe a reduction in the technology specific role of the CIO and stress the need of CIOs to integrate an understanding of technology and its application to a range of complex business issues and processes "such as compliance and the complex economic environment business". The role of strategic decision maker would be fulfilled by an e-Executive Officer (e-EO). This relationship defines the e-centred component of the organizational structure and is depicted in Fig. 4, with the associated reporting hierarchy in Fig. 5.

Table 4
Typical e-centred functional roles

Functional role	
e-Technology Managers (eTM):	e-Executive Officer (eEO):
Liaison with other eTM across the organization	Strategic leadership
Liaison with eEO at the executive level units	Strategic alliance facilitation within the organization
Technological leadership	Providing strategic innovation and vision
Technological vision	Liaison with CEO
Technology management	Securing funding
Technology hardware/software evaluation and acquisition	Establishing new e-based projects
Person management including: supervision; training/education needs; personnel placement across different units	Recruiting and managing eTM
Project management	e-Knowledge dissemination
Identifying new opportunities especially within their functional unit	e-Team building

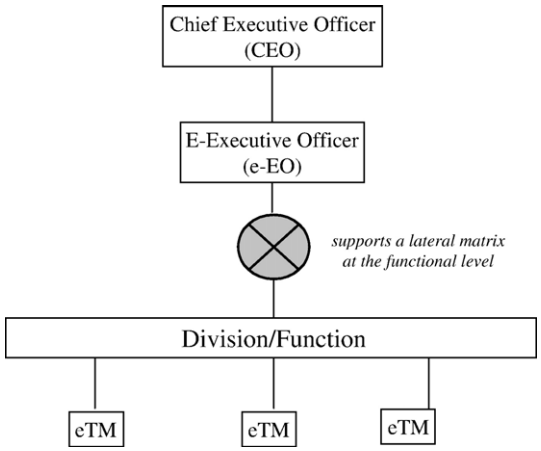

Fig. 4. E-centred component of organizational structures.

Here, we introduce the option of eTMs operating across the functional boundaries due to their specialist skills and for consolidation of corporate operation and strategic knowledge. As this structure supports migration across the functional units, it is flexible and can be re-configured at any time to accommodate a matrix or other hybrid management structures that may be more appropriate for new initiatives leading to agile, flexible and responsive organizations of the future.

7.1. Performance management in the e-centred organization

The advent of the e-environment and the importance of information and knowledge have meant that increasingly organizational decision-making has moved down the hierarchy empowering customer facing employees to make real-time decisions (Bontis, Dragonetti, Jacobsen, & Roos, 1999). The operation of the e-environment would therefore proceed with the FSs undertaking business processing in liaison with the eTM. The supervisory role of the line manager will increasingly become redundant, as these highly skilled operatives, with suitable competences, will be largely self-managed in collaboration with the eTMs. In order for self-management and decision making to be effective and correct as well as timely, vision and strategy needs to be communicated to all employees throughout the organization (Kaplan & Norton's, 1992, 1996). Using balanced scorecards, increasingly FAs can be self-managing and become strategic partners within the organization, challenging the appropriateness of the continuance of conventional line management.

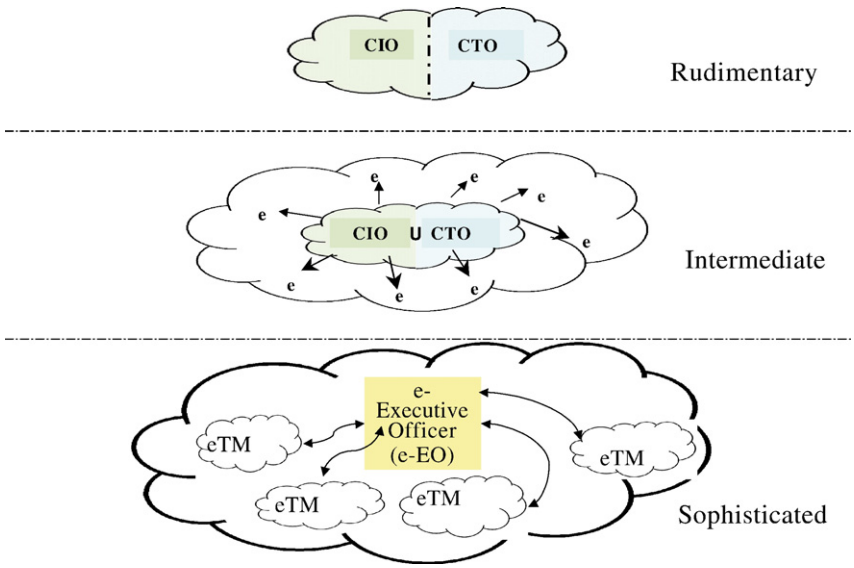

Fig. 5. Management within the e-centred structures.

Moreover, an automated balanced scorecard enables organizations to be proactive in addressing problems earlier and pursuing business opportunities faster. Not only this, but automated synchronisation of complete management information systems such as ERP across an enterprise will enable organizations to link and manage corporate organizational scorecards and personal scorecards through cascading sets of linked objectives (Edwards, 2001). With the removal of the stratum of line managers, employees can now have personal scorecards that are linked to organizational aims and objectives, which will enable a more transparent and effective means of managing and rewarding performance in organizations and identifying areas for training and improvement.

The increased importance of information and knowledge in the e-environment means that intangible assets need to be managed more effectively and there has been a danger of underestimating the value of these intangible assets One of the criticisms levelled at balanced scorecards is that personnel and IT systems are both included in the learning and growth perspective where the challenges of managing people and their knowledge is underestimated (Bontis et al., 1999). However, Kaplan and Norton state that the four perspectives should not be a straightjacket and these should be expanded accordingly. There is a definite need for balanced scorecards to be modified according to the e-environment to ensure optimisation of opportunities within the e-environment in which organizations and their employees are operating. Based on an empirical study of companies that were deemed to be "leading and lagging e-business companies" critical success factors were found to be "robust, relevant and timely measurement systems that enabled them to judge 'real-time' effectiveness of their strategy" (Plant, Willcocks, & Olson, 2003: p267); including performance measurement systems that incorporated internal and external value propositions and one which was flexible enough to adjust criteria metrics and strategy according to the performance of the organization when required. As part of the e-environment and to optimise the e-centred organizational form, the balanced scorecards should be extended to include additional metrics of brand (profile raising), service (CRM), market (building share and profitability) and technology (building the infrastructure) which focus on the customer perspective but also feed into the internal process and learning and growth perspectives (Plant, 2000; Plant et al., 2003; Willcocks & Plant, 2000). Gowen and Tallon (2005) showed that "high technology" organisations are attaching a greater importance on factors related to e-business in their application of Six Sigma programmes which is already yielding process improvements and sustainable competitive advantage.

8. Conclusions

Having conceptualised the scope of e-technologies and the emergent e-environment, we explored its impact on organizational form and function and that of the organizational function on IT. We have moved beyond structuration theory because of the highly complex and integrated e-environment which limits the impact of human actors on organizational structures: "… the more a particular technological artefact is integrated into a larger system, network, or technological configuration, the narrower the range of alternative uses that may be crafted with it. In future workplaces … it is also likely that the increased complexity and Internet working accompanying the growth in global infrastructure will require these artefacts to be more standardized, interconnected and interdependent and hence their use may be less malleable" (Orlikowski, 2000 p.409). Using the mechanisms of scope and role of technology and their impact on organizations through observation and analysis, we have focused on the field in which organizations currently operate to explain current changes and make novel predictions.

We have provided a graphical representation of the impact of technology and the socio-environment on organizational form (Fig. 3) for the three main approaches to organizational theory. We hypothesize that the resultant organizational form for an e-centred organization is most likely to be a composite of the traditional contingency theory and Orlikowski's "extended" structuration theory. As a consequence, representation on this figure would necessarily contain all three models or cubes, demonstrating the considerable variation in organizational structure that is available when operating in the new e-environment.

There is a need for organizations to optimize their responsiveness in a turbulent and complex business environment. We have argued that in order to achieve this, there is a requirement to balance the organizational structure to facilitate its ability to manage the e-environment. We have also suggested matching the functional operatives with e-orientated specialists and for a unique reporting structure to the board through designated e-Executive Officers to be established so that a recognised champion of IT is present and suitably empowered to maximise the chances of the continued take-up of new technology (Pinker et al., 2002). We have also identified current organizational functionalities associated with this new business environment.

Finally, the limitations of this study are a lack of empirical data to validate many of these observations and predictions more fully, although there is limited evidence, our conclusions are based on existing theories of IT and organizations. Further research is currently underway to fully validate the proposed models, through both qualitative and quantitative investigations.

References

Aaker, D. A., & Mascarenhas, B. (1984). The need for strategic flexibility. *Journal of Business Strategy*, *5*(2), 74−82.

Affuah, A., & Tucci, C. L. (2001). *Internet business models and strategies: Text and cases.* New York: International edition McGraw–Hill.

Anderson, P. A., Meyer, K. M., Eisenhardt, K. M., Carley, K., & Pettigrew, A. (1999). Applications of complexity theory to organizational science. *Organizational Science*, *10*, 233−236.

Anthony, R. N. (1965). *Planning and control, a framework for analysis.* Cambridge, MA: Harvard University Press.

Applebaum, S. H. (1997). Socio-technical systems theory: An intervention strategy for organizational development. *Management Decision*, *35*(6), 452−463.

Barley, S. R. (1986). Technology as an occasion for structuring: Evidence from observations of CT scanners and the social order of radiology departments. *Administrative Science Quarterly*, *31*, 78−108.

Bontis, N., Dragonetti, N. C., Jacobsen, K., & Roos, G. (1999). The knowledge toolbox: A review of the tools available to measure and manage intangible resources. *European Management Journal*, *17*(4), 391−402.

Boudreau, M., & Robey, D. (2005). Enacting integrated information technology: A human agency perspective. *Organization Science*, *16*(1), 3−18.

Brown, S. L., & Eisenhardt, K. M. (1998). *Competing on the edge: Strategy as structured chaos.* Boston, MA: Harvard Business School Press.

Brynjolfsson, E., & Smith, M. D. (2000). Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science*, *46*(4), 563−585.

Burns, T., & Stalker, G. M. (1961). *The management of innovation.* London: Tavistock.

Child, J., & Faulkner, D. (1998). *Strategies of cooperation: Managing alliance, networks and joint ventures.* Oxford: Oxford University Press.

Daft, R. (2003). *Organization theory and design.* South Western College Publishing.

Davis, G. F., & Marquis, C. (2005). Prospects for organizational theory in the early 21st century: Institutional fields and mechanisms. *Organization Science*, *16*(4), 332−343.

Davis, L. E., & Taylor, J. C. (1986). Technology, organization and job structure. In R. Dubin (Ed.), *Handbook of Work, Organization and Society* (pp. 379−419). Chicago IL: Rand McNally.

Edwards, J. B. (2001). ERP, balanced scorecard, and IT: How do they fit together. *The Journal of Corporate Accounting and Finance*, *12*(5), 3−12.

Epstein, M. J. (2005). Implementing successful e-commerce initiatives. *Strategic Finance*, *86*(9), 22.

Feeney, D. F., Edwards, B. R., & Simpson, K. M. (1992, December). Understanding the CEO/CIO relationship. *MIS Quarterly*, 435−447.

Fingar, P. (2000). Component based frameworks for e-commerce. *Communications of the ACM*, *43*(10), 61−66.

Friesen, G. B. (2005). Organization design for the 21st century. *Consulting to Management*, *16*(3), 32−51.

Galbraith, J. R. (1977). *Organization design.* Reading, MA: Addison–Wesley.

Galbraith, J. R. (1980). Organization design: An information processing view. In J. A. Litterer (Ed.), *Organizations: Structure and behaviour* (pp. 530-548) (3rd ed.). New York: John Wiley & Sons.

Galbraith, J. R. (2002). *Designing organizations: An executive guide to strategy, structure and process.* San Francisco: JosseyBass.

GartnerGroup. 2001. http://www.cio.com/summaries/enterprise/integration. Accessed October 2005.

Gates, W. H. (1999). *Business @ the speed of thought.* London: Penguin Business.

Gattiker, T. F. (2002). Anatomy of an ERP implementation gone awry. *Production and Inventory Management Journal*, *43*(3/4), 96−106.

Gattiker, T. F., & Goodhue, D. L. (2004). Understanding the local level costs and benefits of ERP through organizational information processing theory. *Information and Management*, *41*(4), 431−443.

Gattiker, T. F., & Goodhue, D. L. (2005). What happens after ERP implementation: Understanding the impact of interdependence and differentiation on plant-level outcomes. *MIS Quarterly*, *29*(3), 559−585.

Gerwin, D. (1979). The comparative analysis of structure and technology: A critical appraisal. *Academy of Management Review*, *4*(1), 41−51.

Gerwin, D. (1981). Relationships between structure and technology. In P. C. Nystrom & W.H. Starbuck (Eds.), *Handbook of organizational design—adopting organizations to their environment.* New York: Oxford University Press.

Gerwin, D., & Christoffel, W. (1974). Organizational structure and technology: A computer model approach. *Management Science*, *20*(12), 1531−1542.

Giddens, A. (1984). *The constitution of society.* Berkley: University of California Press.

Giddens, A. (1989). A reply to my critics. In D. Held (Ed.), *Social theory of modern societies: Anthony Giddens and His Critics.* Cambridge: Cambridge University Press.

Glover, T. (2004). Microsoft set for mobile market — Business brief. *The Business*, *2004*(12).

Goodhue, D. L., Wybo, M. D., & Kirsch, L. J. (1992). The impact of data integration on the costs and benefits of information systems. *MIS Quarterly*, *16*(3), 293−311.

Gowen, C. R., & Tallon, W. J. (2005). Effect of technological intensity on the relationships among Six Sigma design, electronic-business, and competitive advantage: A dynamic capabilities model study. *The Journal of High Technology Management Research*, *16*(1), 59−87.

Hamel, G., & Prahalad, C. K. (1994). *Competing for the future.* Boston, MA: Harvard Business School Press.

Harris, J. G., De Long, D. W., & Donnellon, A. (2001). Do you have what it takes to be an e-manager. *Strategy and Leadership*, *29*(4), 10−14.

Harris, M., & Raviv, A. (2002). Organization design. *Management Science*, *48*(7), 852−864.

Held, D. & Thompson, C. (Eds.). (1989). *Social theory of modern societies: Anthony Giddens and his critics.* Cambridge: Cambridge University Press.
Hickson, D. J., Pugh, D. S., & Pheysey, D. C. (1969). Operations technology and organization structure: An empirical reappraisal. *Administrative Science Quarterly*, *14*(3), 378−397.
Hrebiniac, L. G. (1974). Job technology, supervision and work-group structure. *Administrative Science Quarterly*, *19*(3), 395−410.
Jones, M. (1997). Structuration theory and IT. In Currie & Galliers (Eds.), *Rethinking management information systems* (pp. 103−135). Oxford: Oxford University Press.
Jones, M., & Karsten, H. (2003). Review: Structuration theory and information systems research. *Working paper 11/03. Judge Institute Working Papers*. University of Cambridge.
Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard — Measures that drive performance. *Harvard Business Review*, *70*, 71−79.
Kaplan, R. S., & Norton, D. P. (1996). *The balanced scorecard. Translating strategy into action.* Boston, Massachusetts: Harvard Business School Press.
Kling, R., & Lamb, R. (1999, September). IT and organizational change in digital economies: A socio-technical approach. *Computers and Society*, 17−25.
Krijnen, H. G. (1979). The flexible firm. *Long Range Planning*, *12*(2), 63−75.
Landry, B. J. L., Mahesh, S., & Hartman, S. (2005). Changing the nature of work in the age of e-business. *Journal of Organizational Change Management*, *16*(2), 132−144.
Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and environment: Managing differentiation and integration.* Division of Research, Graduate School of Business Administration, Harvard University.
Lee, J., Siau, K., & Hong, S. (2003). Enterprise integration with ERP and EAI. *Communications of the ACM*, *46*(2), 54−60.
Lipnack, J., & Stamps, J. (1997). *Virtual teams: Reaching across space time and organizations with technology.* New York: John Wiley & Sons.
Lynch, B. P. (1974). An empirical assessment of Perrow's technology construct. *Administrative Science Quarterly*, *16*, 338−356.
Mahoney, J. (2005). Gartner Symposium/ITxpo October 17–21 Orlando, Fla. http://biz.yahoo.com/bw/051017/175846.html?.v=1 (accessed October.2005).
Mahoney, J., McDonald, M. P., & Raskino, M. (2004). *CIOs' 'must do' resolutions for 2005.* Gartner Report, Stamford, CT.
Majchrzak, A., Rice, R. E., Malhotra, A., King, N., & Ba, S. (2000). Technology adaptation: The case of a computer-supported interorganizational virtual team. *MIS Quarterly*, *24*(4), 569−600.
Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*, *34*(5), 583−598.
Mintzberg, H. (1988). The structuring of organizations. In J. B. Quinn, H. Mintzberg, & R. M. James (Eds.), *The strategy process: Concepts, contexts and cases* (pp. 276−303). NJ: Englewood Cliffs: Prentice–Hall.
Mohr, L. B. (1971). Organizational technology and organizational structure. *Administrative Science Quarterly*, *16*(4), 444−459.
Nolan, R. L. (1973). Managing the computing resource, a stage hypothesis. *Communications of the ACM*, *16*(7), 399−405.
Nohria, N., & Eccles, R. G. (1994). Networks and organizations: Structure, form, and action. *Contemporary Sociology*, *23*(3), 423−425.
Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, *3*(3), 398−427.
Orlikowski, W. J. (2000). Using technology and constituting structure: A practice lens for studying technology in organizations. *Organization Science*, *11*(4), 404−428.
Perrow, C. (1967). A framework for the comparative analysis of organization. *American Sociological Review*, *32*, 194−208.
Pinker, E. J., Seidmann, A., & Foster, R. C. (2002). Strategies for transitioning 'old economy' firms to e-business. *Communications of the ACM*, *45*(5), 76−83.
Plant, R. (2000). *E-commerce: Formulation of strategy.* NJ: Hall Upper Saddle River: Financial Times Prentice.
Plant, R., Willcocks, L., & Olson, N. (2003). Measuring e-business performance: Towards a revised balanced scorecard approach. *Information Systems and E-Business Management*, *1*(3), 265−281.
Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review*, *79*(8), 62−78.
Powell, W. W. (1998). Learning from collaboration: Knowledge and networks in the biotechnology and pharmaceutical industries. *California Management Review*, *49*(3), 227−240.
Pozzebon, M., & Pinsonneault, A. (2005). Challenges in conducting empirical work using structuration theory. *Organization Studies*, *26*(9), 1353−1376.
Robbins-Gioia, L. (2002). ERP implementation survey. http://www.robbinsgioia.com/news_events/012802_erp.aspx. Accessed December 2004.
Samuels, M. (2005). CIOs still fight for a seat on the board. http://www.vnunet.com/computing/news/2071369/cios-fight-seat-board. Accessed October 2005.
Schaller, C., Piller, F. T., & Reichwald, R. (2004). Collaboration in CRM: Potentials and challenges of an individualization based approach. In A. H. Kracklauer, D. Q. Mills, & D. Seifert (Eds.), *Collaborative customer relationship management taking CRM to the next level* (pp. 109−132). Berlin: Springer–Verlag.
Sigglekow, N., & Rivkin, J. W. (2005). Speed and search: Designing organizations for turbulence and complexity. *Organization Science*, *16*(2), 101−122.
Sor, R. (2004). Information technology and organizational structure vindicating theories from the past. *Management Decision*, *42*(2), 316−329.
Stanfield, G. G. (1976). Technology and organization structure as theoretical categories. *Administrative Science Quarterly*, *21*(3), 489−493.
Tassabehji, R. (2003). *Applying e-commerce in business.* New Delhi: Sage Publications.
Themistocleous, M., Irani, Z., & Love, P. (2004). Evaluating the integration of supply chain information systems: A case study. *European Journal of Operational Research*, *159*(2), 393−405.
Thompson, J. D. (1967). *Organization in action.* New York: McGraw Hill.
Travica, B. (2005). Virtual organization and electronic commerce. *The DATABASE for Advances in Information Systems*, *36*(3), 35−68.

Turner, C. (2000). *The information e-conomy business strategies for competing in the digital age.* Dover, NH: Kogan Page.
Tushman, M., & O'Reilly, C. A. (1997). *Winning through innovation.* Boston, Mass.: Harvard Business School Press.
Vogt, C. (2002). Intractable ERP: A comprehensive analysis of failed enterprise-resource-planning projects. *ACM SIGSOFT software engineering notes* (pp. 62−68).
Volberda, H. W. (1997). Building flexible organizations for fast-moving markets. *Long Range Planning*, *30*(2), p169−p183.
Ward, J., & Peppard, J. (2002). *Strategic planning for information systems* (3rd ed.). England: John Wiley & Sons.
Weick, K. E. (2004). Rethinking Organizational Design. In R. J. Boland Jr., & F. Collopy (Eds.), *Managing as Designing*. Stanford University Press.
Willcocks, L. P., & Plant, R. T. (2000). Pathways to e-business leadership: Getting from bricks to clicks. *MIT Sloan Management Review*, *42*(3), 50−59.
Woodward, J. (1965). *Industrial organization theory and practice.* London: Oxford University Press.
Zuboff, S. (1988). *In the age of the smart machine.* New York: Basic Books.