DEVELOPMENT OF A CONCEPTUAL MODEL TO MEASURE THE PERFORMANCE IMPACTS OF INFORMATION TECHNOLOGY ON INTER-ORGANISATIONAL PROCESSES WITHIN THE SUPPLY CHAIN CONTEXT

Frank Wiengarten
University of Ulster
Faculty of Business & Management
Jordanstown campus Shore Road
Newtownabbey Co. Antrim, BT37 0QB
Wiengarten-fi@ulster.ac.uk
ABSTRACT

The importance of using IT as an enabler for digital supply chain processes to develop a collaborative integrated supply chain is a well known fact for practitioners. There are many practical examples that suggest that nowadays IT plays a critical role to integrate cross-boarder processes between organisations within the supply chain. But despite the key role that IT plays in supply chain management limited scholarly investigation has been undertaken by the management information systems community to assess its impact on the performance of supply chains so far.

The aim of this paper is to develop a conceptual model that measures the performance benefits of using IT on cross-boarder processes to support collaboration between supply chain members. To guide future research four propositions are developed. This model is based on previous research and uses the RBV, the concept of IT capabilities, and strategic alignment theory as supporting theories. This paper provides the concluding results of a literature review that has been carried out in the IT business value and supply chain performance domain. Furthermore, a conceptual framework that helps researchers to identify IT capabilities has been developed.
1. Introduction
The importance of using information technology (IT) as an enabler for an integrated supply chain is a well known fact for practitioners. There are many practical examples especially in the automotive industry that suggest that nowadays IT plays a critical role in integrating cross-boarder processes and allow to enable collaboration between organisations within the supply chain (e.g. electronic marketplaces, electronic B2B applications). But despite the key role that IT plays in supply chain management (SCM) limited scholarly investigation has been undertaken by the management information systems community to assess its impact on the performance of supply chains so far. Within the literature review for this article it will be identified that empirical and conceptual research in this area is still underdeveloped and needs to be pursued to analyse and clarify which IT functionality and capability affects which process and how these likely improved processes might in turn affect the performance of organisations. The literature that has been reviewed for this article is from the research field IT business value and work in the operational management literature.

The overall aim of this research is to develop a conceptual model to investigate the performance impacts of using IT on inter-organisational business processes within a collaborative supply chain context. The model is based on previous work in IT business value research. It uses the resource-based view (RBV) its extensions, and the theory of strategic alignment as its theoretical foundation. The model focuses on specific capabilities of the technology rather then on resources. Within this article IT capabilities are viewed as higher order resources that are developed out of the functionalities of the technology and embedded in an organisations processes and strategy.

Additionally, within this article a framework has been developed that will give insights about how IT capabilities are developed and which factors are needed to do so. This article aims to review the vast amount of literature of IT business value studies and identifies the main cornerstones that need to be taken into consideration when measuring the value of IT.

This article is organised as follows. Firstly, the current level of knowledge within the IT business value research field will be investigated. It will be analysed what theories are currently in use to investigate IT business value, what methodologies are in use, the limitations of the research, and what are the results of these investigations. Due to formal restriction only a summary of the review will be presented.
Secondly, with the knowledge of the literature review a conceptual model will be developed. This model based on the RBV, capabilities, and strategic alignment theory builds on previous conceptual and empirical studies IT business value studies and will be further developed to overcome previous limitations of IT business value research. Propositions will be developed that state the relationships of the included variables which can be tested empirically. Finally, concluding remarks will be made about how to use this model and test it empirically.

2. Literature Review
The majority of the literature that has been reviewed for this article is taken from the “IT business value” research field. Additional non-MIS work that has been reviewed has been taken mainly from the operational management research field namely supply chain management and performance literature.

The IT business value model that will be developed to evaluate the performance benefits of IT in inter-organisational processes within the supply-chain context builds on previous IT/IS business value models. Consequently, it is essential to review past literature in IT/IS business value. This review will identify and analyse the current state of knowledge about IT/IS business value and will thus provide the researcher with an overview about the domain and existing research gaps and research opportunities.

Before providing the reader with a brief overview of the results of the literature review the research domain where this work is positioned will be briefly introduced and defined. Mukhopadhyay et al. (1995) defines IT business value as “the impact of IT on firm performance”. In more detail Melville et al. (2004) defines IT business value as “the organisational performance impacts of information technology at both the intermediate process level and the organisation-wide level, and comprising both efficiency impacts and competitive impacts”. The aim of this research domain is to identify how and to what extent information technologies and systems affect individual, process, group, organisational, or market performance. Several categories and classifications for research in the IT business value domain have been developed outlining their methodology, level of analysis, or outcome variable (Zhu and Kramer 2002, Hitt and Brynofolfsson 1996). However, one of the most widely accepted and used classification in IT business value studies is to differentiate between the
following three approaches: 1. Firm performance (process-oriented approach); 2. Productivity gains due to information technology; and 3. Consumer value due to IT/IS (Zhu and Kramer 2002, Sircar et al. 2000, Hitt and Brynjolfsson 1996). The first group of studies attempts to explain the business value creation of IT/IS through the processes in which they improve intermediate operational performance, which in turn might affect higher levels of financial performance (Zhu and Kramer 2002). Studies in business performance of IT/IS tend to focus on using frameworks that are rooted in theories of competitive strategies and advantages (Sircar et al. 2000). The approach of modelling IT business value by focusing on the attributes of IT and other organisational resources and their impact on competitive advantage (CA) belong to this group. Productivity based or production-economic based approaches use the theory of production\(^1\) to assess performance issues of information technologies and systems (Sircar et al. 2000). “Productivity issues are measured by the efficiency with which outputs are produced for a given level of inputs and, unless otherwise mentioned, is considered synonymous with labour productivity” (Sircar et al. 2000).

The third approach is grounded in microeconomic theory, and estimates the total benefit that a given purchase confers to consumers and the degree that information technology and system supports the creation of consumer benefits.

The above classification is similar to Melville et al. (2004) groups of performance: IT/IS efficiency and effectiveness. While efficiency studies employ such metrics as cost reduction and productivity enhancements, effectiveness studies measure the achievement of organisational objectives in relation to a firm’s external environment and may be manifested in the attainment of competitive advantage.

To identify the performance impacts of IT capabilities on collaborative supply chain processes the researcher decided to choose a theory that is rooted in CA studies. Using competitive advantages as the dependent variable for measuring the performance benefits of IT is currently the dominant approach in management information system (MIS) research. The reasons for the selection of this approach will be explained throughout this review. However, one the most important reason is that theories of CA make a clear link between input variables (IT) and the output variables (CA).

\(^1\) The theory posits that firms possess a method for transforming various inputs into output, represented by a production function. Different combinations of inputs can be used to produce any specific level of output, but the production function is assumed to adhere to certain mathematical assumptions (Hitt and Brynjolfsson 1996).
Due to the page restriction of this document only the most important research gaps and issues in IT business value studies will be discussed on the following few pages. The researcher identified the following important topics and issues around which this review is further structured. The following points are essential when it comes to measuring the business value of information technology and systems: Selected theory, selected methodology, level of Analysis, and type of IT/IS analysed. The first issue that is essential when it comes to IT business value studies is whether the study is based on a theory or not and whether the selected theory is appropriate for the scope of the study. It has been criticized by many authors that the absence of cumulated research in IT business value has led researchers to use a variety of theories to analyse multiple theoretical paradigms and phenomena (Chan 2000). According to Zhu et al. (2004), the literature has been weak in making linkage between theory and measures, let alone subjecting the proposed measures to empirical validation for reliability and validity (Straub et al. 2002). Melville et al. (2004) identified that researchers have employed several theoretical paradigms in examining the organisational performance impacts of IT, including microeconomics, industrial organisational theory, and sociology and socio-political paradigms. The majority of the recent IT business value studies are using the resource-based view theory (RBV) and its extensions as a theoretical base to assess the impact that IT has on the business value of the organisation. Researchers in MIS have applied the RBV to assess whether or which IT resource has the ability to provide organisations with sustainable and competitive advantage; to assess complementarities between IT and non-IT resources; and to expand and to deepen the knowledge and understanding about IT business value (Melville et al. 2004). According to a literature review about the RBV and information systems research by Wade and Hulland (2004), the RBV started to appear in IS research in the mid-1990s. In the mid-1990s the RBV has been primarily used to assess whether or not IT leads the organisation to competitive or sustainable competitive advantage (e.g. Mata et al. 1995, Andreu and Ciborra 1996, Ross et al. 1996). Whereas approximately from the year 2000 on many studies used the RBV to assess complementarities between certain IT resources like IT infrastructure and human IT resources, and their enhanced impact on business value (Zhu and Kraemer 2002, Zhu 2004). Powell and Dent-Micalef (1997) is one of a very few studies so far

---

2 For an overview of the recent trends and developments of resource-based theories the reader is referred to Acedo et al. (2006).
that have assessed complementary relationship between IT and non-IT resources. Recently instead of using IT resources few MIS researcher are using IT capabilities as the main unit of analysis.

Assessing the applicability of the RBV to IT Wade and Hulland (2004) identified the following three reasons for applying the RBV in the IT/IS business value domain: 1. By defined sets of resource attributes, the RBV facilitates the specification of IS resources; 2. By using the same set of resource attributes, IS resources can be compared with one another, and perhaps more importantly, can be compared with non-IS resources; and 3. The RBV sets out a clear link between resources and sustainable competitive advantage through a well-defined dependent variable, providing a useful way to measure the strategic value of IS resources. According to Furthermore Santhanam and Hartono (2003) stated that “the theory provides a cogent framework to evaluate the strategic value of ISs resources”. However, there are also challenging arguments against using the RBV in the IT/IS business value domain. Most obviously empirical results tend to show to the direction that IT resources in isolation do not have the ability to be a source of competitive or sustainable competitive advantages (references). According to Wade and Hulland (2004), “they (IT resources) form part of a complex chain of assets and capabilities that may lead to sustained performance”. As mentioned above, a view studies are currently using higher order IT capabilities instead of IT resources as the main unit of analysis (Peppard and Ward 2004, Langdon 2006, Bhatt and Grover 2005, Santhanam and Hartono 2003, Zhu and Kraemer 2002, Bharadwaj 2000). Capabilities can be defined as higher order resources that involve the ability of a firm to deploy resources in combination with organisational processes to obtain desired outcomes (Grant 1991 2005). Resources can be distinguished from capabilities as resources are viewed as the productive assets owned by the firm and capabilities are what the firm can do or what the firm is capable of (Grant 2005). Although many MIS researcher are claiming that IT capabilities should be the main unit of analysis throughout the literature review it has been identified that this approach is theoretically and empirically still underdeveloped within the MIS research domain. Peppard and Ward (2004) reviewed the literature about IT capabilities and came to the conclusion that it is relatively unexplored of how to use this approach for empirical studies. However, recently more and more studies are using IT capability constructs to assess the impact that IT has on

Secondly, the methodology that the researchers have chosen to assess IT business value have been examined within the literature review. Melville et al. (2004) identified the following methodologies in IT business value research which are consistent with the findings of this review: Conceptual and theoretical IT business value studies; analytical IT business value studies; and empirical IT business value studies. Whereas Zhu and Kramer (2002) criticised IT business value research for relying on case studies and anecdotes, with few empirical data to measure Internet-based initiatives or measuring the scale of their impact on firm performance this more recent review identified that this issue has been partly solved within the past 4 years but still exists. More and more empirical evidence of IT performance impacts have been published recently. However, the results of these studies are still controversial in terms of the degree of business value that IT creates. Explanations for these changing results can partly be found in the poor execution of surveys (Zhu 2004).

Another important issue in IT business value research is the selected level of analysis. The literature review revealed that the choice of the level where the performance impact information technology is assessed is a very controversial topic in MIS research. Straub et al. (2004) identified the following four levels of analysis that are important in studying IT business value: Individual performance, group performance, organisational/firm performance, and networked organisational performance. The review of the conceptual and theoretical models suggests that the process level should be the main level of analysis in IT/IS business value research. According to Tallon et al. (2000), measuring the BV of IT is supported by a growing number of researchers who advocate a process-oriented assessment of IT BV based on the argument that the first-order impacts of IT investment occur at the process level. Furthermore they stated that the process-centric perspective argues that IT creates value for the organisation by improving individual business processes, or interprocess linkages, or both. Consequently, the greater the impact of IT on individual business processes the greater will be the contribution of IT to firm performance. Barua et al. (1995) also argued in favour to the process level approach. Their basic argument is that “primary economic impacts or contributions (to performance) of information technologies (if

---

3 For example Zhu (2004) identified that part of the changing results are due to poorly executed surveys.
any) can be measured at lower operational levels in an enterprise, at or near the site where the technology is implemented” (Barua et al. 1995). Melville et al. (2004) stated that IT impacts organisational performance via intermediate business processes and these processes in turn might impact higher organisational performance indicators. Not many empirical studies followed these advices; the majority of the reviewed studies used a firm level approach. Apart from Barua et al. (1995) this review identified that only Tallon et al. (2000), Barua et al. (2004), Güttler and Heinzl (2002), and Mukhopadhyay et al. (1995) looked at how information technologies and systems can improve the performance of certain processes. The issue with measuring the impact of IT on the firm level is that these studies have difficulties in identifying how a certain type of information technology affects which performance indicator. And furthermore how much of the improved performance is actually caused by the technology or system. This ‘black box’ approach mainly used to be an issue in input-output productivity based IT value studies but has also been problematic in performance based IT business value studies (Zhu 2004). To overcome these problems performance oriented business value studies are increasingly using first and second order construct as outcome variables (e.g. Barua et al. 2004, Lederer et al. 2001, Ravichandran and Lertwongsatien 2005, Subramani 2004). Using first and second order constructs as dependent performance indicators means in almost all reviewed articles that the business value will be measured firstly on the process level and secondly on the firm level. That means that IT primarily affects the performance of business processes inside and across organisations which in turn may improve financial performance. However, the majority of the reviewed articles are still focusing on the firm level when it comes to measure IT benefits. The disadvantages of this approach has been highlighted in many conceptual (e.g. DeLone and McLean 1992, 2003) and empirical studies (Barua et al. 1995, 2004) but in the majority of IT business value studies the firm level approach is still used.

The fourth and final issue that has been identified concerns the type and of technology or system for which its performance is to be measured. The issue of the selection and definition of the IT/IS that is analysed is handled very loosely in the past decades in MIS research. On one side the description of the system can either be very vague so that the usefulness of linking results of a study to a certain technology and system is

---

4 A black box approach in MIS research means that IT impacts are only measured on higher level financial performance indicators at the enterprise level (Barua et al. 1995).
very difficult or the definition of the system or technology is too precise and the results can not be generalised (Lee, 2000). On the other side there are difficulties with studies using precisely defined functionalities of systems and technologies is that the technological development in information and communication technologies is so fast that the results of a study can be of less interest as the technology is no longer in use by the industry. In an editor’s comment in *MIS Quarterly* (2000) Lee wrote: “The key for MIS research is to focus not on the information technologies themselves but on the lessons that emerge in the interactive system effects between the technological and the organisational, where these lessons pertain to the management of information technology and the uses of information technology for managerial and organisational purposes”.

In conclusion it can be said that many of the issues that have been identified within this review have already been discussed somewhere in the IT business value literature. However, many MIS researchers have not taken the results and advices of previous research into consideration when developing conceptual IT business value model or empirically measuring the business value of IT. The model that will be presented in this article to measure the performance impacts of IT on inter-organisational processes within the supply chain is based on theory and does take the results of previous studies into consideration.

### 3. Research Model

Based on the knowledge gained from the literature review the conceptual model in figure I has been developed to overcome the shortcomings and difficulties of previous IT business value models. This model is developed to identify the performance benefits of using IT to enable/support collaboration between supply chain members. It is developed to fit the requirements of manufacturing industries. The manufacturing industry and especially the automotive industry is characterised of being relatively high in investing and adopting in new information technologies and systems (Subramani 2004). Additionally, the manufacturing industry especially in Europe is characterised of having a relatively high degree of collaboration within its supply chain in the following supply chain processes: Procurement, research and development (R & D) and order fulfilment/distribution processes (Bagchi and Skjoett-Larson 2005). However, this model can be adapted to other industries like retail or finance for example. To do so it is necessary to look at different key inter-
organisational processes and additionally other functionalities that might be required for these processes.

On the left side of the model are the IT capabilities that support collaboration in inter-organisational supply chain processes between supply chain partners. According to the literature the following IT capabilities have been identified as being crucial to enable/support collaboration between supply chain members: Process integration, system integration, interaction capabilities, and transaction digitisation (Barua et al. 2004, Malhotra et al. 2005, Rai et al. 2006, Gosain et al. 2004-5). With the strategic decision to collaborate with its supply chain partner organisations have to invest in IT resources and develop these capabilities that support and enable collaborative supply chains (Malhotra et al. 2005, Rai et al. 2006, Kim et al. 2005-6). However, there are different degrees of collaboration ranging from simply exchanging pricing information to jointly developing a new product from its early beginning. These different degrees of collaboration that are reflected in the degree of information sharing, joint decision making and joint action require different IT capabilities. Again ranging from simply allowing online information exchange to coordinated 2-way communication with pre-defined workflows and electronic document management systems to support research and development. In conclusion it can be said that there needs to be a certain degree of fit between the strategic usage of the system and the capabilities of the system (Soh et al. 2006, Henderson and Venkatraman 1999). Therefore, degree of collaboration will be acting as a mediating variable. The level of analysis will be firstly the process- and secondly on the firm-level. The dependent variable will be the performance impact of IT capabilities on key inter-organisational processes between buyers and sellers within a supply chain followed by the second order dependent variable measuring the financial benefits caused by the IT capabilities. This will make the performance impacts of the IT capabilities on different processes comparable. The processes where supply chain members are collaborating in are procurement processes, order fulfilment processes/distribution, and research and development processes (Bagchi and Skjoett-Larson 2005).

This model is primary based on the RBV and Grant’s (1991, 2005) extension of the RBV which views capabilities as the main source of SCA. The literature review revealed that the RBV is a robust and widely accepted framework to study IT business value.
According to Wade and Hulland (2004) “the theory provides a valuable way for IS researchers to think about how information systems relate to firm strategy and performance”. Furthermore they stated that the RBV provides its user with a cogent framework to evaluate the strategic value of information systems resources. It provides guidance on how to differentiate among various types of information systems. The RBV clearly links resources with SCA and gives guidelines about how to measure the strategic value of IT resources (Wade and Hulland (2004).

It has been mentioned in the literature review that IT resources are rarely a source of SCA (Melville et al. 2004, Powell and Dent-Micallef 1997). IT resources need to be embedded and fitted in processes that execute an organisation’s strategy and additionally are in alignment with the strategic direction of the organisation to be a source of SCA (Grant 2005, Henderson and Venkatraman 1999, Ray et al. 2004). Therefore, this model also uses an extension of the RBV and instead of using resources it uses capabilities as the main unit of analysis.

To include the strategic dimension of IT capabilities this model additionally uses Henderson and Venkatraman (1999) concept of strategic alignment. The strategic alignment model highlights the importance of two types of integration between business and IT namely strategic and operational integration. According to Henderson and Venkatraman (1999) “strategic integration is the link between business strategy and IT strategy reflecting the external components. Operational integration deals
with the link between organisational infrastructure and processes and IS infrastructure and processes”. In that way the concepts of capabilities developed by Grant and Henderson and Venkatraman complement each other. Whereas, Grant’s work highlights the importance of the strategic dimension of capabilities; Henderson and Venkatraman (1999) underline the necessity of strategic and operational alignment for IT capabilities in particular to be a source of strategic advantage.

In the following the included variables and there relationships will be discussed in greater detail. Especially, the development and identification of IT capabilities will be explained in greater detail. Testable proposition will be stated for the relationships between resources, capabilities, strategy and processes.

**IT Capabilities**

To develop a conceptual model that measures the performance impacts of IT on inter-organisational processes within collaborative supply chain partnerships the necessary capabilities of the system firstly have to be identified and defined in the conceptual model. Using Grant’s concept of capabilities and building on the basic tenants of the RBV Figure 2 has been developed to identify capabilities that the IT needs to support/enable collaboration in supply chain processes.

There, are nearly as many definitions and views on resources and capabilities as there are articles about these constructs. Sometimes the words capabilities and resources are used interchangeably. Within this article capabilities are viewed as distinctively different from resources. Resources can be distinguished from capabilities as resources are viewed as the productive assets owned by the firm and capabilities are what the firm can do or what the firm is capable of (Grant 2005). In other words resources are the productive inputs under the roof of the organisation and capabilities are the means of transforming these inputs into higher value outputs.

Building on the basic tenants of the RBV resources are defined as “stocks of available factors that are owned or controlled by the firm” (Amit and Schoemaker 1993). In turn, capabilities are defined as higher order resources that involve the ability of a firm to deploy resources in combination with organisational processes to obtain desired outcomes (Grant 1991, 2005). According to Grant (1991), “capabilities of a

---

5 Barney (1991) adopted Daft’s (1983) definition and defines resources as all assets, capabilities, organisational processes, firm attributes, information, knowledge, etc. controlled by a firm. Within this article capabilities are viewed as higher order resources.
firm are what it can do as a result of teams of resources working together”. In more
detailed Amit and Schoemaker (1993) define capabilities as “a firm’s capacity to
deploy resources, usually in combination, using organisational processes, to effect a
desired end”.

<table>
<thead>
<tr>
<th>SUSTAINABLE COMPETITIVE ADVANTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Stage</td>
</tr>
<tr>
<td>IT Capabilities (to enable/support collaborative supply chains)</td>
</tr>
<tr>
<td>• Process integration</td>
</tr>
<tr>
<td>• System integration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procurement Process</th>
<th>R&amp;D Process</th>
<th>Order fulfilment Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT Functionalities (to enable/support collaborative supply chains)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Online supplier database</td>
<td>• Retrieve and analyse data</td>
<td></td>
</tr>
<tr>
<td>• eCatalogs</td>
<td>• Innovation management</td>
<td></td>
</tr>
<tr>
<td>• Online requests</td>
<td>• Management of change constructions</td>
<td></td>
</tr>
<tr>
<td>• eAuctions</td>
<td>• Tracking tracing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Order management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Electronic receipt and invoicing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. Stage</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IT RESOURCES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT INFRASTRUCTURE</td>
<td>HUMAN IT RESOURCES</td>
<td>IT ENABLED INTANGIBLES</td>
</tr>
</tbody>
</table>

Figure II: Development of IT capabilities for collaborative supply chain processes

Starting from the bottom of figure II organisations need to pick or invest in IT
resources that are necessary to create capabilities. These resources are classified into
the widely accepted and used categories of IT infrastructure, human IT resources, and
intangible IT resources (Bharadwaj 2000). These IT resources bundled together
enable the system to provide organisations with IT functionalities that are needed to
support/enable supply chain collaboration (Zhu and Kraemer 202).

In the next stage these functionalities are applied to enable and support collaboration
of key supply chain processes within manufacturing industries. For example, to have
the important capability of transaction digitisation the IT need to have several
functionalities for this capability. The system need to provide the functionality of
sending online requests for prices or providing the functionality of putting online product information for customers. In turn these functionalities are the product of the IT resources that are bought and under control of the organisation. Furthermore, the organisation needs different capabilities of the system to execute different strategies with the system.

This approach is also consistent with Grant’s (1991) recommendations’ to identify organisational capabilities. According to Grant (1991) “a firm’s capabilities can be identified and appraised by using a standard functional classification of the firm’s activities”. Tailored to IT capabilities that means that IT capabilities can be identified by using a functional classification of the system in use. However, the functionalities and capabilities of the IT are embedded within specific processes and therefore inter-organisational processes have also been included in the analysis of IT capabilities. Zhu and Kraemer (2002) used a similar approach to identify EC capabilities. They developed an EC capability index which is developed out of specific variables that are measuring the functionalities of the EC in use.

IT resources on their own are not expected to provide organisations with sustainable competitive advantage. Older work on the RBV suggested that resources have to fulfil certain attributes to be a source of sustainable competitive advantage. According to Barney (1991) only resources that are valuable and rare are a source of CA. Only when these resources additionally are imperfectly imitable and non-substitutable they provide organisations with SCA. However, recent work suggested that this might not be sufficient for creating SCA (Soh et al., 2006; Ray et al., 2004). If an organisation’s IT resources are deployed to carry out supporting activities that are not necessarily value adding activities or in alignment with its strategy like electronic invoicing in the manufacturing industry they might be able to improve the efficiency of this activity but not be a source of CA or SCA. This leads to the first proposition of this model:

**Proposition I:** IT resources have the ability to support/enable collaboration in supply chain processes and to improve their performance.

Furthermore, applying Grant’s capability and the strategic alignment concept, to be a source of competitive advantage these IT functionalities have to be in alignment with the requirements of the processes to enable/support collaboration. In other words the IT functionalities with to fit with the requirements of the processes. This leads to the second proposition of this model:
**Proposition II:** IT functionalities that are in alignment with the process requirements to enable/support collaboration are a source of temporary competitive advantage.

**Degree of Collaboration**

It has been mentioned in the introduction that collaborating with your supply chain partner is becoming more and more important in many industries. The digital integration of inter-organisational processes is becoming vital in today’s business world. Organisations are collaborating across industries to improve the efficiency and effectiveness of their key business processes. According to Hartono and Holsapple (2004) “collaboration is an interactive, constructive, and knowledge-based process, involving multiple autonomous and voluntary participants employing complementary skills and assets, with a collective objective of achieving an outcome beyond what the participants’ capacity and willingness would allow them individually”. The inter-organisational processes with the highest degree of collaboration within the manufacturing industry are procurement, R&D, and order-fulfilment/distribution processes (Bagchi and Skjoett-Larsen 2005). These processes highly depend on the capabilities of the IT like the process integration or transaction digitisation capability to enable and support the collaboration between supply chain members.

Within this model collaboration is viewed as a process which includes the following stages to be taken by each of the collaborating supply chain members: 1. Information sharing, 2. Joint decision making, and 3. Joint action (Malhotra et al. 2005, Zaheer et al. 1998).

While this conceptual model is constipated for collaborative supply chain strategy the IT capabilities to do so have to be selected to fit the requirements of the strategic usage of the system. Therefore, the capabilities of the system need to be in alignment with the strategic usage of the system (Henderson and Venkatraman 1999). This leads to the third proposition of this model:

**Proposition III:** IT capabilities that are in alignment with an organisations strategy to collaborate with its supply chain partners are a source of SCA.

Only at the third stage of figure II IT is becoming a source of SCA for organisations.
Performance impact on selected supply chain processes

One of the key points that the literature review revealed is that IT affects the performance of an organisation primarily on the process level (Barua et al. 1995, Melville et al. 2004). The improved effectiveness of the processes might then in turn affect overall organisational financial performance indicators. Selected studies identified that not all of the benefits of the IT will be visible on the aggregate financial level. Therefore, this model links and measures the performance impacts of IT primary on the process level and secondly on the firm level with financial indicators. Which leads to the forth proposition:

Proposition IV: IT capabilities primarily improve the performance of business processes which in turn might improve the financial performance to provide the organisation with SCA.

However, the RBV is traditionally a theory that using the firm level as the unit of analysis. More recently researchers are using the process level as the level of analysis when applying the RBV (Ray et al. 2004). According to Ray et al. (2005), “there is a growing consensus in the strategy literature that business processes are the basic unit of CA”. According to Ray et al. (2004), “in some cases using the RBV to examine the economic implications of resources and capabilities at the firm level can lead to misleading conclusions, and that process-level analysis may be more appropriate”.

But what has to be kept in mind is that IT can only develop CA and SCA in key inter-organisational processes. This key process has to be a process that generates a great amount of rent compared to other processes. And what is a key inter-organisational process in one industry might not be relevant in other industries. Only applied to these processes IT can be a source of CA or even SCA.

Conclusion

In conclusion it can be said that the IT business value literature still has to be developed further to allow researcher and practitioners to draw conclusions on the impact that IT investments have on the performance of organisations. This can certainly also be said about the business value of IT on supply chain processes. Whereas, the investments in IT to support collaboration in supply chains is raising research about its performance impact is still in his infants.

However, with the usage of the RBV and its several developments the IT business value research domain is going in the right direction with acknowledging the strategic
importance of IT (Peppard and Ward 2004). But this model underpins the importance of not analysing IT resources and capabilities in isolation. This model identified that additionally to Barneys (1991) four assumptions of SCA resources IT needs firstly be selected and applied to the functional requirements of the processes, and secondly needs to be in alignment with the strategy of the organisation to be source of SCA. However, the presented model is by no means mature. It needs to be developed further to allow for more general propositions about the business value of IT. Furthermore, this model has to be tested empirically to make conclusions about its stated propositions. What this model can do is to give directions in which IT business value research needs to be developed further and that is viewing IT in its context and to acknowledge the strategic dimensions that are involved in IT investments and usage.
REFERENCES


