

A Critical Review of the Impact of IT on Organisational Flexibility

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Hui Liu

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Abstract

Increasing unpredictability and competition as markets globalize means that it is important for organisations to be able to respond to change effectively. While researchers have argued that IT use can lead to a more flexible organizational structure, others have found that this is not necessarily so. A challenge in this field is the ambiguity of the key concepts and a lack of integration into a nomological network. For example, there are many different types of information technology resources, and organisational flexibility is a multidimensional concept (e.g. organisations may have operational, structural and strategic flexibilities) (Golden & Powell, 2000; Volberda, 1996). Thus, studying only one type of IT resource or one aspect of organisational flexibility could mean neglecting the others. This study reviews the literature to understand the relationship between IT and organisational flexibility. Eighty-three relevant articles were located after an extensive search. 95% of them concluded that different types of IT resources could directly or indirectly contribute to some aspect of organisational flexibility. Moreover, different types of IT resources contributed to different types of organisational flexibilities. The study summarises the findings of the review and provides directions for future research in this area.

Chapter 1: Introduction

Highly competitive environments and unstable market demand makes it difficult for organisations to retain their competitive advantages. Moreover, quicker technological innovation requires organisations to learn, change and adapt fast. These real-world difficulties push organisations to be more flexible. Flexibility is a crucial aspect of an organization's competitive advantage and helps ensure organizational survival in the long run. For example, organizational flexibility can contribute to organizational innovation (Xu & Zhao 2011; Xu & Liu, 2008), and have a positive effect on a business' customer relationship management (CRM) practices (Legorreta, Chen, & Ching, 2006). Furthermore, an appropriate level of resource flexibility and operational coordination flexibility can improve a firm's ability to develop new products (Liu, Li, & Wei, 2009). These results contribute to the development of an organization's competitive advantage and long-term survival.

Many researchers have focused on changing organizational structures to achieve organizational flexibility (Schreyogg & Sydow, 2010). For example, organizations can become more flexible by switching from hierarchies to networks, from having formal, rigid rules to encouraging spontaneous interaction, from establishing specialized departments and clear boundaries to improvised processes and temporary project teams, and from moving from vertical lines of command to lateral organization-wide communication (Schreyogg & Sydow, 2010).

Information technology (IT) resources are often seen as crucial for supporting such changes, and thus increasing organisational flexibility. IT resources also seem to be a strategic factor for achieving a competitive position. From some perspectives, firms want to leverage their IT resources to produce organisational flexibility. In recent years, researchers have started to try to understand the relationship between IT resources and organisational flexibility.

Information technology resources are of different types. For example, they include hardware, software, procedures, personnel, and data/information (Delporte-Vermeiren, 2003). However, IT competence, which incorporates issues such as the level of IT investment, the quality of IT and the nature of IS/business partnerships, is also considered to be an organisational IT resource. IT strategy can also be seen as an important IT resource. All these IT resources could affect organizational flexibility. At the same time, organizational flexibility is also a multidimensional concept- organizations may have more than one type of organizational flexibility, such as operational, structural and strategy flexibilities (Volberda, 1996).

Thus, focusing on one type of IT resource or one aspect of organisational flexibility implies neglecting the other facets. To understand the relationship between organisational flexibility and IT resources, this dissertation will undertake a review to integrate material from different fields to build a rich picture of the phenomenon being studied. The next chapter reviews the literature on this topic. It discusses the definition of IT, IT resources and organisational flexibility. In addition, the value of organisational flexibility and methods for enhancing organisational flexibility are discussed. Next, the relationship between IT resources and organisational flexibility are examined. The third chapter introduces the meta-narrative review methodology and the reason for choosing this methodology. The fourth chapter discusses the main findings, and the study ends with a discussion and conclusion.

Chapter 2: Literature review

In this section, the definition of IT is first described. Then, the various types of IT resources are classified. After that, the definition and value of organisational flexibility is discussed. Finally, the relationship between IT and organisational flexibility is examined.

2.1 Information technology

“Information technology” was first mentioned by Leavitt and Whistler in 1958:

The new technology does not yet have a single established name. We shall call it information technology (IT). It is composed of several related parts. One includes techniques for processing large amounts of information rapidly and it is epitomized by the high speed computer... (p. 1)

Information technology is further defined as the “hardware, software, procedures, personnel, and data employed in the production, dissemination, and utilization of information, both formal and informal, in an organization” (Delporte-Vermeiren, 2003). Information technology competency is similarly defined as “the organizational base of IT resources and capabilities and describes a firm’s capacity of IT-based innovation by virtue of the available IT resources and the ability to convert IT assets and services into strategic applications” (Sambamurthy, Bharadwaj & Gover, 2003, p. 244). The latter authors also state that the important elements of IT competency include the level of IT investment, the quality of IT infrastructure (global connectivity and reliability), IT human capital (appropriate technical and business skills), and the nature of information systems (IS)-business partnerships. All of these elements can positively affect organisational performance.

Piccoli and Ives (2005) point out that studies on information technology have a view of IT, which is misguided and misleading. Mahmood and Mann (1993) state that higher levels of organisational performance and productivity do not occur only because of greater investment in IT but also because of strategic IT management. They further point out that strategic managers must first

determine their long-term goals and objectives, and only then should they decide the appropriate level of IT investment necessary to achieve these goals and objectives. Piccoli and Ives (2005) also argue that businesses should focus on IT-dependent strategic initiatives that consist of strategies for obtaining and containing competitive moves.

Piccoli and Ives (2005) further state that IT-dependent strategic initiatives can help companies retain their competitive advantage by establishing barriers against erosion, which are obstacles preventing other companies from imitating their current competitive advantages. Four types of IT-dependent barriers can be used to protect organisational competitive advantages: IT resource barriers, complementary resource barriers, IT project barriers, and pre-emption barriers (Piccoli & Ives, 2005).

However, this study is not going to discuss how an organisation can build a sustainable competitive advantage with IS or IT; the aim is to uncover the relationship between IS and organisational flexibility. Nevertheless, since organisational flexibility is one aspect of competitive advantage, it follows that Piccoli and Ives' (2005) notion that in order to achieve organisational flexibility, focusing narrowly on IS may not be enough. Thus, this article looks not only at IS resources, such as IT investment and IT competency, but also at IT-dependent strategic initiatives to better understand the contribution of IS to organisational flexibility.

2.2 IT resources and capabilities

Information systems have been utilised in many different ways, including for communication, reporting, decision-making, daily transactions, collaborating with external and internal parties, sharing knowledge, and producing goods and services. This variety means that there needs to be a good classification. Saggi, Dorit and Philip (2010) have provided one way of doing so, as shown in Table 1 below.

Table 1: Eleven types of information systems

Types of IS	Definition
Mediated Communication Systems (CMC)	Using computers and telecommunications networks to process, deliver, compose and store communications such as electronic mail (Hiltz & Turoff, 1985).
Virtual Worlds (VW)	An electronic environment that visually mimics complex physical spaces where people can interact with each other and with virtual objects (Bainbridge, 2007).
Web Stores (WS)	Website platforms where vendors sell their products and services.
Decision Support Systems (DSS)	Using computer communications, data, documents, knowledge and models to solve problems and make decisions (Power & Sharda, 2009).
Group Support Systems (GSS)	An aid to group decision-making in organisations by supporting information sharing within groups, and anonymity (Wilson, Griffin, & Jessup, 2010).
Databases (DB)	Software system for storing data in an electronic form that users can connect to so as to create and manipulate electronic data (Hope & Forrest, 2010).
Inter-organisational Systems (IOS)	Automated information systems shared between more than two companies (Cash & Konsynski, 1985).
Knowledge Management Systems (KMS)	For supporting, creating, transferring, and creating, and applying knowledge in organisations (Alavi & Leidner, 2001).
Customer Relationship Management Systems (CRM)	For identifying customers, understanding and predicting customer consumption patterns, identifying appropriate products and services, and delivering them in a personalised format directly to the customer (Sudzina, 2007).
Enterprise Resource Planning Systems (ERP)	Integrating all of a company's departments and functions on a single computer system that can serve all those different departments' particular needs" (Wailgum, 2008).(Majed, 2002).
Knowledge-based Systems (KBS)	Using artificial intelligence to solve problems. It combines a repository (database) of expert knowledge with utilities that facilitate knowledge retrieval in response to specific queries, along with learning and justification, or for transferring expertise form one domain of knowledge to another (Akerkar & Sajja, 2010).

Aral and Weill (2007) define IT resources as a combination of IT assets and IT capabilities. IT assets are divided into four categories: infrastructural, transactional, informational and strategic. IT infrastructural assets provide a shared platform for IT services, while transactional assets are used to build

automated processes and cut costs, as well as to increase volume per unit cost. The purpose of informational assets is to provide information for managing, accounting, reporting, planning, analysis and data mining, and strategic assets help with entering new markets and product innovation (Aral & Weill, 2007).

Information technology capabilities consist of IT competencies (skills) and IT practices (routines) (Aral & Weill, 2007). *Competencies* refer to individuals' or groups' skills that are used to actively manage or accomplish organisational tasks (Aral & Weill, 2007). Moreover, competencies are captured from learning and the repeated performance of contextual activities (Aral & Weill, 2007). *Practices*, in contrast, are routines that accomplish organisational tasks, and act as mechanisms for socially storing and accessing knowledge about the most effective ways to accomplish those tasks (Aral & Weill, 2007). Practices and competencies are closely intertwined: practices help individuals and groups develop competencies, and competencies are necessary for the effective execution of organisational practices toward specified goals (Aral & Weill, 2007).

Another way to classify IT resources is by classifying different aspects of an organisation's information system capabilities. Wade and Hulland (2004) argue that eight core IT capabilities exist, and they can be subdivided into three categories (Table 2): inside-out, outside-in, and spanning. *Inside-out* capabilities are internally-focused, such as technology development and cost controls. In contrast, *outside-in* capabilities are externally oriented, centred on creating stable customer relationships, understanding competitors and managing other external relationships. Finally, *spanning* capabilities integrate the firm's inside-out and outside-in capabilities, by improving IS/ business partnerships and IS planning and change management.

Table 2: Three types of IT capabilities (Adapted from Wade & Hulland, 2004, p. 112)

Outside-in	Spanning	Inside-out
<ul style="list-style-type: none"> • <i>External relationship management:</i> managing links between the IS function and stakeholders outside the firm (such as supply chain management) • <i>Market responsiveness:</i> collecting information from sources outside the organisation as well as market intelligence across departments, and the organisation's response to that learning (for example, via customer relationship management) 	<ul style="list-style-type: none"> • <i>IS-business partnerships:</i> processes of integration and alignment between the IS function and other functional areas or departments of the firm • <i>IS planning and change management:</i> ability to anticipate future trends, choose suitable platforms that can accommodate anticipated changes and manage the resulting technology changes and growth effectively 	<ul style="list-style-type: none"> • <i>IS infrastructure:</i> off-the-shelf computer hardware and software • <i>IS technical skills:</i> IS/IT employees of a firm have appropriate, updated technology skills • <i>IS development:</i> capability to develop or experiment with new technologies • <i>Cost-effective IS operations:</i> ability to provide efficient and cost-effective IS operations on an on-going basis

Aral and Weill's (2007) and Wade and Hulland's (2004) notions of IS resources share some similarities. For example, Aral and Weill's (2007) notion of IT competence and IT practices is similar to Wade and Hulland's (2004) inside-out capability, if we equate IT competency with IS technical skills, and IT practices with cost-effective IS operations. Moreover, Aral and Weill's (2007) notion of four types of IT assets is closely related to Wade and Hulland's (2004) concept of outside-in, spanning and inside-out capabilities. In addition, IT infrastructure is mentioned by both, Aral and Weill's (2007) transactional assets are related to Wade and Hulland's (2004) cost-effective IS operations, and Aral and Weill's (2007) informational assets underpin three of Wade and

Hulland's (2004) capabilities: external relationship management, IS-business partnerships and IS planning and change management. Lastly, the role of Aral and Weill's (2007) strategic IT assets resembles Wade and Hulland's (2004) market responsiveness capability.

2.3 Organisational flexibility

Flexibility is defined as "the capacity to adapt" (Golden & Powell, 2000).

However, flexibility is difficult to define in an organisation due to the reason that it is multidimensional and context-dependent (Golden & Powell, 2000). Golden and Powell (2000) point out that the definition sometimes refers to particular managerial situations or problems, and an organisation can be very flexible in some ways and less flexible in others. Thus, it is not entirely appropriate to oversimplify and refer to a flexible system as an unabridged situation within an organisation.

Organisational flexibility has been classified in various ways by researchers. There are two main streams of thought from Golden and Powell (2000) and Volberda (1996). Their classifications are described in the following pages, because they are both representative, but different. While Volberda (1996) assesses organisational flexibility by looking at organisational scale and the degree of reaction, Golden and Powell (2000) classify organisational flexibility in terms of the features of flexibility. The following paragraphs clarify this difference.

Volberda (1996) provides two criteria for organisational flexibility. One is *speed* and another is *variety*. Speed refers to the time an organisation spends responding to organisational change. Variety refers to the quality and numbers of options and capability available in an organisation to respond to organisational change. Organisational flexibility is classified into four categories by the level of reaction on scale of change: steady-state flexibility, operational flexibility, structural flexibility and strategic flexibility (Volberda, 1997).

1. *Steady-state flexibility* aims to seek efficient production of goods and services. The procedures are usually static and relatively stable over time. This is not a real type of flexibility as it occurs when an organisation seeks to balance economies of scale and diverted production to reduce transport costs.

2. *Operational flexibility* means an organisation can react efficiently on production-volume changes; for example, an organisation can easily increase or decrease product demand. An organisation may need to stay stable when facing a less turbulent environment. Under this condition, an organisation may focus on reducing costs, improving productivity and maintaining routines to build efficiency. However, when market demands fluctuate, an organisation needs to alter its plans or activities frequently. Thus, market demands require organisations to establish operational flexibility to react to changing circumstances.

3. *Structural flexibility* occurs when an organisation can switch its structure easily. Sometimes, an organisation may need to change its organisational structure to capture a competitive advantage in a new, competitive environment (Schreyogg & Sydow, 2010). For example, an organisation may attempt to stimulate innovation by changing the way decisions are made, so that employees from the front-line or the bottom of the hierarchy can participate in the decision-making process. A company may also need to improve its structural flexibility to become more market-oriented to improve its responsiveness to customers' needs.

4. *Strategic flexibility* occurs when an organisation effectively changes its strategy, such as changing products' markets, using different technologies or increasing competency advantage so as to "... respond quickly to changing competitive conditions (and) develop and/or maintain competitive advantages" (Hitt, Keats, & DeMarie, 1998). While strategy can be divided into three levels- corporate-level strategy, business-level strategy and operational-level strategy (Johnson, Scholes, & Whittington, 2005, p. 1) – this aspect of flexibility pertains

more to business-level strategy, which focuses on product choice, meeting customer needs, and exploiting or creating new opportunities.

Golden and Powell (2000) extend Volberda's work and specify four characteristics of flexibility:

- *Temporal flexibility* can be described in terms of the length of time that it takes an organisation to respond to environmental changes.
- *Range* is the amount of capacity available in an organisation for adapting to foreseeable and unforeseeable changes.
- *Intention* is the degree to which organisations take an offensive or defensive stance towards flexibility. Firms with an offensive stance (*agile firms*) explore and exploit opportunities for market arbitrage, discover opportunities for innovation and obtain competitive market opportunities by assembling resources with speed and an element of surprise (Sambamurthy et al., 2003).
- *Focus* refers to the area in which the flexibility is created, such as internal or external.

Golden and Powell (2000) further assert that the temporal and range aspects of organisational flexibility can be evaluated with these criteria:

- Temporal:
 - *Efficiency* measures the degree to which organisations meet challenges within time constraints imposed, with the least cost and degradation of performance.
 - *Responsiveness* measures the speed of adaptation to new circumstances.
- Range:
 - *Versatility* measures the organisation's capability of adopting foreseen changes, the extent to which the organisation has planned for and can respond to changes, and the range of

activities that the organisation has completed contingency planning for.

- *Robustness* is the ability to adapt and respond to unforeseen changes.

Thus, both Volberda's and Golden and Powell's work on flexibility is useful for this study: Volberda defines different ways in which organisations can be flexible, while Golden and Powell provide a more nuanced way of evaluating organisational flexibility broadly. An interesting future research project would be to examine how the four characteristics of flexibility differ across the different types of flexibility.

2.4 Value of organisational flexibility

"Flexibility and inflexibility are always combined in capital industry and what are possibly emerging now are new permutations of each rather than a simple trend towards greater flexibility"
(Golden & Powell, 2004).

As early as 1975, Steer found that the evaluation criterion most used to assess organizational effectiveness was flexibility (as cited in Golden & Powell, 2004). Organizational flexibility contributes to organizational innovation (Xu & Zhao, 2011; Xu & Liu, 2008) because external learning can lead to organizational resource flexibility and competence flexibility, which support radical innovation (Xu and Zhao, 2011). Moreover, both resource flexibility and competence flexibility could lead to independent innovation (Xu & Liu, 2008). Since innovation is an important facet of competitive advantage, organizational flexibility's role in encouraging it allows organizations to enhance their competitive advantage.

Organizational flexibility, together with the right people, information technology and process flexibility, helps a business' customer relationship management (CRM) practices and CRM performance because organization flexibility

ensures organizations will be able to adjust and adapt to change in a timely manner, reducing the costs incurred by late responses.(Legorreta et al., 2006). Enterprises with better customer relationships can better understand customer needs, respond to market change more quickly, and come up with better opportunities for discovering new market.

Liu, Li and Wei (2009) conducted a survey in China and found that the appropriate level of resource flexibility and operational coordination flexibility supports new product introduction capability. New product introduction capability is one of the most important factors that ensure the success of new product development (Liu et al., 2009) and the capability of new product development is crucial for an organisation surviving in a long term and staying competitive.

Golden and Powell (2004) outlined that there can be disadvantages to strategic flexibility in the form of increasing costs, stress on employees and a lack of organizational focus. However, flexibility has become as important a determinant of competitiveness as costs. There is evidence that greater flexibility is needed in the strategic process now compared with the 1970s. Flexibility has become so important to organizations that it may have a role as a critical success factor in its own right. Today's world demands more flexibility (Golden & Powell, 2004). Thus, it is important to understand how flexibility can be enhanced.

2.5 Enhancing organisational flexibility

Volberda (1996) points out that in order to obtain flexibility, organisations must commit to two tasks: managerial tasks and organisational design tasks.

Managerial tasks focus on establishing a variety of capacities in an organisation and on improving adaptation speed (control capacity) towards change to generate better flexibility. Volberda (1996) argues that developing flexibility is not exclusively the role of the manager, and every organisational member can participate in the process of capability development. However,

“authoritarian managers may restrict capability development to a limited number of people, more democratic and more participative forms of decision making in organizations can result in a much wider involvement” (Volberda, 1996, p. 361). For example, managers can improve flexibility by training employees, improving processes, communication and decision making.

The *organisational design task* aims to create adequate organisational conditions as a platform (organisational controllability) for managerial capability, (Volberda, 1996). Managerial tasks are like the software of a personal computer, while organisational design tasks are more like configuring the hardware in a personal computer. Computer hardware enables and constrains software’s capacity. Organisational design tasks determine organisational capacity, such as product capacity, finance capacity and information capacity. Managerial tasks refer to organizational processes that determine the extent and variety of tasks can be done. Organisationally dynamic capability and adaptation speed refer to organisational control capacity and the adequate organisational condition is regarded as organisational controllability.

Controllability limits the control capacity, and both organisational control capacity and controllability determine the organisational flexibility (Volberda, 1996). An organisation’s controllability is also determined by its culture, structure and technology (Volberda, 1996).

Strategic flexibility is essential for organisations to find new markets and core competencies. Sanchez (1995) points out that in order to obtain strategic flexibility in product competitions, organisations must obtain resource flexibility and coordination flexibility. Organisations have high resource flexibility when: a) a resource being used has a large range of alternative uses, b) the costs of switching from one use to another are low, and c) the time required to do so is short (Sanchez, 1995). Coordination flexibility is related to a company’s ability to define its product strategy and how resources are used in fulfilling it (Sanchez, 1995). A high level of coordination flexibility means a company can

configure chains of resources and deploy these resources easily and effectively (Sanchez, 1995).

Strategic flexibility can be created through an organisation's competency building and leveraging (Sanchez, 1995). In order to survive in an uncertain future, companies need to create and improve competency to meet future demands. Organisations can use their available resources and capabilities to improve their current competencies. They can then exercise some of their strategic options; by exercising these options, the company can create new flows of resources. This is followed by the development and deployment of new kinds of resources for building competencies. Lastly, success in competency building creates new strategic options. This circle of success can lead to organisations gaining competencies constantly.

Modularity in product and process architectures greatly facilitates the creation and realization of strategic flexibility by an organization (Sanchez, 1995). The modular approach intentionally tries to create a product or process design that permits the substitution of different versions of functional components for the purpose of creating product or process variations with different functionalities or performance levels. An objective of the modular approach to design of organisational processes is to create the ability to readily reconfigure the organisation as a system by substituting functional process variations into the process architecture. Modular process architecture can greatly decrease the need for direct inputs if management adequately resources change processes within the range of process variations allowed by the modular process architecture. The speed of organisational reconfiguration in response to a changing environment can be increased, thereby enhancing the organisation's strategic flexibility. Modular process architectures may also improve the ability of an organisation, or network of organisations, to innovate within functional processes (Sanchez, 1995).

2.6 The role of IT in organisational flexibility

In the modern business world, IT resourcing is one of the crucial determinants in sustaining competitive advantage, because it can improve efficiency, generate differentiation, and channel domination (Piccoli & Ives, 2005).

Investment in IT can generate positive impacts for organisations. Harris and Katz (1991) state that companies can improve their performance by investing more in IT. For example, the most profitable insurance companies have spent more on IT; in contrast, the least profitable have spent less (Bazaee, 2010). Bazaee (2010) studied gas and oil companies in Iran and India, and found that in both industries, IT investment led to increases in performance, mediated by managerial capability. Becalli (2007) studied the European banking industry, and found that investment in IT services, from external providers such as consulting services, implementation services, training and education, and support services, seems to have had a positive influence on accounting profits and profit efficiency.

IT may be used to create cost efficiencies, provide product differentiation, enhance market focus, and raise entry barriers. Moreover, IT can increase productivity, improve communication, and provide jobs as well as increase decision quality (Köllner & Krisch). Moreover, IT speeds up business processes at an enormous rate, saving the adopting organisations a great amount of time.

Information technology also has the potential to dramatically improve organisational flexibility (Lucas & Olson, 1994). Lucas and Olson (1994) point out that IT alters flexibility in three major ways (Figure-2). First, IT can reduce time and place-of-work constraints. Second, IT can increase work efficiency. Third, IT enables the firm to respond quickly to changing market conditions.

The purpose of organisations gaining flexibility is to increase their effectiveness and gain a competitive advantage. Lucas and Olson (1994)

illustrate three steps necessary for gaining organisational flexibility that lead to competitive advantages. The first step is to obtain an IS capability. The second step is to achieve increased flexibility. Gaining flexibility means that time and place will be less constraining to work, nature and pace of work will be changed in a positive way, and the organisation will respond more quickly. The third step is that organisations must generate secondary effects: technological dependence, anticipated responses and management complexity. In order to achieve competitive advantage, organisations need to deal with the fact that they will become more dependent on IT. Thus, the stability and flexibility of IT is crucial for organisations to generate a competitive advantage. Organisations need to deal with requests from customers, employees, and even competitors to increase their IT use. Organisations may be influenced by their customers and employees may not be willing to use the IT and IS that is provided for them. Organisations also need to manage the greater complexity generated by increased flexibility. For example, managers may find it hard to control employees who can work where they want. Only when organisations can successfully deal with these secondary effects, can they then benefit from the flexibility created by IT.

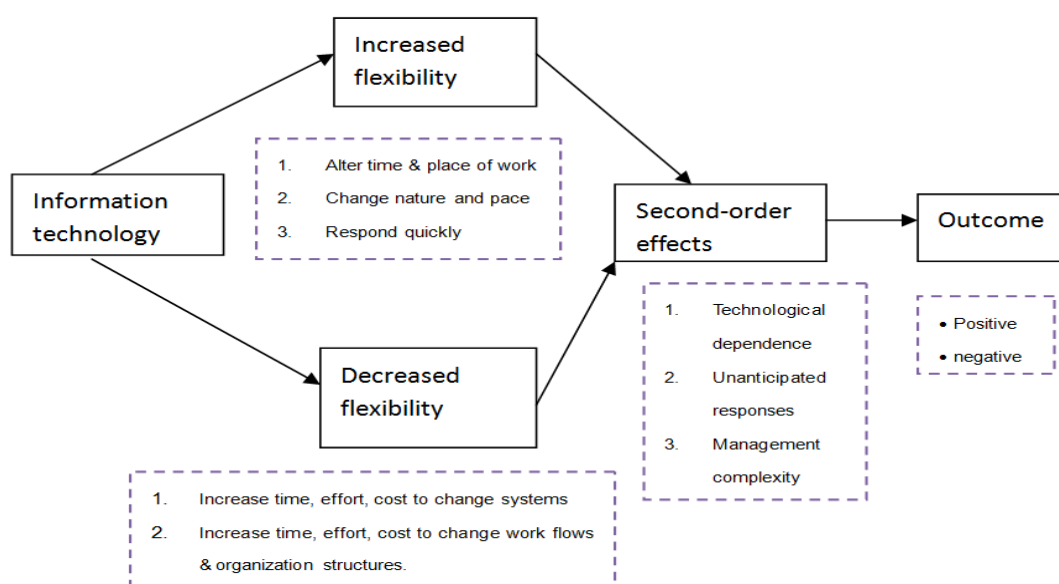


Figure 1. Relationship between IT resources, organisational flexibility and competitive

advantage (Source: Lucas & Olson, 1994, p.158) Reprinted with permission

Sambamurthy et al. (2003) provide a similar process for generating competitive advantages from organisational flexibility. They state that, first of all, organisations must obtain IT competencies, which are dependent on IT investment scale and IT capabilities. Then, organisations can obtain or improve certain capacities such as process reach and richness, as well as knowledge reach and richness. After that, an organisation can enlarge its capacities in customer, partner and operational agilities. Thus, organisational flexibility can be achieved as in Figure 3.

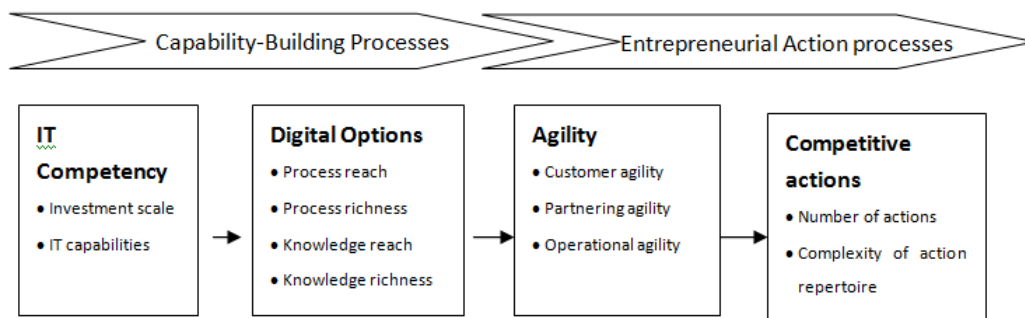


Figure 2. Relationship between IT competency, agility and competitive actions (Source: Sambamurthy et al., 2003, p.251) Reprinted with permission

Since the 1990s, organisations' adoption of IT innovations has led to less dependence on hierarchies and the collection, storage, and distribution of information common in command and control bureaucracies (Zammuto et al., 2007). This result is not only because of IT but the combination of IT features with organisational arrangement and practices that support IT use (Zammuto, et al., 2007). The combination of IT and organisational features can lead to five affordances (affordable activities): visualising entire work processes, real-time/flexible product and service creation, virtual collaboration, mass collaboration, and simulation/synthetic representation (Zammuto et al., 2007).

- *Visualising entire work processes* leads to better decision making. Organisations need to adapt both technology and organisational

features to achieve this. Technologically, in order to achieve real-time visualisation capability, organisations need to adopt business process management tools coupled with dashboards that display the status of works in progress. For process monitoring, firms need integrated databases coupled with intelligence software. Technology such as radio frequency identification can provide real-time tracking. In terms of organisational features, organisations require process standardisation and a good understanding of processes to identify key performance indicators and to carry out continual operational reviews to monitor progress and solve any problems. Visualisation affordance can lead to better performance, understanding and problem solving.

- *Real-time/flexible product and service creation* is defined as the ability to create products and services enhanced by software, by quickly recombining components in new and innovative ways. Web-based service-oriented architectures, standardised component designs and open source software are the necessary technological features for this ability. It provides opportunities for people from different backgrounds and expertise to come together easily to facilitate more creative mixing of product and service components.
- *Virtual collaboration* is the ability to share and integrate others' knowledge when that knowledge is conveyed primarily through virtual media. Virtual collaboration is highly dependent on intertwining technology, such as virtual teams and online electronic networks. In addition, an organisation needs to encourage open knowledge sharing, knowledge acquisition, knowledge maintenance and updating.
- *Mass collaboration* is the ability of people to interact on a many-to-many basis through the internet, as opposed to a one-to-one basis such as instant messaging or a one-to-many basis such as list servers. The purpose of mass collaboration is to obtain information from unknown others to create new, unexpected content. The major implication of

mass collaboration is the potential for developing temporary organisations quickly.

- *Simulation/synthetic representation* is the capability to conduct what-if scenarios, and the ability to shape or favour a variety of specific uses. Dashboards coupled with business process management tools and business intelligence are necessary technology features. Moreover, simulations imply action is the necessary organisational feature. This capability can lead to a better understanding of how performance can be enabled by empowerment without an overload, and how better performance can be confidently enabled by the right balance between refinement and challenge. An example where information systems can help improve organisational efficiency and responsiveness is provided by Ngai and Gunasekaran (2004), who study how companies such as Dell and BMW use IS to establish order in supply chain management strategy. They mention that companies can achieve benefits such as reducing the lead time for processing orders and for transporting goods, effective inventory management and more accurate delivery, as well as 24-hour service and improved vendor relations, by using the internet in supply chain management (Ngai & Gunasekaran, 2004).

These five affordances (combining IT and organisational changes) support the growth of organisational flexibility. For example, visualizing entire work processes improves organizational controllability because it allows organizations to monitor entire work processes. Real-time/flexible product and service creation increases the variety of organisational tasks. The increase in organizational task variety could enhance organisational control capacity, which affects organizational flexibility (Volberda, 1996). Virtual collaboration helps organisations absorb knowledge, and could lead to improvements in organisational competencies. Competence building results in strategic flexibility (Sanchez, 1995). Both mass collaboration and simulation/synthetic

representation represent coordination flexibility. Collaboration flexibility is the ability to define, configure and deploy resources (Sanchez, 1995). Mass collaboration aims to obtain information from others and use it as a type of organizational resource, that it could be generated and deployed through mass collaboration. Simulation/synthetic representation improves resource utilization by being able to simulate “best solutions”. This ability to define and deploy resources contributes to coordination flexibility. Consequently, coordination flexibility could lead to strategic flexibility.

However, Lucas and Olson (1994) mention that IT can also lead to an unintended decrease in flexibility in two ways. First, changing IT systems takes time, effort, and is costly. Second, IT systems causing workflow and structural changes also increase time spent, effort, and cost (Figure 3). Different IS may cause different effects on organisational flexibility. One example is computer-integrated manufacturing (CIM). Gerwin (1993) points out that CIM can reduce manufacturing flexibility due to hierarchical control structures preventing subsystems from exhibiting sufficient autonomy. On the other hand, Gerwin (1993) postulates that electronic data interchange (EDI) networks have a positive effect on providing adaptability. Thus, the conclusion that IS either reduces or improves organisational flexibility is too simplistic. Instead, IT's effects on flexibility require scrutiny on a case-by-case basis. Gerwin (1993) further says IT/IS can reduce process uncertainties for companies, reduce truncation errors such as shipping to the wrong location, sending the wrong item and deleted product issue.

2.7 Summary

The literature review began with the definition of IT and IT resources. Different types of IT resources and classification of these IT resources have been discussed. Different types of IT resources are deployed for different purposes, and may thus have different impacts on organisational flexibility.

Next, this chapter defined organisational flexibility and discussed the

dimensions and features of organisational flexibility. It then briefly discussed ways to measure organisational flexibility. Organisational flexibility is multidimensional, and people from different departments and levels within organisations may think of flexibility differently. People can study different features of organisational flexibility, such as the temporal aspect of flexibility, the range of flexibility, and organisational intention towards flexibility. The temporal aspect covers reaction time and speed of adaptation to change. Range describes the capacities and capabilities available to process changes. Intention describes positive or negative reactions to change. Finally, flexibility can be generated from both inside and outside the organisation.

The section that followed described the benefits of organisational flexibility. The business environment is getting more and more capricious. Thus, organisations are required to be more and more flexible in order to survive. Moreover, fierce competition requires organisations to react more quickly to customers and to be more effective. Organisational flexibility seems to be an important factor for gaining such competitive advantages.

This chapter also discussed how organisational flexibility can be enhanced. Two directions have been provided for enhancing organisational flexibility. The first direction focuses on managerial tasks; the other direction is organisational design tasks. Managerial tasks aim to create a variety of solutions to changes, to improve reaction times and speed of adaptation to changes. Organisational design tasks aim to improve overall organisational capability through technology, culture and structure. Improved overall organisational capability can better control the variety of tasks and can also increase speed of adaptation.

The role IT plays in shaping organisational flexibility was also discussed. Information technology resources seem to play an important role in generating organisational flexibility, but can also impede it. In one way, IT resources improve efficiency and effectiveness, and in another way the same resources

produce complexity and extra costs. The influence of IT resources on organisational flexibility seems to be a paradox. In addition, there are a variety of IT resources, and organisational flexibility is multidimensional. Thus, the relationship between different types of IT resources and organisational flexibility needs to be clarified.

Chapter 3: Methodology

3.1 Meta-narrative Review

A meta-narrative review methodology is used in this study. This approach integrates material from different fields to build up a rich picture of the phenomenon being studied. The goal of this approach is to uncover the different 'storylines' underlying research in a particular field, because, very often, "different groups of scientists [would] have conceptualized and investigated the same problem in different ways and produced seemingly contradictory findings" (Greenhalgh et al., 2005, pg. 417). The narratives in these different paradigms comprise the sets of studies that follow seminal theoretical and empirical articles (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004).

This method is appropriate for studying the impact of IT on organisational flexibility, because research on this topic can be found across a range of fields, such as information systems, strategy and operations management. In addition, these studies have looked at various related facets of organisational flexibility, such as operational flexibility, structural flexibility and strategic flexibility. The topic has also been studied at various levels of analysis and with very different datasets. Traditional approaches may lead to researchers focusing only on a single dimension or stream of research of flexibility and ignoring the others. A meta-narrative review, in contrast, is useful for revealing consonant and dissonant findings across these studies, the key concepts in this field and the relationships between them. Such an approach can thus provide a more complete picture of this topic.

Different paradigms use their own set of concepts, theories, methods and instruments to discover truth that cannot be satisfactorily explained through a different paradigmatic lens, making paradigms incommensurable (Greenhalgh et al., 2005). Greenhalgh et al. (2004, 2005) explain the different roles played

by the conceptual, theoretical, methodological and instrumental tools researchers use to understand a word, no matter what particular lens or paradigm they look through:

- Conceptual tools define what objects are considered to be worth of study and thus, as legitimate scientific endeavours;
- Theoretical tools specify the relationships between the objects of a study and with the rest of the world;
- Methodological tools delineates the ways in which the object of study has been investigated;
- Instrumental tools are the accepted tools and techniques used for finding answers.

This study's meta-narrative review begins by identifying the different literature streams through intuition, networking and browsing. This led to the seminal papers within the different literature streams being located after searching references of references. To qualify as 'seminal', papers are evaluated in terms of their comprehensiveness and contribution to future work. In this study, papers were considered to be seminal if they have been cited more than 50 times. Next, the papers that referenced these seminal works would be selected. Once identified, their conceptual and theoretical models were summarised.

Next, the narratives of the studies in each research tradition were mapped by using citation-tracking software and manual searches of electronic databases. The key elements, key actors and events, and the metaphors used to describe it were then identified for each stream. Following that, each primary study within each tradition was evaluated for its validity and relevance to the review question, and comparable results were grouped together. Finally, the main dimensions of the topic were identified after looking across the different traditions. This was accompanied by an assessment of the contribution each tradition has made to the various aspects of the study, and an attempt was made to explain contradictory findings.

3.2 Application of Meta-narrative Review Methodology

A three-step process was used to obtain articles for the review (Figure. 4). First, the Web of Science, a cross-disciplinary citation database, was searched for articles featuring the keywords 'organizational flexibility' and its variants (such as 'operational flexibility', 'structural flexibility' and 'strategic flexibility'), in combination with 'IT', 'IS' and 'computer sciences' and 'information systems' (and their variants). The keywords were selected by reading the seminal articles in the field, such as Lucas & Olson (1994). 99 articles were located, and 18 articles were relevant for this study, based on a review of their abstracts. Articles were considered to be relevant if they: a) were empirical, and not theoretical or conceptual, and b) examined how some aspect of IT/IS (resources, competencies, or capabilities) influenced organisational flexibility overall, or some aspect of it.

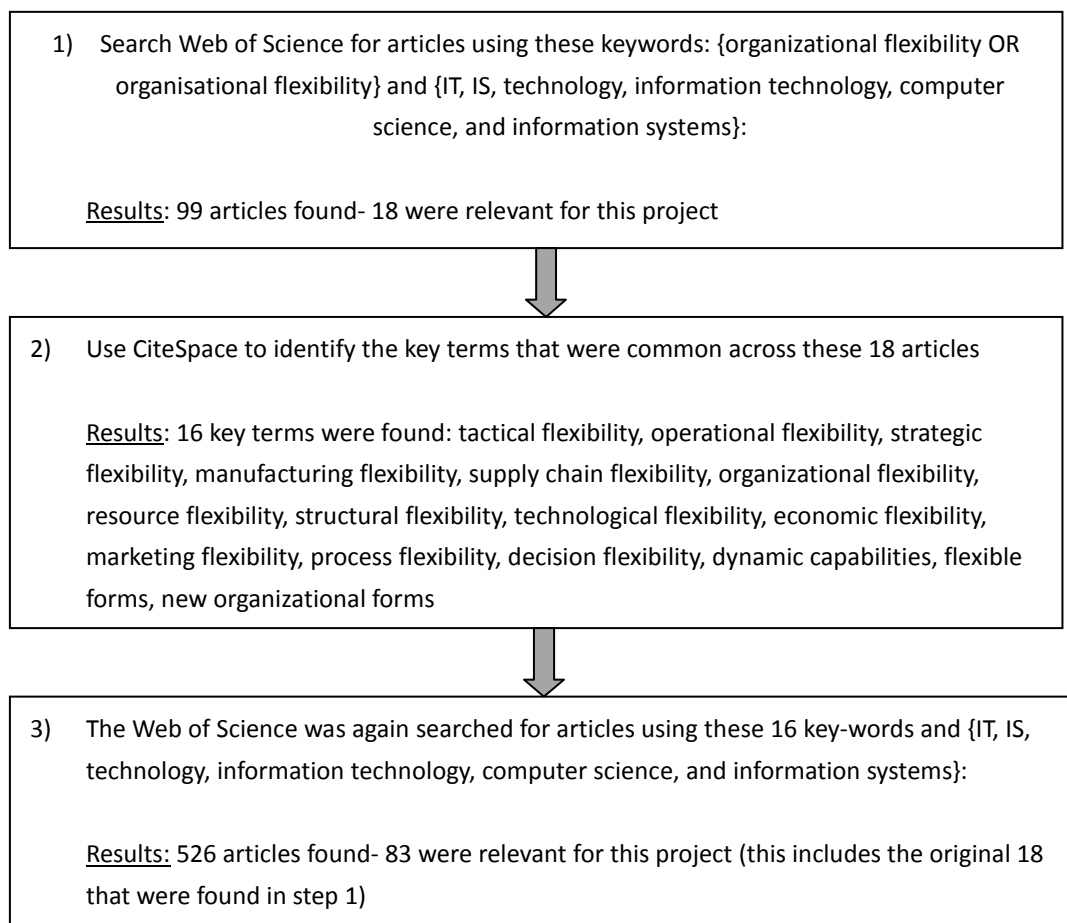


Figure 3. Summary of the Literature Search Process

IT resources and organizational flexibility. 83 articles met the requirements. Two examples of articles that met the criteria are Botarelli, Taticchi and Cagnazzo's (2008) study of the impact of virtual technology on organizational flexibility, and Govers and Mur-Veeman's (2008) analysis on the ability of ERP systems to impede organizational flexibility. An example of an article that was found through the literature search but was not relevant for the study is Fioretti (2012), which provides two measurements of flexibility but does not mention any relationship between IT resources and organizational flexibility.

Chapter 4: Results

This chapter begins by discussing the types of flexibility that have been studied in the 83 articles that were reviewed. Next, it describes the various aspects of IT/IS that have been shown to have an effect on organisational flexibility. Finally, it reviews what has been found about the relationship between IT/IS resources and organisational flexibility.

4.1 Key elements: types of flexibilities influenced by IT resources

The review identified nine types of flexibilities resulting from IT utilisation (Figure 6). Organizational flexibility was mentioned most frequently (53 articles), followed by supply chain flexibility (9 articles), strategic (6 articles) and marketing flexibility (5 articles). The relationships between IT and both operational and process flexibility were studied by three articles. The least studied types of flexibility were economic and decision flexibility (1 article each).

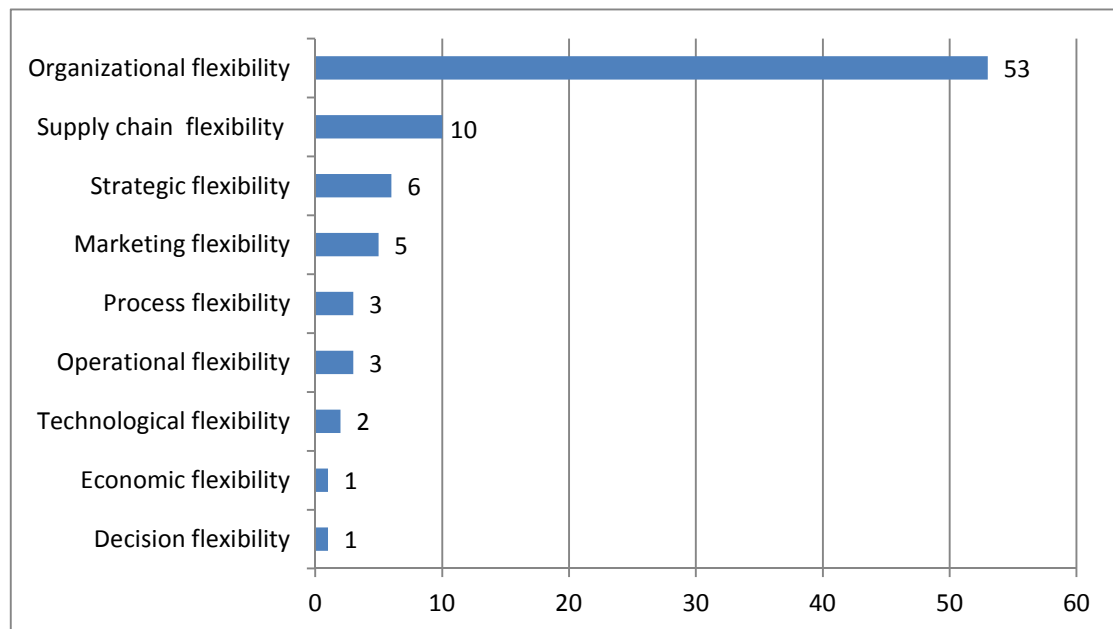


Figure 6. Number of articles that studied different aspects of flexibility

4.2 Key elements: types of IT resources that influence organisational flexibility

Eighteen types of IT resources have been identified as having an impact on organisational flexibility. Among these, IT capability and competency appear most frequently, with 13 articles mentioning them. IT resources and investment are next, featured in 10 articles. Enterprise systems and generic ICT were investigated by eight articles. Business process management and IS design planning and architecture were mentioned by six and seven articles respectively. Virtual technology, Web service and business process management technology were all examined in just five articles. IT integration and knowledge management technology were analysed by three and four studies respectively (Figure 7).

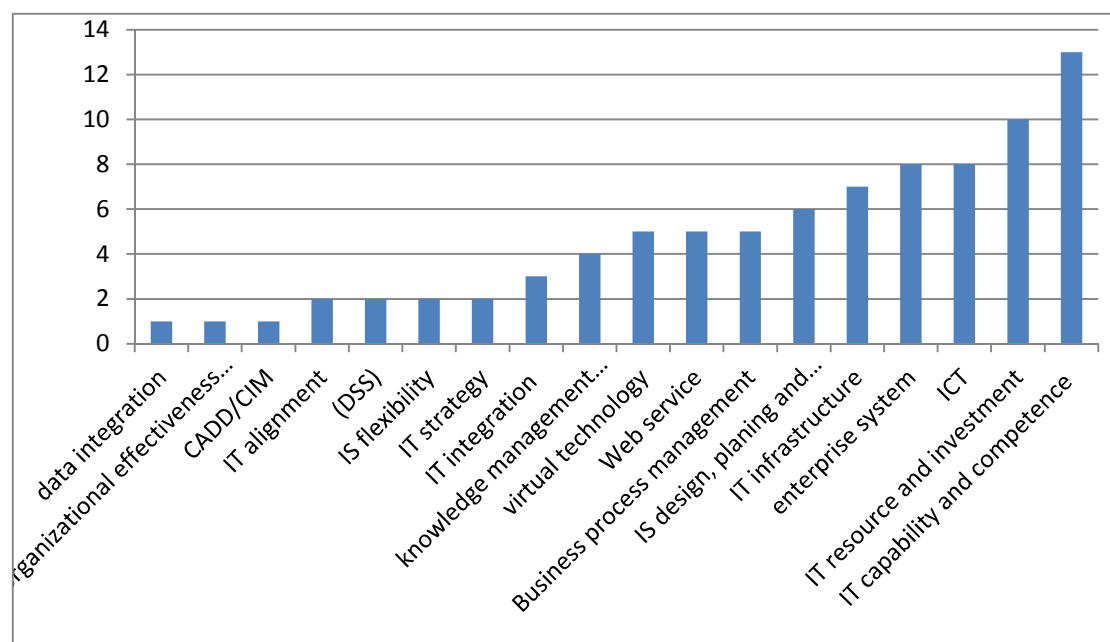


Figure 5. Number of articles that studied different types of IT

4.3 Classification of IT resources

In order to better understand the function of IT resources, Wade and Hulland (2004) classified IT resources into three categories: Outside-in, Spanning and

Inside-out. The 18 types of IT resources can be grouped into these three categories (Table 4).

Table 3. Classification of IT Resources into Wade & Hulland's Categories

Outside-in (5 articles)	Spanning (23)	Inside-out (55)
<ul style="list-style-type: none"> •Web services (5) 	<ul style="list-style-type: none"> •Enterprise system (8) •Business process management (5) •IT alignment (2) •IT integration (3) •DSS (2) •Data integration (1) •IT strategy (2) 	<ul style="list-style-type: none"> •IT infrastructure (7) •IT resource and investment (8) •IT capability and competence (13) •IS flexibility (2) •CADD/CIM (1) •Organizational effectiveness system (1) •IS design, planning and architecture (6) •Knowledge management system (4) •ICT (8) •Virtual technology (5)

Outside-in resources are those related to external relationship management and market responsiveness (Wade & Hulland, 2004). Web services are used for making a firm's IT architecture modular, and hence more flexible. While these services can be for serving either internal or external users, they are arguably used more extensively for creating customer-facing services that enable organizations to connect with their customers and develop stable customer relationships. In addition, a flexible IT architecture helps a firm respond more quickly and easily to changes in its product-markets. Thus, web services are placed in the outside-in category.

Spanning resources are relevant for IS-business alignment, IS planning and change management. Enterprise systems and data integration are used to integrate organizational resources and reduce the boundaries between departments to better control organizational process and resources. Business process management systems, IT strategy and IT alignment enable

organisations to better align business and IT. DSS leads to the better deployment of organisational resources, for example by improving IS planning so that IT resources are better managed to deal with organisational conditions. Moreover, DSS contributes to predicting future trends better, thus enhancing better change management.

Finally, inside-out resources refer to internal IT competencies, such as IS infrastructure, IS technical skills, IS development and cost-effective IS operations (Wade & Hulland, 2004). Thus, these resources- IT infrastructure, IT investment and IT capability and competence- fit into this category.

Based on this categorisation, the majority of studies have focused on inside-out resources (55 of the 83 articles). Outside-in resources are the least studied - only one type of IT resource (web services) in five articles.

4. 4 Influence of IT resources on organisational flexibility

4.4.1 Positive Impact

70% of the studies are empirical while the rest are conceptual. Among these, 36% of the articles are case studies and 34% are surveys. 80 of the 83 articles (96%) supported the notion that IT contributes to organizational flexibility¹.

4. 4.2 Negative impact

Three articles indicated that IT resources could have a negative impact on organizational flexibility: two mentioned that ERP systems could constrain organizational flexibility because of its complexity and stereotypes;(Govers & Mur-Veeman, 2008; Ignatiadis & Nandhakumar, 2007), and the third one (Rollier (1998) stated that the careful planning required for IT infrastructure could restrict flexibility. Govers and Mur-Veeman (2008) and Ignatiadis and Nandhakumar's (2007) articles were empirical, while Rollier's (1998) article was conceptual.

¹ Organisational flexibility here refers to the nine types of organisational flexibility

Govers and Mur-Veeman (2008) state that the comprehensiveness and complexity of ERP systems requires advanced and specialized knowledge and skills, and ERP skill incompetence could lead to non-flexible ERP computerization, reducing organizational flexibility. Ignatiadis and Nandhakumar (2007) conducted a case study and mentioned that ERP could result in rigidly defined control mechanisms that creates power differentials and increased rigidity. Rollier (1998) argued that IT infrastructure can decrease organizational flexibility because while adaptable IT infrastructure is constructed by careful planning, careful planning constrains flexibility

Table 4. Studies that found a negative impact of IT resources on organizational flexibility

Author	IT resources	Theory/findings	Methods
Rollier, 1998	IT infrastructure	Deploying an effective infrastructure needs careful planning, but planning constrains flexibility.	concept
Govers & Mur-Veeman	Enterprise system	Comprehensiveness and complexity of ERP require advanced and specialized knowledge and skills, skilled incompetence and non-flexible ERP computerization lead to inflexibility	survey
Ignatiadis & Nandhakumar	Enterprise system	ERP is rigidly defined control mechanisms and it creates power differentials and increased rigidity.	case study

4. 5 History of research in this domain

The data illustrate that articles on this topic began appearing from 1992. From 1992 to 2004, the number of research articles remained stable, averaging two articles each year. The number of articles doubled to seven from 2004 to 2005.

Except for dips in 2007 and 2010, the number of articles increased continuously from seven to 11 between 2005 and 2011. In 2012, the number dropped to six (Figure 8).

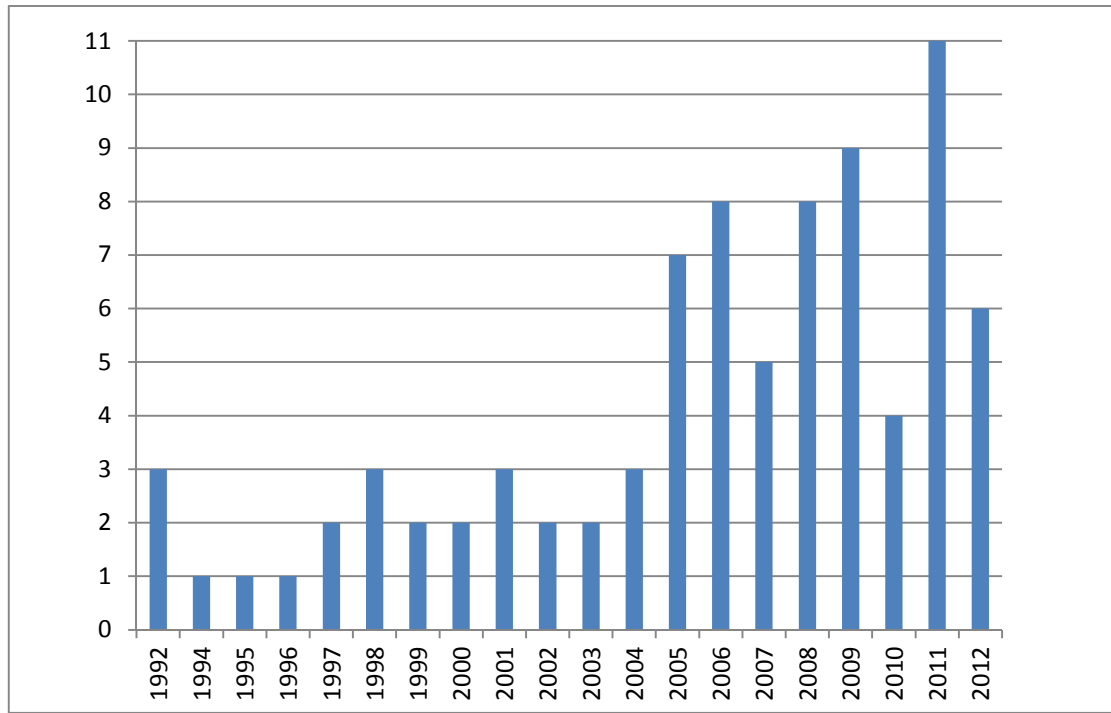


Figure 6. Number of articles published on IS and flexibility (1992-2012)

4.6 Impact of IT on Various Aspects of Flexibility

The results show that nine types of organisational flexibilities have been studied (Section 4.1). These nine types of flexibility are treated as eight different study streams, and each stream is discussed separately.

4.6.1 Impact of IT on organisational flexibility

Almost all types of IT resources, except ERP and IT infrastructure, have been found to contribute to organisational flexibility. IT resources, IT capability and competency, IT resources and investment, information communication technology (ICT), IT infrastructure and IS design, planning and architecture can significantly facilitate overall organisational flexibility.

Five articles state that enterprise systems can positively affect organizational flexibility. For example, Golden and Powell (2004) argue that

inter-organisational systems (IOS) improve efficiency, responsiveness, versatility and robustness, thus improve organizational flexibilities. In terms of IT capability and competency, four surveys, one case study and two theoretical studies have been conducted. For example, Prager (1996), Dean (1997) and Oh and Teo (2006) indicate that personal IT knowledge and skill, IT managerial capability, as well as skill and knowledge integrated with people and technology, can significantly contribute to organisational flexibility. Four theoretical and two empirical studies have been conducted on the impact of IT resources and investment. For example, Lu and Ramamurthy (2011) conducted a survey and found that both information sharing and the implementation of IT can directly affect organisational flexibility and are mediated by planning comprehensiveness.

Five surveys have been carried out on the impact of IT infrastructure. Bhatt, Emdad, Roberts and Grover (2010) point out that proper IT infrastructures improve information generation and dissemination. Information generation can significantly improve organisational responsiveness. Information communication technology has been examined by three theoretical and three empirical studies. Groupware, network enterprises, detailed and real-time information as well as remote logging facilitated by ICT, are considered necessary to be able to promote organisational flexibility (Zahller, 2012; Perez-Alvarez, 2002; Botarelli, aticchi & Cagnazzo, 2008). Information systems design, IS planning and IT architecture have been analysed by three theoretical studies and one empirical study (Krouwel & Land, 2011) that introduced the normalized system design approach. Users involved in IS planning and service-oriented architectures are described as facilitators of organisational flexibility in those studies.

General IT resources such as IT capability and competency, IT resourcing and investment, IT infrastructure and ICT seem to do better at generating overall organisational flexibility than specific IT resources, such as Web services and

data integration (Figure 9).

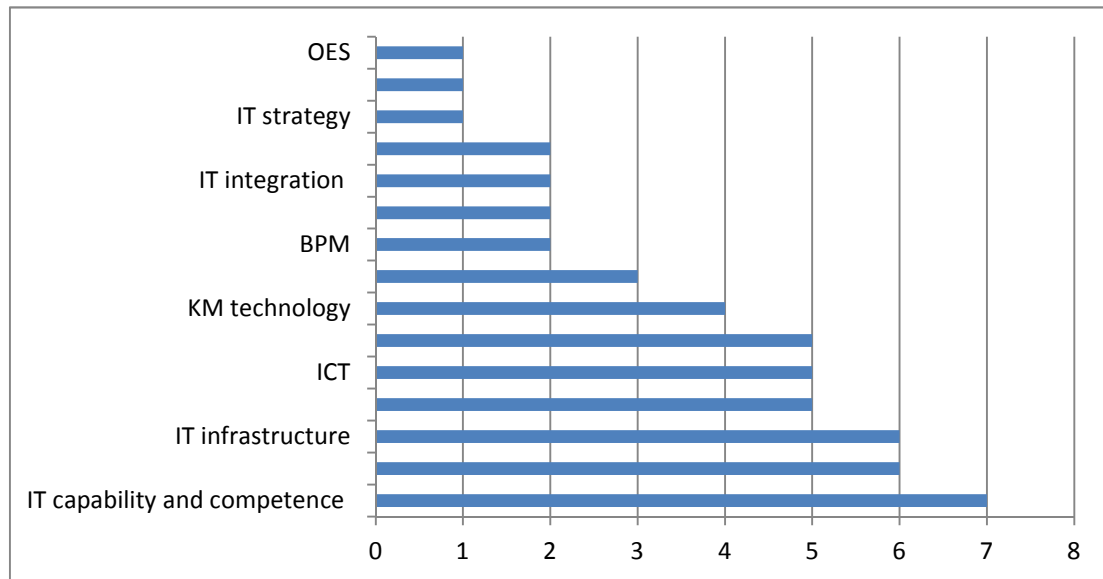


Figure 7. Impacts of IT resources on organisational flexibility

All three categories of IT resources affect organizational flexibilities. Inside-out capabilities, such as IT capability and competence, IT resources and investment, IT infrastructure and knowledge management technology, seem to do better at generating overall organizational flexibility than the other two types of IT resources.

Table 5. Impact of inside-out and spanning IT resources on organisational flexibility

Categories of IT resources	Types of organizational flexibility
Inside-out	General organizational flexibility
spanning	
Outside-in	

4.6.2 Impact of IT on supply chain flexibility

“Flexibility dimensions required by all the participants in the supply chain to successfully meet customer demand” (Grigore, 2007, p. 67). The review found that seven types of IT resources could contribute to supply chain flexibility: IT capability and competence, ICT, IT infrastructure, virtual technology, enterprise systems, IS flexibility and IT integration. Information technology integration, virtual technology and generic ICT has been mentioned by two articles each,

while one theoretical and one empirical study have been undertaken on the impact of IT capability and IT competencies. Ngai, Chau and Chan (2011) state that IT resources like mobile and wireless technologies, such as radio frequency identity (RFID) and sensor network technologies for real-time data collection, could enhance supply chain capability. Moreover, integrative technologies, such as extensible mark-up language (XML) and Web services for the real-time monitoring of events through portals, could significantly improve organisational flexibility. Lastly, a combination of business process re-engineering, management technologies for business process automation, and a redesign of supply chain systems or enterprise systems can to some extent contribute to organisational flexibility. IT integration coordinates partners' and supply chain functions by sharing information related to demand forecasts, production schedules, inventory, and production quality that dictates supply chain activities. Moreover, IT integration facilitates knowledge sharing along the supply chain (Ngai et al., 2011). "[Information technology] integration also includes the exchange of knowledge with partners up and down the supply chain, allowing them to collaborate and to create synchronized replenishment plans" (Ngai et al., 2011, p. 1).

For ICT, sharing a broad range of information with partners, modular design of interconnected processes, structured data connectivity and IT-supported dynamic adjustment allow organisations to sense change and adapt their supply chain linkages quickly (Gosain, Malhotra, & El Sawy, 2004). In terms of virtual technology, Wang and Wei (2007) point out that existing inter-firm relationships are improved by enhancing information visibility through virtual integration; in turn, relational governance improves supply chain flexibility with its ability to enhance information visibility.

In terms of IT infrastructure and supply chain flexibility, Bush, Tiwana and Rai (2010) argue that IT infrastructure flexibility strengthens the influence of product design modularity on supply chain responsiveness.

Inter-organisational systems facilitate information sharing through the supply chain and lead to supply chain flexibility (Chang, Chen, & Su, 2008). In terms of IS flexibility, electronic trading hubs facilitate multi-party information sharing and trading; business process management systems orchestrate inter-organisational processes and automatic data capture, to allow the reconciliation of the physical location and tracking of goods with information flows. These capabilities all benefit supply chain flexibility (White, Daniel, & Mohdzain, 2005) (Figure 10).

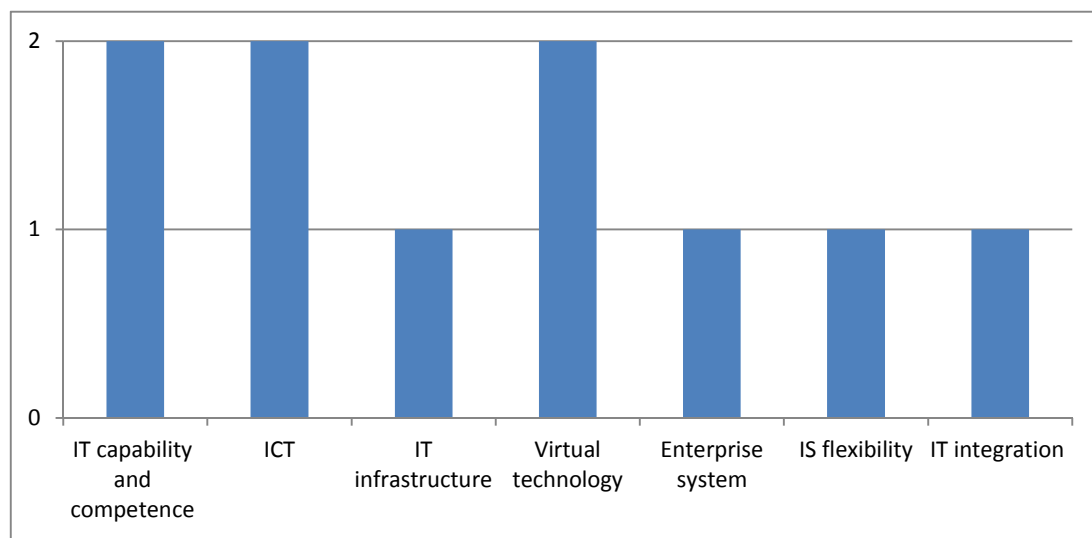


Figure 8. Impacts of IT resources on supply chain flexibility

These seven types of IT resources can be categorised into spanning and inside-out capabilities. IT capability and competence, IT infrastructure, IS flexibility, ICT and virtual technology are inside-out IT resources, because they pertain to an organisation's internal IT capacity. Enterprise systems and IT integration are spanning-type resources, because they are related to IS and business alignment, IS planning and change management. Thus, supply chain flexibility can be achieved with both spanning and inside-out capabilities.

Table 6. Impact of spanning and inside-out IT resources on supply chain flexibility

Categories of IT resources	Types of organizational flexibility
Spanning	Supply chain flexibility
Inside-out	

4.6.3 Impact of IT on strategic flexibility

Strategic flexibility can be achieved by three types of IT resources: IT capability and competency, IT resource and investment and computer-aided design/computer-aided manufacturing. Information technology capability and competency, such as technical and behavioural capabilities of IT personnel, can facilitate infrastructure capabilities; in turn, infrastructure capabilities affect IT-dependent strategic flexibility directly and are mediated by IT- dependent systems and information agility (Fink & Neumann, 2007). Bharadwaj, Bharadwaj and Konsynski (1999) have conducted a survey of the relationship between IT investment and organisational value and have concluded that IT investments have a significantly positive association with strategic flexibility and intangible value. In terms of the relationship between CADD/CAM and strategic flexibility, Sanchez (1995) states that CADD/CIM systems and modular product designs can greatly increase the potential flexibilities of key product creation resources, coordination flexibilities and strategic flexibility (Figure 11).

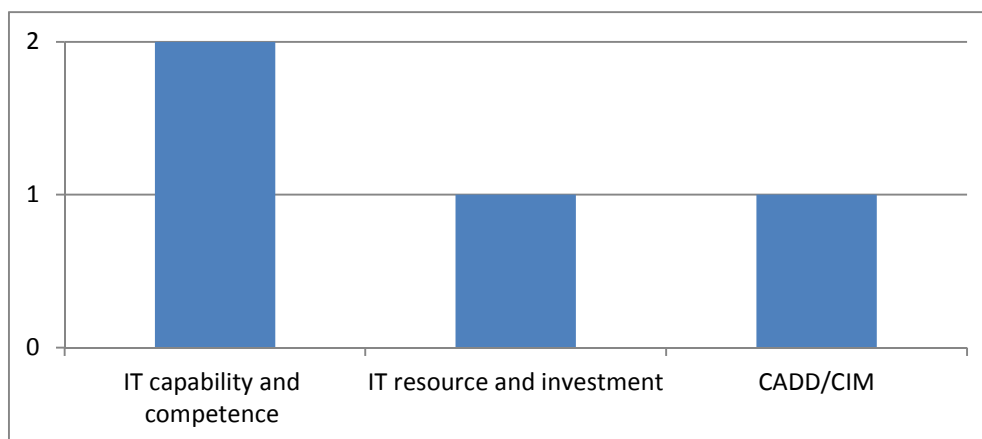


Figure 9. Impact of IT resources on strategic flexibility

The three types of IT resources are in the inside-out category; thus, inside-out IT resources influence strategic flexibility.

Table 7. Impact of inside-out IT resources on strategic flexibility

Categories of IT resources	Types of organizational flexibility
Inside-out	Strategic flexibility

4.6.4 Impact of IT on marketing flexibility

Marketing flexibility aims to “increasing in the flexibility of marketing structures and processes” (Calin, 2010, p. 178). Some studies, such as Richardson and Weill (1999), Legorreta, Chen, and Chan (2006) and Park and Seo (2012), have found that marketing flexibility is enhanced by IT resources such as generic ICT and Web services. IT resources and investment were studied in two articles. “Resource re-deployment process in which dynamic capability opportunities are enhanced by the use of information technologies play an important role in customer relationship improvement” (Park & Seo, 2012, p. 1). In terms of IT competency, Huang, Ouyang, Pan and Chou (2012) argue that IT leveraging competency enhances a firm's capacity to process information in a turbulent business environment, which leads to information processing efficiency and information processing effectiveness.

Moreover, managerial IT capabilities based on IT-business partnerships, strategic planning and post-IT-project analysis result in the development of technical IT capabilities associated with a flexible IT infrastructure, which in turn drive flexibility or a firm's ability to react to change in its products and markets (Tallon, 2008). For generic ICT, Richardson and Weill (1999) conducted a case study at Telstra's National Telemarketing Centre and found that the customer-oriented call centre provides nation-wide customer and product support services, thereby achieving quicker customer satisfaction. In terms of Web services, the analytical ability of Web-based customer infrastructure allows enterprises to sense and respond quickly (Roberts & Grover, 2012). (Figure 12)

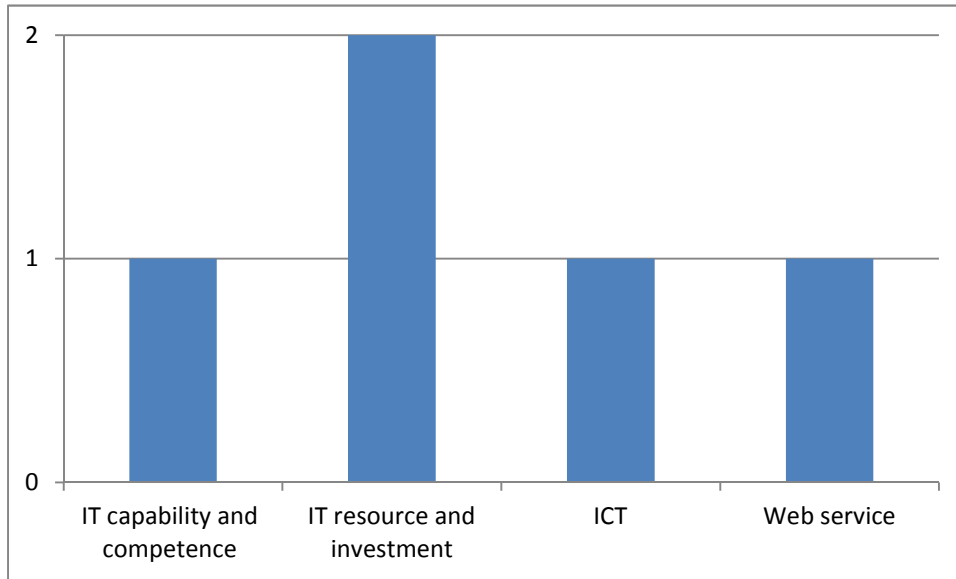


Figure 10. Impact of IT resources on marketing flexibility

Among the four type of IT resources, IT capability and competencies, IT resource and investment as well as ICT are in the inside-out category; web refers to service refer to outside-in flexibility. Surprisingly, inside-out capability significantly impacts marketing flexibility as marketing concentrates on outside customers.

Table 8. Impact of inside-out IT resources on marketing flexibility

Categories of IT resources	Types of organizational flexibility
Inside-out	Marketing flexibility

4.6.5 Impact of IT on process flexibility

Business process management systems and Web services facilitate process flexibility (Figure 13). Business process management systems provide directly transferable business process models (Heininger, 2012), and enable enterprises to refocus and constantly re-engineer volatile organisations (Afshar & Sepehri, 2006), which in turn improves process flexibility. Web services can contribute to process flexibility, and both of them support the loose coupling of processes that allows organisations to survive during rapid environmental fluctuations, promotes their sensitivity to the environment, and permit

sub-system breakdowns without damaging the entire organisation (Moitra & Ganesh, 2005).

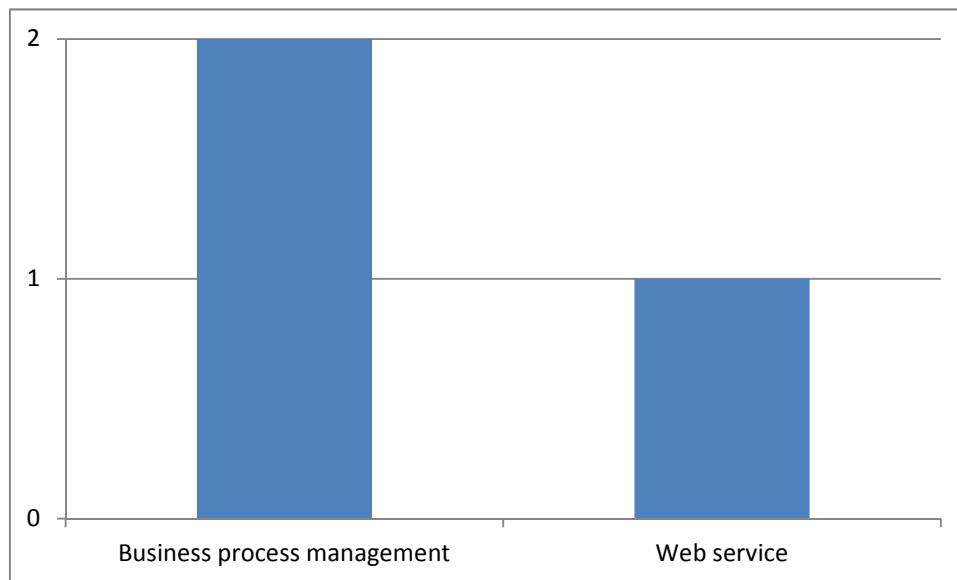


Figure 11. Impact of IT resources on process flexibility

Since web services are outside-in IT capabilities and business process management is an example of a spanning IT capability, process flexibility is supported by these two types of capabilities (Table 10).

Table 9. Impact of outside-in and spanning IT resources on process flexibility

Categories of IT resources	Types of organizational flexibility
Outside-in	Process flexibility
Spanning	

4.6.6 Impact of IT on technology flexibility

Technology flexibility refers to “the characteristics of technology that allow or enable adjustments and other changes to the business process” (Nelson, Nelson, & Ghods, 1997, p. 76). It can be created by web services and an IT strategy. The utilisation of Web service applications contribute to the flexibility of IT infrastructure resources and information flexibility, and further improves IT flexibility (Fink & Neumann, 2009). Moreover, flexibility strategies for sustainable technological development enhance the flexibility of technological systems (Knot, van den Ende, & Vergragt, 2001)(Figure 14).

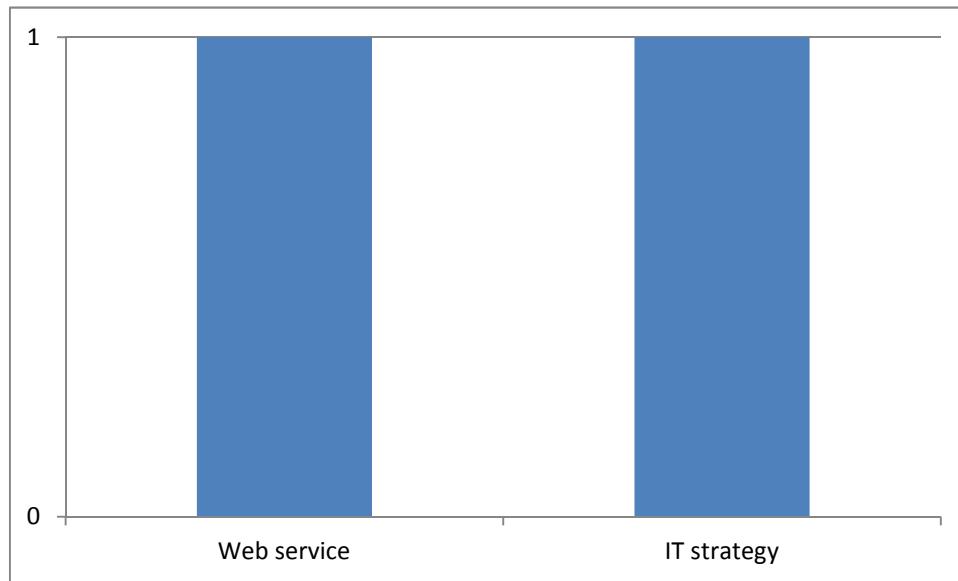


Figure 12. Impacts of IT resources on technology flexibility

As web services are an example of outside-in capabilities and IT strategy is an example of IT spanning capability, technology flexibility is similar to process flexibility in that it is supported by these two types of capabilities.

Table 10. Impact of outside-in and spanning IT resource on technology flexibility

Categories of IT resources	Types of organizational flexibility
Outside-in	Technology flexibility
Spanning	

4.6.7 Impact of IT on other flexibilities

Decision support systems (DSS) “open... up the decision process to new possibilities such as information source and roles, recognizing the value of new ideas as well as implementing recursive decision processes” (Sharfman and Dean Jr. 1997), which means the process is circular from start to end, not linear. DSS contribute to *decision-making flexibility*. For example, MinneTAC, an evaluator service network, allows users to construct decision-making behaviours from separate, configurable components, and allows the dynamic construction of analysis and modelling tools from small, single-purpose evaluator services, thus contributing to decision-making flexibility (Collins, Ketter, & Gini, 2010).

Business process management technology and IT competency can contribute to *operational flexibility*. Being competent at leveraging IT means that a firm is better able to process information in unstable business environments, which leads to information processing efficiency and effectiveness.

Information systems flexibility can contribute to *economic flexibility*. Economic flexibility represents the cost efficiency of business processes. Information systems flexibility can reduce the cost to change IS capacity or infrastructure, thus leading to economic flexibility (Collins et al., 2010; Gebauer & Schober, 2006).

All three types of flexibility can be facilitated by a spanning capability (Table 12). In addition, decision support systems contribute to decision flexibility and enable the affordance of virtual collaboration.

Table 11. IT resources' impact on other flexibilities

Categories of IT resources	Types of organizational flexibility
Decision support systems (DSS)	Decision flexibility
IT competency and capability	Operational flexibility
IS flexibility	Economic flexibility

Decision support systems represent spanning flexibility while IT competence and capability as well as IS flexibility refer to inside-out flexibility. Thus, it could be concluded that decision flexibility could be achieved by possessing spanning IT capabilities, while inside-out IT capabilities positively influence operational flexibility and economic flexibility.

Table 12. Impact of categories of IT resource on other flexibilities

Categories of IT resources	Types of organizational flexibility
spanning	Decision flexibility
Inside-out	Operational flexibility
	Economic flexibility

Chapter 5: Discussion and Conclusion

A meta-narrative review was used to study the relationship between IT resources and organisational flexibility. The review provided an overall picture of the topic: it highlighted the patterns through which research in this field developed, the key concepts that have been studied, and the relationships that have been found between specific types of IT resources and specific types of flexibilities.

The literature review shows that research on this topic increased significantly after 2005. One possible reason for this could be the turbulence of global markets in recent years, when IT use increased significantly. Between 2002 and 2003, and from 2008 to 2009, global markets experienced a significant recession and suffered from serious economic crises. This could have increased the need to examine how IT can help firms become more flexible and respond to crises quickly.

Most of the articles reviewed conclude that IT resources contribute to organisational flexibility. These studies also illustrate that different types of IT resources contribute to different types of organisational flexibilities. Thus, it is possible that the negative consequence of IT on flexibility may be mitigated.

Despite only a few articles argue that IT resources, in some circumstances, can result in inflexibility, ERP systems have been considered to be a factor of negative impact on flexibility due to the reason that they are rigid and require a high level of skills and knowledge (Govers & Mur-Veeman, 2008). Moreover, enterprise systems like ERP can lead to rigid process and power differentials (Ignatiadis & Nandhakumar, 2007). Lucas and Olson (1994) argued that deploying and changing IT assets could result in time, effort and cost increases for changing work flows and organisational structures. Rollier (1998) state that deploying IT infrastructure requires careful planning. Nevertheless, well-planned IT infrastructure is less flexible because well-planned IT infrastructure has been constrained for certain purposes, so that when an organisation faces new

tasks that are out of the range of the planned purpose, then the IT infrastructure may be useless to the tasks. When the environment is unstable and changes occur frequently, rigid IT infrastructure impedes organisational flexibility and organisations will have to change their rigid IT infrastructure frequently to survive. However, changing IT assets is costly, requiring time, effort and other resources (Lucas and Olson, 1994), such as ERP systems that “decision makers cannot make changes that improve efficiency or reduce costs without altering the ERP software. Because integrated software systems are difficult and expensive to alter, the costs of innovation and change are higher” (James, Sharon, & Lee, 2008, p. 79).

Thus, the review indicates that, while most articles advocate the positive impact of IT resources on organizational flexibility, inflexible IT assets, such as inflexible IT architecture and rigid ERP systems, as well as a lack of ability in adapting new information systems, could result in inflexibility. Moreover, the case study in Ignatiadis and Nandhakumar (2007) shows that when an organisation deploys an information system, it may also need to adjust its management, routines, decision making patterns and power structures. Thus, organisational structural flexibility supports IT adaptation too, not just vice versa.

Volberda (1996) argues that an organisation needs to undertake managerial tasks and organizational design tasks to obtain organisational flexibilities. As mentioned previously, managerial tasks refer to an organisation’s ability of providing variety of capacity towards internal or external needs and improve adapting speed towards to change while organizational design tasks aim to provide adequate condition. Increasing IS flexibility, structural flexibility and an attitude of willingness are relevant for organizational design tasks. IT competence belongs to managerial tasks, as it provides the capacity to utilise existing IT assets and adapt new assets. Higher levels of IT competence seem less vulnerable for the complexity and change of IT assets. It could be

captured from learning and the repeated performance of contextual activities (Aral & Weill, 2007). IT asset flexibility, structural flexibility and willingness to change are relevant for organisational design because they could provide flexible condition. Service-oriented architecture and loose coupling are closely related to the ability to generate IT asset flexibility.

The study also illustrates that different types of IT resources may contribute to different types of organizational flexibilities. It provides the use for organisations which intent to capturing particular organisational flexibilities. Eighteen types of IT resources and nine types of organisational flexibilities were identified. Inside-out capabilities, such as IT competence, IT infrastructure and ICT, impact most types of organizational flexibilities, especially general organizational flexibility. While inside-out capabilities focus on internal issues, they could generate outside-focused flexibilities such as marketing flexibility, supply chain flexibility and strategic flexibility. This review found that strategic flexibility was achieved by inside-out capabilities.

Web services is a type of outside-in capability that contributes to marketing flexibility, technology flexibility, process flexibility, and organizational flexibility; however, among these, only marketing flexibility seems to be externally-focused. IT spanning capabilities were found to be related to decision flexibility, technology flexibility, process flexibility, supply chain flexibility, and organisational flexibility. Most of the flexibilities are focusing on the internal organisational operations; only supply chain flexibility is externally-focused. The review did not surface clear relationships between the three inside-out focused IT capabilities and outside-in focused flexibilities.

Since different types of organizational flexibilities support different purposes and have different outcomes, future researchers may want to examine relationships between the different types of flexibilities and their links with various IT resources. One type of flexibility may promote or impede another type of flexibility. For example, process flexibility may contribute to strategic

flexibility, while manufacturing flexibility may improve marketing flexibility. At the same time, while an IT resource may increase a certain type of flexibility, it may also weaken another type of flexibility or increase another type of flexibility. Hence, the relationships between the different types of flexibilities need to be clearly understood.

Future research could also focus on the indirect impacts of IT resources on organisational flexibility. For example, organisational structure and organisational learning may significantly influence organisational flexibility. How do these features interact with an organisation's IT resources? Could the latter have an indirect impact on organisational flexibility by influencing organisational structure, organisational learning ability and innovativeness? Researchers should also conduct narrower and in-depth studies on specific IT resources to find out why and how they contribute to specific aspects of flexibility. Furthermore, future research could focus on IT development policies to understand how organisations can develop policies to ensure that their IT investments promote organizational flexibility.

This study had a number of constraints. First, not all aspects of organisational flexibility may have been found during the literature search. Other types of organizational flexibilities may exist, but may have not been part of the review because their relationship with IT may not have been investigated yet. Secondly, more than half of the articles reviewed were about inside-out IT capabilities, with only five articles analysing outside-in capabilities. This indicates that the three types of IT capabilities have not been studied to the same level of intensity. Thus, possible relationships between aspects of organisational flexibility and various IT capabilities may not have been found, even though they exist, because they have not been studied yet. Lastly, this research only focuses on the impact of IT resources on organisational flexibility. Other factors that contribute to organizational flexibility in parallel with IT have not been examined in detail.

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