Information Technology for competitive advantage within logistics and supply chains: A Review

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Abstract

This paper offers a systematic review of the literature on the use of information technology (IT) in logistics and supply chain management to achieve competitive advantage. While IT has revolutionized traditional logistics and supply chains to achieve numerous benefits such as increased efficiency and responsiveness, it is not still clear to what extent IT has contributed to competitive advantage within logistics and supply chains. This paper contributes to this debate by: (i) reporting the literature on the role of IT in achieving competitive advantage within logistics and supply chains based on the linkages between ‘adaptation’, ‘alignment’, and ‘agility’, (triple A’s) (Lee, 2004), and (ii) discussing managerial implications and identifying future research directions.

Keywords: Information technology, Competitive advantage, adaptability, agility, alignment, Supply Chain.
1. Introduction

Contemporary logistics and supply chains have to deal with multiple challenges from urban and rural demands, such as how to make use of competitors as collaborators, increasing cross channel visibility and incentives, tradeoffs between analytics and if/then modeling, complexity optimization, ability to allocate indirect spend, varying metric targets and incentives aligned to desired results (e.g. Fawcett et al., 2011; Gunasekaran and Ngai, 2011). Practitioners need to deal with challenges such as how to manage complexity much closer to the customer and how logistics activities can support these, especially how logistics managers can function as the commanding officers of the information control tower (Cegielski et al., 2012; Hazen and Byrd, 2012). To meet those challenges, it is necessary to devise strategies and value differentiators with the support of information technology (IT) (e.g. Ketchen and Hult, 2007; Ngai et al., 2011).

Literature suggests that IT has revolutionized traditional logistics and supply chains to achieve numerous benefits such as increased efficiency and responsiveness (Gunasekaran and Ngai, 2004; Subramani, 2004; Gunasekaran and Ngai, 2011; Prajogo and Olhanger, 2012; Subramanian et al., 2014; Gunasekaran et al., 2015). However, while on one hand supply chain challenges and practitioners’ expectations in terms of achieving competitive advantage through the use of IT solutions are enormous, on the other hand it is not clear to what extend IT has contributed to competitive advantage within supply chains (Grover and Kohli 2012; Wang et al., 2012; Fosso-Wamba et al., 2015).

To address this gap, this study reviews systematically the literature from 2004-2014 on the use of IT in logistics and supply chains to achieve competitive advantage. We conceptualize the use of IT within logistics and supply chains to achieve competitive advantage based on the characteristics of adaptation, alignment and agility (Lee, 2004). Our paper is informed by the following questions: Does IT enable supply chains: (i) to accommodate market changes -that is, to become adaptable (Lee, 2004)? (ii) to incentivize supply chain partners to improve the supply chain –that is, to be aligned (Lee, 2004)? (iii) To rapidly respond to short-term changes in demand or supply –that is, to be agile (Lee, 2004)?

Our contribution lies in (i) arguing for and reporting the literature on the role of IT in achieving competitive advantage within logistics and supply chains based on ‘adaptation’, ‘alignment’, and ‘agility’, (triple A’s) (Lee, 2004) and (ii) discussing managerial implications and identifying future research directions.

The rest of the paper is organized as follows. Our classification scheme used to review previous studies is discussed in Section 2. The methodology adapted to select the sample and collect relevant studies are explained in Section 3. Adaptation, alignment and agility related studies are described


in Section 4. The theoretical and managerial implications of our study are presented in Section 5 and the summary of the review, limitations, and future research directions are outlined in Section 6.

2. Classification scheme

To gain competitive advantage supply chains need to develop ‘agility’, ‘alignment’ and ‘adaptation’ (triple-A’s) (Lee, 2004). Supply chain ‘agility’ refers to quick response of supply chain to short term changes because of uncertainties both in the upstream and downstream supply chains. It is, hence, related to the ability of the supply chain to deal with unexpected changes in market demand and to have the appropriate capabilities to transform these changes into opportunities (Swafford et al., 2008), enabling the supply chain to gain competitive advantage in a turbulent and volatile environment (Swafford et al., 2006; 2008; Ngai et al., 2011; Blome et al., 2013; Yusuf et al., 2014; Brusset, 2016). Supply chain ‘alignment’ can be defined as the process integration of several members in the supply chain to achieve better performance. Gattorna (1998) has highlighted the importance of alignment between firms’ supply chain strategies and those of their external and internal partners. Such view has been highlighted in later studies (e.g. Johnson and Scholes, 1999; Christopher et al., 2004; Pagell, 2004; Baier et al., 2008; Wong et al., 2012) where it was also noted the benefits in terms of enhancing customer value and gaining competitive advantage. At the same time, however, scholars have underlined the ongoing challenges in achieving alignment and the need to further investigate how alignment can be achieved and its performance implications. Finally, supply chain ‘adaptation’ enables the supply chain to evolve (adapt) according to market changes in terms of strategies, products and technologies (Lee, 2004). Swafford et al. (2006) define adaptation as “the ability to change from one state to another state in a timely and cost effective manner” (p. 174). Later studies such as Schoenherr and Swink (2015) have underlined the importance of supply chain adaptation as a dynamic capability (Teece et al., 1997) that can assist product designers in innovative thinking (Pavlou and El Sawy, 2011) through “providing a context for the development and refinement of a firm’s product innovation capability” (p. 909) and reducing product risk. Adaptation, being a dynamic capability, enables first mover advantages in the market place (Eisenhardt and Martin, 2000) and hence achievement of competitive advantage. However, Eckstein et al. (2015) have suggested that theory on the effects of supply chain adaptation and agility remain fragmented and apart from few exceptions (Lee, 2004; Ketchen and Hult, 2007) the majority of scholars use the terms agility and adaptation interchangeably (Gligor et al., 2013; Schoenherr and Swink, 2015), resulting in a lack of solid research on adaptation (Eckstein et al., 2015).
In this paper we aim to contribute to the debate on the role of IT within supply chain management and the achievement of adaptable, aligned, and agile supply chains (Lee, 2004). To this extent, we use the triple-A (Lee, 2004) framing, which has been used in order to propose a supply chain performance model that incorporates the triple-A classification as antecedents to supply chain performance and supply chain performance as antecedent to organizational performance (Whitten et al., 2012). Furthermore, the triple-A framing has been used by Eckstein et al. (2015) to empirically investigate how supply chain agility and adaptability affects cost performance and operational performance, whereas in a recent study Dubey and Gunasekaran (2015) have used this framing to characterize sustainable humanitarian supply chain design. Therefore, the aforementioned use of the triple-As framework by scholars to investigate the achievement of competitive advantage within supply chains coincides with our aim to study the achievement of competitive advantage in supply chains through the use of IT. So far literature has highlighted the role of IT in e.g. achieving supply chain integration and performance (Prajogo and Olhager, 2012; Liu et al., 2016) and supply chain and firm performance (Qrunfleh and Tarafdar, 2014) drawing on the wider argument that information measuring and monitoring is key to successfully managing the supply chain (Gunasekaran and Ngai, 2004). IT allowed collaboration and sharing of data and information in order to identify shifts in the market and take appropriate actions such as moving facilities, changing suppliers, and outsourcing (Ketchen and Hult, 2007). Ngai et al. (2011) have illustrated the role of IT in achieving agile supply chains, in terms of utilizing IT to enable sensing and response capabilities, sharing information and knowledge among functions and supply chain members’ allowing them to collaborate, respond to rapidly unforeseen events and market changes, and creating a virtual supply chain.

Since the key publication of Garr (2003) suggesting that IT alone cannot create strategic value due to wide availability and affordability of data storage, data processing and data transport, researchers investigate the role of IT with caution, and have suggested that IT per se is unlikely to generate value, but only when complemented by organizational and human resources (Coltman and Devinney 2013; Coltman, Devinney, and Midgley 2011). Furthermore, in a recent study Fosso-Wamba et al. (2015) suggested that although the business value of IT within supply chains is widely acknowledged, much is still unknown, and the study of the role of IT within supply chains continues to be one of the key issues amongst academics and practitioners (Grover and Kohli 2012; Wang et al., 2012). Our study addresses this gap by drawing on the triple-As framing to review the literature on the role of IT in achieving agile, adaptable, and aligned supply chains.
3. Methodology

We reviewed the literature to analyze the linkage between IT and supply chain competitive advantage. Such a review comprehensively searches for relevant prior studies in a specific topic using a pre-determined method to synthesize and appraise the status of the topic (Klassen et al., 1998; Parris and Peachey, 2013). Following Gunasekaran et al. (2006), we acknowledge that the review may not be exhaustive, but it does provide reasonable insights into the state of the art of the influence of IT in achieving competitive advantage through Adaptation, Agility, and Alignment. We used EBSCO, Scopus, Springer link, Taylor and Francis online journals, Sage journals, Wiley online library and Emerald journal databases to identify the previous published studies. Our search included only peer-reviewed English articles. Our approach is in consistent with other previous reviews (Gunasekaran and Ngai, 2004; Gunasekaran et al., 2006; Gunasekaran et al., 2015), as well as with the concept of fit-for-purpose evidence (Boaz and Ashby 2003; Briner et al. 2009; Gough 2007), which proposes the appraisal of quality as being subordinate to the review objective. Therefore, importance should be placed on how the evidence provided contributes to synthesis and understanding (Pawson 2006; Pawson et al. 2004; van Aken and Romme 2009).

We used “information technology” as the key word within title and abstract of each individual journal title and further looked for ‘adaptation’, ‘alignment’, and ‘agility’ within the content of each article. Our use of keywords coincides with literature reviews in the field (e.g. Gligor and Holcomb, 2012b; Chen et al., 2014; Gunasekaran et al., 2015; Mansouri et al., 2015; Wang et al., 2016). We attempted to understand the pattern of contribution for a decade i.e. from 2004 to 2014. This was for two reasons. Firstly, Gunasekaran and Ngai (2004) have provided a review of the role of IT and systems within supply chain integration and management until 2004, and therefore our review builds on this work, drawing on works from 2004 until 2014. Secondly, the majority of literature focused on triple-A’s was published during that time. We strengthened our sampling process by interchanging key word search using the three major competitive elements and manually checked whether each article discusses anything related to the attributes of IT as a strategic resource. For instance, Blome et al. (2013) article did not refer to IT in the abstract since they did not focus on IT in their article; hence we did not consider their article in the agile category even though it discussed antecedents and enablers of supply chain agility. However as per our sampling criterion we have included studies that discuss agility, alignment and adaptation and information attributes in the content even at cases that these keywords were not found in the abstract. Following previous reviews, we made notes on the articles we found through our review, structured the literature review, and built the bibliography and classifications (Denyer and Tranfield, 2009; Wong et al., 2012; Beske et al., 2014; Gunasekaran et al., 2015). The final sample of our review consists of 100
articles, which are shown in Table 1. The full bibliographical details are provided in the references section. The articles of our sample were studied in depth and the results of our review are discussed in the following sections.

Table 1: Journal articles

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Journal</th>
<th>Number of articles</th>
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<tbody>
<tr>
<td>1</td>
<td>Computers and Operations research</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>European Journal of Operational research</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>International Journal of Operations &amp; Production Management</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>International Journal of Physical Distribution &amp; Logistics Management</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Int. J. Production Economics</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>International Journal of Production Research</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Journal of Operations Management</td>
<td>7</td>
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<tr>
<td>8</td>
<td>Journal of Supply Chain Management</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Journal of the Operational Research Society</td>
<td>3</td>
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<tr>
<td>10</td>
<td>Logistics Information Management</td>
<td>11</td>
</tr>
<tr>
<td>11</td>
<td>Journal of Business Logistics</td>
<td>2</td>
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<tr>
<td>12</td>
<td>Manufacturing and Service Operations Management</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Transportation Research Part E: Logistics and Transportation Review</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Decision Sciences</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>Management Science</td>
<td>12</td>
</tr>
<tr>
<td>16</td>
<td>Omega: The international Journal of Management Science</td>
<td>6</td>
</tr>
<tr>
<td>17</td>
<td>Industrial Management and Data Systems</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>Industrial Marketing Management</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>Information Systems Research</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>International Journal of Computer Integrated Manufacturing</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>Supply Chain Management: An international Journal</td>
<td>2</td>
</tr>
<tr>
<td>22</td>
<td>European Journal of Information Systems</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>Benchmarking: An International Journal</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>Information Systems Journal</td>
<td>1</td>
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<tr>
<td>25</td>
<td>Information Systems Management</td>
<td>1</td>
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<tr>
<td>26</td>
<td>Information Sciences</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>Harvard Business Review</td>
<td>1</td>
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<td></td>
<td>Total</td>
<td>100</td>
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4. Adaptation, alignment and agility in supply chains

In this section we review the literature on adaptation, alignment, and agility in supply chains.

4.1 Literature on adaptation

Adaptation studies discuss how supply chains can be adjusted “to accommodate market changes” (Lee, 2004: p. 1) (Table 2). Accommodating market changes, hence, means decisions in terms of
variables that relate to outsourcing decisions and the role of IT outsourcing and post contract adaption and governance (Susarla, 2012); internal capability development and acquisition, that is, how IT capabilities influence inventory efficiency of firms and shareholders' wealth (Mishra et al., 2013) and mass customization (Peng et al., 2011), innovation and the creation of appropriate competencies through IT (Gordon & Tarafdar, 2007), and how organizations with the support of IT can combine capabilities to create superior value in responding to customer requirements (Boulesnane & Bouzidi, 2013). Studies also adopted a learning capability perspective with Saraf et al. (2013) evaluating the assimilation stage of enterprise systems based on the relationship between external institutional pressure and degree of assimilation, whereas Zahay and Handfield (2004) predicted the likelihood of learning and sharing in adopting B2B technologies. Finally, scholars have looked into the business value of using IT for supply chain adaptation and co-creation of value (Jing and Zhao, 2014) and related benefits (Aral et al., 2012).

Other studies have studied the relationship between IT investments for accommodating customer requirements and profitability (Anderson et al., 2006; Jeffers, 2009), and efficiency in terms of reducing communication costs (Ding et al., 2010), on the strategic implications of the use of IT to improve financial performance (Theodorou & Florou, 2008), whereas others presented the benefits and requirements to succeed with using IT for demand supply management (Hilletofth, 2011), supply chain partnerships (Malhotra et al., 2007) and the creation of supply chain competitive advantage (Fawcett et al., 2011).

Few studies (Albadvi, 2004; Lin & Kao, 2013) discussed the role of IT on supply chain adaptation at a country and/or industry level. Scholars highlighted the role of IT adoption and evaluation (e.g. intangible benefits) in small and medium businesses (Chuang et al., 2009) and corporate diversifications (Chari et al., 2008), as well as the relationship of IT and intangible assets (trademarks) (Gao & Hitt, 2012). Furthermore, the literature has explored for instance how IT can offer differentiated services (Ho & Mallick, 2010), or the role of electronic medical records in patient satisfaction (Ilie et al., 2009), or the negative consequences of using IT in supply chains and sustainability (Chung and Wee, 2010). Finally, a study has been carried out in emerging countries to understand the IT capability of third party logistics service providers and its influence on service providers’ competitive advantage (Lai et al., 2007). Few scholars examined the dynamic patterns of IT value over time and measured the improvement using productive efficiency (Lin & Chuang, 2013), as well as the productivity gain and IT investment factors with respect to developed and developing countries (Shih et al., 2007).

We did not find sufficient studies focusing on the upstream or downstream and the impact of IT. Furthermore, IT adaptation is mainly captured based on mostly economic indicators than other
Table 2: Summary of adaptation literature

<table>
<thead>
<tr>
<th>Source</th>
<th>Research question</th>
<th>Supply chain structure and decision level</th>
<th>Factors involved</th>
<th>Managerial insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahadri (2006)</td>
<td>Define a national strategy model for information technology (IT) development in developing countries</td>
<td>Service - country level national strategy</td>
<td>Key technologies, socio-economic sectors and applications</td>
<td>Increase investments in e-education, e-research, e-coffee and e-information services.</td>
</tr>
<tr>
<td>Anderson et al., (2006)</td>
<td>Whether IT does create value that is reflected in the market value of firms and in their future profitability</td>
<td>Automatic, informative and transform industries, strategy</td>
<td>Shareholder value and VaR spending</td>
<td>Companies that spent more during the Y2K period increased in value and improved their training performance</td>
</tr>
<tr>
<td>Arul et al., (2012)</td>
<td>Test the dependence of performance benefits of IT and incentive schemes</td>
<td>US major human capital management (HCM) vendors - adoption of a specific technology (HCM) solutions found in typical enterprise resource planning (ERP) systems.</td>
<td>Information technology (IT), performance pay, and human resource (HR) analytics practices</td>
<td>Demand for HCM is significantly higher in firms that have adopted the performance pay and HR practices</td>
</tr>
<tr>
<td>D’Arcy &amp; Devraj (2012)</td>
<td>Understand relationship between formal and informal sanctioning technology misuse as well as preconditions and contextual factors</td>
<td>US computer users, tacit</td>
<td>Certainty severity, social desirability pressure, moral beliefs, virtual status, employment level and technology misuse intention.</td>
<td>Employees that spend a greater number of working days away from the office are more inclined toward technology misuse.</td>
</tr>
<tr>
<td>Boekema &amp; Beuzid (2014)</td>
<td>To determine how organization can combine capabilities (collective intelligence, knowledge management and innovation) to create superior value and to understand the role played by information technology.</td>
<td>Firm level strategic decision making, Innovation, knowledge management, collective intelligence</td>
<td>IT mediates the relationship between capability and effective decision making and superior value creation.</td>
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<tr>
<td>Chari et al., (2008)</td>
<td>Do IT investments pay off in the context of corporate diversification and are economically significant?</td>
<td>Strategy and firm level manufacturer, IT investment, diversification and firm performance</td>
<td>Performance impact of IT investment is greater for firms with greater levels of diversification.</td>
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<tr>
<td>Chiang et al., (2009)</td>
<td>To investigate the effect of compositions of managerial/functional characteristics of the top management team (TMT) on the extent of information technology (IT) adoption in small businesses (SMEs)</td>
<td>US small and medium size enterprises, Strategic, Top management characteristics – Composition of age, education and group heterogeneity Extent of IT adoption</td>
<td>Age average and the education average of TMT in small businesses are significant predictors of the extent of IT adoption</td>
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<tr>
<td>Howbury et al., (2005)</td>
<td>How companies can develop and exploit reverse logistics for positive advantage? How resource commitment and information technology capabilities impact performance.</td>
<td>Automobile Aftermarket Industry, Strategic, Resource commitment, IT capability, economic performance and service quality.</td>
<td>Resources are targeted to building a firm’s information technology capabilities and to enhance firm performance.</td>
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<tr>
<td>Ding et al., (2015)</td>
<td>Investigate IT effects on inputs and whether it reduces communication costs</td>
<td>Service – Academic scientist publication, technical</td>
<td>Research productivity, IT measures and science characteristics</td>
<td>IT increases research productivity and enhances collaboration.</td>
</tr>
<tr>
<td>Faveeet et al., (2014)</td>
<td>How IT can be exploited to obtain a distinctive SC advantage?</td>
<td>Managers affiliated to professional associations, Information sharing culture, supply chain connectivity, supply chain collaboration, customer satisfaction, operational performance</td>
<td>Focus IT investments on two capabilities: more efficient processes, more collaborative SC relationships. Balance technological and cultural factors by adopting measures to promote sharing and building mechanisms.</td>
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<tr>
<td>Guo &amp; Finn (2012)</td>
<td>Examine the relationship between IT and tradeoff, one of the most important intangible assets of a firm.</td>
<td>Manufacturing firms, strategic, Trademarks, IT measures, total assets, R&amp;D expenditure, advertising expenditure, labour cost, and stock price volatility</td>
<td>IT is associated with higher level of trademark applications, suggesting an increased rate of product introduction.</td>
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<tr>
<td>Gordon &amp; Tarabishy (2007)</td>
<td>Explores how an organization’s IT competences influence its ability to innovate</td>
<td>Service and manufacturing firms, strategic, Information and knowledge management, project management, collaboration and communication, business involvement, innovation initiation, development and implementation</td>
<td>IT competences helps organization to be more innovative.</td>
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<tr>
<td>Gunter et al., (2006)</td>
<td>How to improve collaborative planning in supply network by preserving autonomy of each member and utilization of information technology</td>
<td>Forestry and timber industry, Supply network, strategic, Supply chain management systems, coordination and collaboration.</td>
<td>Long-term agreement of goals and exchange about availability of alternatives improved supply chain management systems.</td>
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<tr>
<td>Hausdor &amp; Bynl (2012)</td>
<td>Do logistics information technology (LIT) innovations induce positive performance outcomes for the adopting firm? How does the buyer-supplier relationship affect the relationship between LIT adoption and performance outcomes?</td>
<td>Logistics industry, strategic, Environmental factors, organizational factors, logistics innovation, competitive advantage and logistics innovation diffusion.</td>
<td>Adoption of RFID or EDI leads to positive results for the adopting firm. Building positive relationship with partners help to derive maximum benefits from technology adoption.</td>
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<tr>
<td>Heim &amp; Peng (2010)</td>
<td>Examine the impact of IT use on the structure, practices, and performance of manufacturing plants</td>
<td>High performance Manufacturing firms, strategic, Process variables, productivity, organization structure, cooperation, employee configuration, customization orientation, integration between function, inter-functional design efforts and customer satisfaction</td>
<td>SPC-related intelligence perhaps has had an even stronger effect upon discretionary work practices than has IT-based dynamic intelligence.</td>
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Ho & Mallick (2010) Provided an interpretation based on IT investment as per heterogeneous competition in banking services US Banking industry, strategic IT expenditure, average price, net revenue, market share, non-interest expenditure, other operating expenses and capital expenditure. US banks’ profits are negatively related to IT expenditure; IT expenditure appears to have a negative effect in influencing profitability

Bic et al., (2009) How does accessibility to an electronic medical records (EMR) system affect physicians’ acceptance and usage decisions in a large hospital setting? US Hospital, strategic Physical accessibility, logical accessibility, perceived usefulness, perceived ease of use, attitude towards EMR and behavioural intention to use EMR Accessibility is an important factor that limits acceptance of complex IT such as EMR.

Jeffries (2009) How operations as marketing strategy will mediate IT investment to increase profitability and enhance firm performance. Third party logistics firms, strategic IT deployment, IT ownership, operations performance, market orientation, and financial performance Customer controlled approach will enhance the financial performance of firms

Lee (2008) How to achieve competitive advantage in supply chains through agility, adaptability, and alignment. Supply chain level Competitive advantage, agility, adaptability, alignment The achievement of competitive advantage depends on the ability of the supply chain to be aligned, adaptable, and agile.

Lee et al., (2007) How IT capability of third party logistics providers affect their competitive advantage Chinese third party logistics firms, strategic Technology orientation, resource commitment, managerial involvement, IT capability, cost advantage, service variety and quality advantage. Strategic IT orientation of 3PL firms significantly influences both resource commitment and managerial participation in the development of IT capability which support competitive advantage

Lind Chauang (2013) Examine the dynamic patterns of IT value over time, as measured by productive efficiency. US Manufacturing and service firms, operational IS labour, non-IS labour, Company capital, value added of a firm, Individual IT professionals, strategic Technology orientation, resource commitment, managerial involvement, IT capability, cost advantage, service variety and quality advantage. ICT capability is the important antecedent for the relationship between IT capability and stock market returns.


Mihalos et al., (2013) How IT capability influences inventory efficiency of firms and shareholders wealth? High IT capability firms, strategic IT capability, inventory efficiency, stock market returns and risks. IT capability is the important antecedent for the relationship between inventory efficiency and stock market returns.

Mithas et al. (2015) Examine how visa and immigration policies are related to the salaries of American and foreign IT professionals employed in the United States. Non-US citizens, strategic IT professionals earn a significant salary premium when compared with IT professionals.

Mithas & Krishnan (2008) Study the supply and demand side factors on the compensation of information technology professionals considering human capital and institutional explanation. Individual, IT professionals, strategic IT experience, education, visa status, cash compensation, type of industry, IT intensive. Non-US citizens earn more than IT experience. Firm specific skills are not important.

Miyahara et al., (2007) Study the impact of outsourcing projects from the vendor perspective that maximizes value to both vendor and its clients. Services sector vendor, tactical Significant events and management changes Quantiﬁed impact of outsourcing decisions which will mutually beneﬁt client and vendor.

Peng et al., (2011) Examine IT applications on a ﬁrm’s mass customisation (MC) capability. High performance manufacturing, strategic New product development, manufacturing IT, Supplier collaboration IT, modular product design, conﬁgurator IT, Mass customisation capability. IT applications facilitate a ﬁrm’s MC capability. In particular manufacturing IT is found to have an insigniﬁcant effect on MC capability.

Pramanik & Bhatnacharjee (2004) Empirically compare the relative ability of two competing theories (technology acceptance model and expectation-disconfirmation theory) to explain IT commitment intention. Service – University students, tactical Perceived usefulness, perceived ease of use, expectation, disconfirmation, performance, satisfaction and intention. Satisfaction has less effect on integrated model.

Rowenden & Liu (2011) Examine the impact of environmental factors such as industry clock speed and information anxiety on IT investment strategy. Firms within Fortune 1000 list, strategic Perceived central factors, managerial processes and IT investment strategy IT investing behaviour is a multifaceted phenomenon.

Rosacker & Rosacker (2015) Investigate IT applications in public organisations. Public organisations, strategic IT project management, public sector organisational culture, government IT project management. Need for business practices

Russell and Hogg (2004) How a diffusion model provides unique and valuable insights into supply chain IT implementations that other analysis techniques have failed to detect? Aerospace firms, strategic Perceived attributes of innovation, organisational factors, communication channels, leadership factors and adoption rate. Take holistic approach, manage perceptions, build and maintain strong organisational networks, balance central management and local input, build leadership at all levels, and across functions.

Salanova et al., (2004) Analyze IT information style and its influence on shop floor workers’ wellbeing. Tire production companies, strategic IT implementation style, innovation set-up or planning, participation in the implementation process, training! Workers wellbeing (affective outcomes and cognitive outcomes). Existence of two styles (continuous implementation style and first time implementation style). Information technology implementation styles are related more with cognitive aspects of subjective well-being than with affective ones.

Shih et al., (2007) Examine the factors that influence IT investment in developed and developing countries to determine how National level, strategic IT Investment (spending on computer hardware per capita), IT capital. Negative relationship between IT investment and interest rates, but positive and
greater investment might be stimulated to achieve productivity gains. The procedure evaluates candidate classification, requiring a strict predetermined procedure, which guarantees objectivity and clarity.

Sussidi et al. (2012) Investigating the role of decision rights delineated ex ante that enable Pareto improving amendments. IT outsourcing and post contract adoption and governance, strategic. This study addresses post contract governance and examining the way firms manage adaptation within a contract is an important question.

Tarifi et al., 2013) Examine whether IT architecture flexibility facilitates strategic alliance formation and enables firms to derive value from alliances. Technology intensive industry, strategic. Service oriented architecture, collaborative, arm’s length, joint venture, non-equity alliance and Total’s q. Open communication standards are associated with greater predictability to firms arm’s length alliances. IT architecture flexibility allows the firm to derive greater value from collaborative alliances.

Tambe and Hitt (2014) Investigate IT spillovers generated through the IT labour pool. IT intensive industry, strategic. IT capital stocks measures, IT employment measures, IT intensity of other firms firms located in high-tech regions, where IT investment is likely to be much higher, may receive substantial economic benefits.

Theodorou & Flocas, 2008) Study the impact of IT on financial performance for the different types and levels of business strategy Greek manufacturing firms with advanced IT, strategic. Cost, innovation, flexibility and quality. Effect of IT on financial performance was observed to be greater for firms which emphasizes the higher level of flexibility strategy and the middle level of cost strategy.

Weiks et al. (2010) How perceived novelty influences the way individuals reconcile their perceptions of risk versus reward when considering the adoption of an IT innovation. Biometric hand-scanner, strategic. Personal innovations for IT, perceived novelty, perceived risk, perceived reward, attitude and behavior intention. Deeper understanding of the influence of affective beliefs provides organizations with an opportunity to leverage various interventions to facilitate user adoption.

Chung and Wex (2010) Investigation the impact of the green product design, the deterritorializing factor and the information technology application investment in business process considering remanufacturing. Original equipment manufacturer, tactical. Supplier design (Production and dispatching plan), buyer (Selling plan) and enhanced IT application. Integrated production inventory deteriorating model considering interactions among information technology application, operation process innovation and value of product design.


Jung and Zhao (2014) Explore how business value of IT in supply chain is co-created in downsourced process. Downstream supply chain, strategic. Internal resource application, relational resource, e-supply chain capability and process performance. Complementarities of internal and relational resources have higher impact for e-supply chain capability process performance.

Malhotra et al. (2007) How does the use of standard electronic business interfaces SERs enable supply chain partnerships to become more adaptive? Downstream supply chain (OEM’s, distributors & retailers), strategic. Mutual adaptation, Adaptive knowledge creation, collaborative information exchange (quality, breadth, privilege) and use of SERs. Range and specific nature of information exchange is more valuable than the quality of information.

Saraf et al. (2013) In the assimilation stage of enterprise systems, how do the learning capabilities of an organization affect the relationship between external institutional pressures and the degree of assimilation. Focal firms, tactical and operational. Potential absorptive capacity, scaled absorptive capacity, assimilation, top management participation and beliefs and external pressures (mimetic, imitative and normative). Importance to training and support, common understanding of systems and usage behaviour, continued development of potential and realized capacity will benefit ERP success.

4.2 Literature on alignment

Alignment means, according to Lee (2004), to “establish incentives for supply chain partners to improve the performance of the chain.” (p. 1). The majority of studies investigate the impact of IT alignment on performance. Cao and Dowlatshahi (2005), for instance, explored the impact of the alignment between virtual enterprise (VE) and IT on business performance and established that the alignment between VE and IT had a positive impact on business performance. Lin and Tseng (2006) discussed the direct and indirect impact of supply chain participation strategy (SCPS), information technology application (ITA), and manufacturing participation strategy (MPS) on customer satisfaction (CS) and organizational performance (OP).

Apart from the link between alignment, IT, and performance, studies have looked into the benefits that IT can bring to alignment and subsequently on performance. For Burea et al. (2006) it is IT sophistication that leads to superior business performance and for Devaraj et al. (2013), who focus at the health sector, IT can impact on patient flow and bring improved hospital efficiency and performance. The study of Prajogo and Olhager (2012) is one of the influential studies in the alignment perspective, investigating the integrations of both information and material flows between supply chain partners and their effect on operational performance. Finally, the study of Bardhan et al. (2007) explores the pathways through which IT impacts on project-level performance measured in terms of speed, quality, and cost, whereas they show the fit between IT project alignment, project competencies and project performance.

The majority of studies on alignment focus on private companies and supply chains, either in European (e.g. Bourlakis and Bourlakis, 2005) or in Canadian (Bahli and Rivard, 2005), US organizations (Byrd et al., 2008; Ko & Osei-Bryson, 2006) and Chinese firms (Lai et al., 2006). Services, industrial, and financial sectors (Laura & Duchessi, 2007) are included. Later studies (e.g. Oh et al., 2012) focus on the far-east (Singapore), Korea (Seol et al., 2008), whereas others in the software development industry (Perunovic et al., 2012).

In this section, we observe that: (i) the majority of studies focus on the role of IT alignment on performance (e.g. business, operational, and supply chain performance) (ii) few studies have focused on developing and testing appropriate IT alignment evaluation frameworks (Gunasekaran et al., 2006), and few have proposed decision making models to understand the decisions underpinning the selection of IT and the processes related to the IT investment justification (Karhaman et al., 2007), or have illustrated how the use of IT contributes to efficiency (Chen et al., 2006; Seol et al., 2008; Devaraj et al., 2013), and (iv) few studies, if any attempt to view the IT alignment literature using alternative theories (as in the previous section).
Table 3: Summary of alignment literature

<table>
<thead>
<tr>
<th>Source</th>
<th>Research question</th>
<th>Supply chain structure and decision level</th>
<th>Factors involved</th>
<th>Managerial insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulb &amp; Rivard (2005)</td>
<td>Validate measures of the risk factors associated with outsourcing IT operations.</td>
<td>Canadian organizations</td>
<td>Transaction, client and supplier</td>
<td>Calculated IT outsourcing operation's risk by multiplying the overall uncertainty score with the cost's score.</td>
</tr>
<tr>
<td>Bandhan et al. (2007)</td>
<td>Explore the pathways through which IT impacts project-level performance measured in terms of speed, quality, and cost.</td>
<td>RBG North American private and public organization</td>
<td>IT Usage, project environment, alignment, project competence, project performance</td>
<td>Providing insight into how to integrate IT into innovation-intensive operational activities for improving project execution competence and productivity.</td>
</tr>
<tr>
<td>Berntstock et al. (2008)</td>
<td>Assess logistic information technology use and acceptance as an essential component of an expanded model of logistics service quality (LSQ).</td>
<td>Manufacturing firms</td>
<td>Perceived usefulness of technology, perception of ease of use of technology, intention to use technology, use of technology</td>
<td>Results provided evidence of approximately equal relationships between perceived ease of use (PEOU) and perceived usefulness (PU) and intentions to use information technology tools.</td>
</tr>
<tr>
<td>Boulahla &amp; Boulahla (2005)</td>
<td>Investigate the integration process of retailer's information technology strategy within logistics strategy and to find out those aspects of the retailer's distribution and operational performance.</td>
<td>Local food multiple retail market</td>
<td>Retailers logistics operation, retailers IT operations, retailer integrated distribution strategies and operation.</td>
<td>The paper will assist in understanding that fully absorbed information technology and logistics strategies and operations will be rewarded with superior pecuniary and operational efficiency benefits.</td>
</tr>
<tr>
<td>Bruner et al. (2006)</td>
<td>To investigate the relationship between service practices, service performance, and business performance and information technology (IT) sophistication.</td>
<td>Ireland service companies</td>
<td>Service practices, information technology sophistication, service performance and business performance</td>
<td>Analyse the interaction effects of IT sophistication in a contingency framework of service practice-service performance relationship.</td>
</tr>
<tr>
<td>Byrd et al. (2008)</td>
<td>Investigate the direct and indirect impact of IT at both the intermediate and organization levels.</td>
<td>US Publicly traded companies</td>
<td>IT infrastructure, logistics information system impact on the supply chain and firm performance</td>
<td>A superior IT infrastructure was shown to be directly related to both firm performance measures, and also indirectly through on intervening variable, LEV's impact.</td>
</tr>
<tr>
<td>Cao and Doulanbailu (2005)</td>
<td>Explore the impact of the alignment between virtual enterprise (VE) and IT on business performance under agile manufacturing setting.</td>
<td>Extractive and manufacturing industry</td>
<td>Virtual enterprise, information technology, alignment and business performance</td>
<td>Established that the alignment between VE and IT had a positive impact on business performance.</td>
</tr>
<tr>
<td>Cao and Hoffman (2011)</td>
<td>Compare how firm places on different aspects of business level virtual enterprise (VE) strategies and how the amount of functional level information technology supports for each aspect of VE strategy are aligned.</td>
<td>Extractive, manufacturing and utilities companies</td>
<td>Alignment of virtual enterprise, alignment of IT, alignment between VE and IT.</td>
<td>This study examined alignment-performance issues associated with VE strategies and IT from the perspective of how functional-level IT strategic planning should align with and support business-level VE strategies.</td>
</tr>
<tr>
<td>Chen et al. (2009)</td>
<td>Develop a DEA non-linear programming model to evaluate the impact of IT on multiple stages along with information on how to maximize the IT-related resource to maximize efficiency.</td>
<td>Hypothetical data set from previous study</td>
<td>Final assets, employees, IT investment, deposit, profit and loan recovered.</td>
<td>Developed new models for evaluating IT impacts on firm performance when intermediate measures are present.</td>
</tr>
<tr>
<td>Chen and Lan (2009)</td>
<td>Develop three factor constant elasticity of substitution frontier model.</td>
<td>Panel data from 15 countries</td>
<td>GDP, non-IT capital and non-IT labour.</td>
<td>Identifies the effect of simultaneous inputs of the following factors value of IT, the productivity paradox, the complementarity and the substitution and complement relationship on productive paradox.</td>
</tr>
<tr>
<td>Devaraj et al. (2013)</td>
<td>Examine the role of IT in patient flow and its consequences for improved hospital efficiency and performance.</td>
<td>US Hospitals</td>
<td>IT investment, shift patient flow, even patient flow and hospital performance</td>
<td>Analysis of data from 507 US hospitals shows that IT is associated with shift and even patient flow, which in turn is associated with improved revenues. In addition IT can significantly affect the quality of patient care and financial performance.</td>
</tr>
<tr>
<td>Devaraj et al. (2007)</td>
<td>Develop empirical proxy measures of information technology (IT) risk and empirically analyze IT returns.</td>
<td>Sample of fortune 1000 firms</td>
<td>Production function and market value specifications.</td>
<td>Shows that managers should apply a higher hurdle rate of expected returns when investing in IT assets, as compared to other types of capital investments.</td>
</tr>
<tr>
<td>Ganmeenkam et al. (2006)</td>
<td>Develop IT/IS evaluation framework that better reflects the new business environment.</td>
<td>Previous studies</td>
<td>IT/IS evaluation and justification. Evaluation of IT/IS implementation of projects, evaluation criteria and techniques and tools.</td>
<td>Classified the literature based on general IT/IS evaluation concepts, evaluation criteria for justifying IT/IS projects, techniques and tools used for IT/IS evaluation and justification, and evaluation of the implementation of IT/IS projects.</td>
</tr>
<tr>
<td>Jerber et al. (2008)</td>
<td>Propose a configurational perspective of how information technology (IT) assets and capabilities affect firm performance.</td>
<td>SPL companies</td>
<td>IT application, shared knowledge, business work practices, open communication, customer</td>
<td>Treated the impact of explicit and tacit IT resources interactions with two non-IT resources (open communication, customer).</td>
</tr>
<tr>
<td>Reference</td>
<td>Methodology</td>
<td>Context</td>
<td>Outcomes</td>
<td></td>
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<tr>
<td>Kahtman et al. (2007)</td>
<td>Develop a multi-attribute decision making model for evaluating and selecting among logistic information technologies.</td>
<td>Logistics company</td>
<td>Tangible benefits, intangible benefits, policy issues and resources</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Offered a structured hierarchical model for logistic information technology evaluation and selection to view tangible benefits, intangible benefits, policy issues and resources</td>
<td></td>
</tr>
<tr>
<td>Kesavan &amp; Markland (2006)</td>
<td>Argue that public sector operations success depends on dimensions of information technology applied in conjunction with a unified set of service operations concepts.</td>
<td>Service sector – Dept of motor vehicle</td>
<td>Service strategy, service delivery system and performance measure Report that measures of effectiveness vary widely and are absolutely essential to the satisfaction that citizens have with government services at all levels.</td>
<td></td>
</tr>
<tr>
<td>Lee &amp; Dush-Bryson (2006)</td>
<td>Investigate the investment on IT to justify the business value.</td>
<td>Large U.S. firms</td>
<td>Output, IT capital, IS labour, value added, IT stock, non-capital non-IT labour, industry IT investments have a positive impact on productivity; the impact is conditional and is not uniform but depends on the amounts invested in other related areas, such as non-IT labour, on IT capital, and/or IT investments.</td>
<td></td>
</tr>
<tr>
<td>Lai et al. (2008)</td>
<td>Study 3PL providers IT capability and how IT capability affects their competitive advantage.</td>
<td>Chinese logistics companies</td>
<td>IT strategy taxonomy, membership, IT advantage, financial performance. Resource effort and managerial commitment help a 3PL provider to build up its IT capability, and IT capability significantly determines the competitive advantage of 3PL firms.</td>
<td></td>
</tr>
<tr>
<td>Laurin &amp; Duchesne (2007)</td>
<td>Present a methodology for building an information technology (IT) implementation Bayesian Networks (BNs) to predict the attainment of IT benefits, given specific implementation characteristics (e.g., application complexity) and activities (e.g., reengineering).</td>
<td>Services, industrial and financial sectors</td>
<td>IT Maintenance, Project management, vendor support, organisational arrangements, business planning, IS User interaction, IS management role, functional management role, application complexity, application suitability, application analysis, reengineering and benefits Demonstrates how to build an IT implementation BN from survey data.</td>
<td></td>
</tr>
<tr>
<td>Lee (2004)</td>
<td>How to achieve competitive advantage in supply chains through agility, adaptability, and alignment.</td>
<td>Supply chain level</td>
<td>Competitive advantage, agility, adaptability, alignment The achievement of competitive advantage depends on the ability of the supply chain to be aligned, adaptable, and agile.</td>
<td></td>
</tr>
<tr>
<td>Lin &amp; Chang (2011)</td>
<td>The study negates the relationship between IT value and productivity. The IT productivity paradox is re-examined under the one-equation stochastic frontier production model and tested five national characteristics using two-equation stochastic frontier production model.</td>
<td>25 countries panel data</td>
<td>GDPP, ordinary capital, labour expenditure The IT productivity paradox occurs in developing and developed countries. European countries gain more productive efficiency than the G7 countries when IT is considered as a production factor. Different national characteristics have impacts on a country’s output and productive efficiency. The national characteristics present both complementarity and substitutability phenomena in association with IT investment. The joint presence of national savings and IT creates the substitutability phenomenon across different frontiers. An important policy implication is that policy makers must carefully utilise national characteristics while formulating IT investment strategies.</td>
<td></td>
</tr>
<tr>
<td>Love et al. (2006)</td>
<td>Use structured case approach that includes indirect costs to gain an understanding of how a construction firm embrace the IT evaluation process.</td>
<td>Construction company</td>
<td>External &amp; internal factors, benefits consideration, justification area, social considerations and indirect cost components. IT implementation has several benefits such as quality of service improvements, cost savings and improved communication.</td>
<td></td>
</tr>
<tr>
<td>Millet &amp; Gogan (2006)</td>
<td>Propose problem structuring using dialectical processes such as organizing versus disorganizing potential of information technologies.</td>
<td>Software selection at a business college</td>
<td>Structuring, unstructuring, grouping and adjusting. Examines four processes such as structuring, unstructuring, grouping, and adjusting. Implications for the design of decision support systems are discussed.</td>
<td></td>
</tr>
<tr>
<td>Nascimento &amp; Olesen (2009)</td>
<td>Define and analyze role within information technologies (IT) in service delivery.</td>
<td>IBM Service Delivery</td>
<td>Operational, key performance indicators, tolerance, critical success factors, outcomes and dashboards. The need emerged from “disenfranchised customers”, “delayed solutions”, and the third is “low employee morale”.</td>
<td></td>
</tr>
<tr>
<td>Authors and Year</td>
<td>Description</td>
<td>Research Methodology</td>
<td>Industry Focus</td>
<td>Findings</td>
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<tr>
<td>Oh et al. (2012)</td>
<td>This study examines the impacts of the use of IT by retail firms in integrating channel activities as a response to the needs of customers.</td>
<td>Singapore retailers</td>
<td>Cross-channel human resource capability, IT enabled channel integration capability, exploitative competences, explorative competences, environmental dynamism and firm performance.</td>
<td>Integrating organizational resources, retail firms can attain better performance by developing exploitative and explorative competences and that in dynamic environments, especially possession of explorative competences is particularly rewarding.</td>
</tr>
<tr>
<td>Panariti et al. (2012)</td>
<td>This study explores the impact of vendor capabilities and a proxy method to calculate the impact of IT on the capabilities and IT performance.</td>
<td>Software development and electronic manufacturing service industries</td>
<td>Information technology, competence, capabilities and objectives</td>
<td>Proposed model and insights on how IT enables competences, enhances capabilities and contributes to the fulfillment of vendor objectives.</td>
</tr>
<tr>
<td>Pflege and Ungarer (2012)</td>
<td>Investigates the integration of both information and material flows between supply chain participants and their impact on operational performance.</td>
<td>Australian firms</td>
<td>Long-term relationship, information sharing, logistics integration and performance</td>
<td>Supply chain integration involves “hard” and “soft” interaction exchange mechanisms for physical material flow between the two parties.</td>
</tr>
<tr>
<td>Radakrishnan et al. (2009)</td>
<td>Examines the relationship between IT and business value from a process-oriented perspective</td>
<td>Computer-related equipment manufacturer</td>
<td>Information technology, management processes, operational processes, management process capabilities, operational process capabilities and firm performance</td>
<td>IT can improve firm-level financial metrics reflecting operational and management performance.</td>
</tr>
<tr>
<td>Seol et al. (2008)</td>
<td>This study attempts to examine the impact of information technology (IT) on organizational efficiency in public services using a new approach.</td>
<td>Local government in Korea</td>
<td>IT budget, number of servers and PCs, proportion of IT educated professional, proportion of electronic approval and proportion of electronically distributed documents</td>
<td>The approach emphasizes the dominant IT variables, prioritizes IT investments and predicts degrees of efficiency.</td>
</tr>
<tr>
<td>Seram &amp; Stump (2004)</td>
<td>Develop an integrated model of the antecedents and outcomes of IT investments in the context of organizational purchasing.</td>
<td>National association of purchasing management</td>
<td>Competitive environment, IT investment, quality orientation, communication frequency, relationship quality, purchasing costs, purchasing cycle time and purchasing process improvement</td>
<td>The study provides additional evidence to support the emerging view that recognizes IT's impact on social relationships and sheds new light on the “IT productivity paradox.”</td>
</tr>
<tr>
<td>Torkzadeh et al. (2006a)</td>
<td>This study focuses on how to build an effective team upon team size and information technology.</td>
<td>Assembly line</td>
<td>Number of team members, fraction of a time unit of information, fraction of time an individual can spend on communication</td>
<td>Developed a model to determine the value of teamwork performance versus information technology and team size.</td>
</tr>
<tr>
<td>Torkzadeh et al. (2006b)</td>
<td>Investigate the role of teamwork and IT to improve production.</td>
<td>Assembly line</td>
<td>Number of team members, fraction of a time unit of information, fraction of time an individual can spend on communication</td>
<td>Developed the effectiveness of value of teamwork performance versus information technology and team size.</td>
</tr>
<tr>
<td>Torkzadeh et al. (2008)</td>
<td>Reports on confirmatory analysis and factorial invariance tests of the impact of information technology instrument.</td>
<td>Manufacturing and service</td>
<td>Customer satisfaction, management control, task innovation and task productivity</td>
<td>The impact of information technology on individual level of work has high reliability.</td>
</tr>
<tr>
<td>Wagner et al. (2014)</td>
<td>Outline the potential of social media and their affordances in supporting knowledge creation within organizations.</td>
<td>Social media</td>
<td>Knowledge creation theory and Social media affordances</td>
<td>The study provides an innovative perspective on how social media and their affordances may support knowledge creation.</td>
</tr>
<tr>
<td>Walden &amp; Hoffman (2007)</td>
<td>Shows how operations researchers can effectively manage the production costs of computing services.</td>
<td>IT function of multiple firms</td>
<td>Employees' utility, cost effort</td>
<td>The model has four major innovations such as external resource consideration, richness of analytical model, constant economies of scale and managerial talent and integration of complex consumers with TQM.</td>
</tr>
<tr>
<td>Dong et al. (2009)</td>
<td>Try to understand the value of information technology (IT) in supply chain context.</td>
<td>Manufacturing firms</td>
<td>Digitally enabled SCM and performance improvement</td>
<td>IT can create value in supply chain context. Managerial skills and partner support are significant value drivers in supply chains. Competition shaping IT value creation.</td>
</tr>
<tr>
<td>Feng (2004)</td>
<td>Investigates the extent to which e-business tools of the e-marketplace are used by channel members in the retail sector for business-to-business supply chain management.</td>
<td>B-to-B marketplace companies</td>
<td>Procurement cost, global sourcing, reduced lead time, efficiency of exchange information, inventory, faster time to market, stock out, service level and customer information</td>
<td>Companies to integrate their internal and external supply chain activities and share strategic information.</td>
</tr>
<tr>
<td>Lin and Tseng (2006)</td>
<td>Direct and indirect impact of supply chain partnership (SCP), information technology application (ITA), manufacturing participation strategy (MPS) on customer satisfaction (CS) and organizational performance (OP).</td>
<td>Chinese manufacturing corporations</td>
<td>Organizational performance, customer satisfaction, manufacturing participation strategy, information technology application and supply chain participation strategy.</td>
<td>Manufacturing participation strategy planning plays a pivotal role in achieving organizational performance in implementing the supply chain system.</td>
</tr>
<tr>
<td>Müller and Scoring (2007)</td>
<td>To address the interaction between supply chain coordination and information technology (IT).</td>
<td>Conceptual thought</td>
<td>IT based transaction cost, impact of IT on SCM and integration is SCM</td>
<td>The reduction of transaction costs is dependent on the form of supplier integration.</td>
</tr>
<tr>
<td>Oumait et al. (2012)</td>
<td>Examine alignment between supplier management practices (SM) and information systems (IS) strategies and its effects on supply chain integration and supply chain flexibility.</td>
<td>US manufacturing firms</td>
<td>Lean and agile supplier management practices, IT for efficiency and flexibility, supply chain integration and flexibility</td>
<td>IT (e.g., supplier management practices) is positively associated with supply chain integration (flexibility).</td>
</tr>
<tr>
<td>Tarafdar and Oumait (2009)</td>
<td>Identify processes associated with &quot;Faceted IT Business Alignment.&quot;</td>
<td>Manufacturing and service firms</td>
<td>Alignment at the level of projects, aligning decision processes</td>
<td>Characterize two levels at which IT-business alignment occurs.</td>
</tr>
</tbody>
</table>
illustrate four types of alignment states resulting from “strategic” and “tactical” alignment levels, and propose alignment-related managerial actions appropriate for each type making process, balancing standardisation and customisation, formal and informal communication, alignment at the level of IT skills takes place and identify the processes and aspects associated with Tactical IT-business alignment

<table>
<thead>
<tr>
<th>Wang et al. (2011)</th>
<th>To understand the rationale behind a particular type of electronic logistics marketplaces (ELM) termed collaborative ELM.</th>
<th>UK fast moving consumer goods industry</th>
<th>Technology provider, shipper and carriers</th>
<th>Complexity of communication is reduced and a number of benefits have been achieved by both shippers and carriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yao and Zhu (2012)</td>
<td>Use industry-level data to examine whether electronic linkage (EL) use with buyer and supplier industries helps reduce the bullwhip effect as measured by inventory-demand variance ratio.</td>
<td>US manufacturing</td>
<td>IT in focal industry, EL use with buyer and supplier industry and inventory demand variance ratio</td>
<td>EL use with supplier industries reduces the bullwhip effect and EL use with buyer industries increases it. EL tends to behave differently depending on whether it is used upstream or downstream in the supply chain.</td>
</tr>
</tbody>
</table>

4.3 Literature on Agility

To be agile means to be able “to respond to short-term changes in demand or supply quickly” (Lee, 2004: p. 1). The majority of articles in this category (Table 4) discuss the impact of IT on performance. In particular, Cao & Dowlatshahi (2005) and Dowlatshahi & Cao (2006) looked into the impact of alignment between VE and IT on business performance in an agile manufacturing for five different industries. Furthermore, the seminal article by Paulraj and Chen (2007) explored the impact of strategic buyer–supplier relationships and IT on a firm’s external logistics integration and agility performance whereas Swafford et al. (2008) explored the link between flexibility, agility, and performance, suggesting that it is the synergy between flexibility and agility as enhanced by IT that gives competitive business performance. Finally, Gligor and Holcomb (2012) empirically established the link between supply chain agility and firm performance.

The majority of articles on agility focused on the manufacturing sector (e.g. Dowlatshahi & Cao, 2006; Paulraj & Chen, 2007; Gligor and Holcomb, 2012; Gligor et al., 2015), with the exception of Chakravarty et al. (2013) whose study was in B2B electronic marketplaces and aimed at understanding how IT competencies shape organizational agility and firm performance. Furthermore, the articles used mostly quantitative methods (e.g. Cao & Dowlatshahi, 2005; Paulraj and Chen, 2007; Vickery et al., 2010; Gligor et al., 2015). Only an article by Tseng and Lin (2012) adopted a case study approach to investigate how the appropriate agile enablers should be adopted to develop enterprise agility, and how an enterprise can effectively improve its agility. Interestingly, a conceptual article by Overby et al (2006) proposed enabling characteristics of enterprise agility, the specific influence of IT and digital options on enterprise agility, and a method for measuring enterprise agility. Still, this article does not propose or is based on an alternative theory to explain the impact of IT and agility on supply chain related phenomena.

The literature on agility presents the same challenges with the aforementioned literature on alignment and in particular (i) the mere focus on performance, and (ii) qualitative and theory
development papers, proposing the use of alternative theories for explaining related phenomena are missing, apart from very few exceptions (e.g. Overby et al., 2006; Tseng and Lin, 2012).

Table 4: Summary of agility literature

<table>
<thead>
<tr>
<th>Source</th>
<th>Research question</th>
<th>Supply chain structure and decision level</th>
<th>Factors involved</th>
<th>Managerial insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhanakshico &amp; Cao (2006)</td>
<td>Explored the impact of the alignment between virtual enterprise (VE) and IT on business performance in an agile manufacturing (AM) setting for five different industries.</td>
<td>Manufacturing and manufacturing industry</td>
<td>Virtual enterprise, information technology, alignment and business performance</td>
<td>Overall success of AM depends on how well the companies engaged in this endeavor consider the importance and the use of energy among the agility enablers.</td>
</tr>
<tr>
<td>Chakravorty et al. (2013)</td>
<td>Proposes two distinct roles to understand how IT competencies shape organizational agility and firm performance.</td>
<td>B2B electronic market place</td>
<td>Firm performance, entrepreneurial agility and adaptive agility</td>
<td>IT stable agility, ability to use IT competencies needs the knowledge and IT facilities provide support to be agile with strategic actions. Competencies are source of agility but it creates rigidity.</td>
</tr>
<tr>
<td>Gligor et al. (2015)</td>
<td>Examine the association between firms’ supply chain agility (FSCA), cost efficiency and customer effectiveness across various environmental situations.</td>
<td>Manufacturing and other firms</td>
<td>Firm supply chain agility, customer effectiveness, cost efficiency, environmental sustainability, environmental dynamism and environmental complementarity</td>
<td>Provides a better understanding of how FSCA contributes to firm financial performance.</td>
</tr>
<tr>
<td>Gligor and Holcomb (2012)</td>
<td>Empirically establish the link between supply chain agility and firm performance.</td>
<td>Manufacturing and retail firms</td>
<td>Supply chain coordination, supply chain cooperation, supply chain communication, supply chain agility, operational performance and relational performance</td>
<td>Cooperation leads to coordination and communication thereby impact supply chain agility. Supply chain agility doesn’t impact operational and relational performance.</td>
</tr>
<tr>
<td>Gligor and Holcomb (2012b)</td>
<td>Explore the role of logistics capabilities in achieving supply chain agility.</td>
<td>Manufacturing, and supply chain</td>
<td>Manufacturing, organizational and supply chain agility</td>
<td>Agility has been referred as manufacturing flexibility, supply chain speed, or lean manufacturing. Logistics capabilities in achieving supply chain agility has not been addressed.</td>
</tr>
<tr>
<td>Lee (2006)</td>
<td>How to achieve competitive advantage in supply chains through agility, adaptability, and alignment.</td>
<td>Supply chain level</td>
<td>Competitive advantage, agility, adaptability, alignment</td>
<td>The achievement of competitive advantage depends on the ability of the supply chain to be aligned, adaptable, and agile.</td>
</tr>
<tr>
<td>Overby et al. (2006)</td>
<td>Illustrate the enabling characteristics of enterprise agility, the specific influence of IT and digital options on enterprise agility, and a method for measuring enterprise agility.</td>
<td>Firm level</td>
<td>Information technology, digital options, enterprise agility</td>
<td>Decompose agility factors, suggest how IT support sensing and responding components of agility.</td>
</tr>
<tr>
<td>Swatford et al. (2006)</td>
<td>Explores whether supply chain flexibility and supply chain agility leads to increased performance.</td>
<td>Firm level</td>
<td>Information technology integration, supply chain flexibility, supply chain agility, competitive business and relational performance</td>
<td>Flexibility is an antecedent of agility in supply chain contexts. Provides therefore insights into the relationship between IT integration, supply chain flexibility and agility, and competitive business performance. A firm with IT integration and flexibility has more potential to achieve agility rather than a firm that focuses only on IT integration.5</td>
</tr>
<tr>
<td>Qureshi and Tarafdar (2012)</td>
<td>Examine the role of strategic supplier partnership and postponement respectively, on the relation between lean and agile supply chain strategy and supply chain responsiveness.</td>
<td>USA manufacturing firms</td>
<td>Lean supply chain strategy, agile supply chain strategy, strategic supplier partnership, postponement, supply chain responsiveness and firm performance</td>
<td>Strategic supplier partnership fully mediates the relationship between lean supply chain strategy and supply chain responsiveness, and that postponement partially mediates the relationship between an agile supply chain strategy and supply chain responsiveness.</td>
</tr>
<tr>
<td>Tseng and Lin (2011)</td>
<td>How should the appropriate agile enablers be adopted to develop enterprise agility? How can the enterprise effectively improve in agility?</td>
<td>Electronic company</td>
<td>Agility drivers, agility capabilities and agility providers</td>
<td>Proposed QFD-based framework to logically link up and deal with issues of the interface and coordination among the agility providers, capability and driver.</td>
</tr>
<tr>
<td>Vickery et al (2010)</td>
<td>Investigate the roles of supply chain information technologies (SCIT) and supply chain organisational initiatives (SCOI) in engendering agility and business performance in manufacturing firms</td>
<td></td>
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<tr>
<td>Tier 1 automotive supplier in the USA</td>
<td>Supply chain information technologies, supply chain organisational initiatives, agility and firm performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No direct separate impact of SCIT on agility. Greater agility was found to be a complete mediator that leads to enhanced firm performance</td>
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</tbody>
</table>

5. **Theoretical and managerial implications**

Our review of the literature on the use of IT for achieving competitive advantage in supply chains shows that the adaptation of IT for achieving competitive advantage has been studied extensively whereas both alignment and agility studies are limited.

The literature on triple-As underlines mostly the importance of IT for value creation and business performance, the role of resource commitment and IT resources on performance, and suggests that IT can be explored and exploited for SC innovation (e.g. Boulesnane and Bouzidi, 2013) and to obtain a distinctive SC advantage (Fawcett et al 2011). Furthermore, to become agile, organizations would need to invest in IT to obtain significant organizational capabilities and strategic processes (Sambamurthy et al., 2003; Ngai et al., 2011; Qrufleh and Tarafdar, 2014) and build competences at both supply- and demand-side (Blome et al., 2013).

Based on our review, we argue that the achievement of competitive advantage in supply chains through IT is based on the ability of organizations to utilize IT strategically and synergistically to achieve alignment, adaptability, and agility. Those organizations that fail to build the appropriate capabilities through IT to achieve the synergy of these attributes may still be able to achieve competitive advantage, but it is short-lived. Organizations that aim only for agility will use IT to accommodate short-term changes; still they would be able to deal with uncertainties in the supply chains and have IT in order to share information and increase performance. If organizations aim only for adaptation, organizations should use IT to adapt to market changes. In this case, forecasting tools and big data analytics could help organizations evolve according to (forecasted) market changes and achieve high performance. Nevertheless, their ability to achieve competitive advantage without being ‘agile’ is unlikely. Finally, aiming for alignment means that organizations need to think strategically about which IT to use and how to integrate with other supply chain members to achieve better performance. Still, they would need to look into how to become ‘agile’ and how to adapt to sudden or future changes in the market, and therefore would need to synergistically include ‘agility’ and ‘adaptation’ in their business strategy. Our review also coincides and expands the argument by Gligor et al. (2015) who suggest that more research is needed to address “the impact of firm supply chain agility on firm performance” (p. 71). This argument is extrapolated in the framework of figure 2.
Managers would need to pay attention to IT and its synergistic and strategic use to achieve supply chain competitive advantage (adaptation, alignment, and agility). These competitive advantage elements may be particular to different organizations and contexts, as well as dependent on the different views, agendas, and requirements of various stakeholders within supply chain partners. We argue that it is important that managers build particular capabilities for achieving synergy among the three-As to achieve competitive advantage manifested through the three competitive elements. Any attempts to attend to any two of the attributes will end in short-term advantage that will be overcome by competitors. More attention should be also paid to the particular technological competencies that reside within the firm, and its organizational and supply chain goals (Gunasekaran and Kobu, 2007; Gunasekaran et al., 2015). Challenges may arise because of the underlying human and organizational factors that influence the use of IT as a strategic resource to achieve competitive advantage (Bharadwaj et al., 2007; Rai et al., 2006). This is related to the different organizational strategies which have an impact on what technology will be used and how. Hence, stakeholder participation is needed for supply chain and IT strategy formulation, in order for these to be aligned with different stakeholder goals (Sheu, 2011). Managers would therefore understand and further explore the different attributes of supply chain and logistics competitive elements when deciding on the use of IT to achieve competitive advantage.

6. Concluding remarks, limitations and future directions

The paper reviewed the literature on IT and how it leverages supply chains to gain competitive advantage. Our attempt was to investigate the contribution of IT on the triple-As to achieve competitive advantage.
The paper has the following limitations:

1. We selected those articles in a 10-year period which we believe is representative of the research on the role of IT within logistics and supply chains. Although we are not claiming that the list is exhaustive, it is comprehensive since it covers the majority of highly-ranked journals in the field.

2. Following scholars (e.g., Ngai et al., 2008; Chen et al., 2014; Gunasekaran et al., 2015) we used particular keywords. These keywords were decided collectively by all authors. If other keywords were used, the results would be different, but not related to our research aims.

3. In this paper, we characterized the supply chain using the triple-A's. Other frameworks could have been used. However, our choice was based on the relevance of this framing for our research and the fact that it reflects the recent views of scholars in the field.

Notwithstanding the aforementioned limitations, we suggest future research directions on how to leverage IT in supply chains and logistics to achieve competitive advantage, based on both the literature review as well as our 20-year experience working in the area:

1. Based on our framework, a model that explicates the role of IT for competitive advantage within supply chains can be tested, collecting data from supply chain parties.

2. Measures of supply chain adaptation, alignment, and agility could be identified and used by interviewing and/or surveying supply chain practitioners. Such measures would need to be adapted to the aims and goals of the supply chain parties.

3. When evaluating the impact of IT in different contexts (e.g., strategy, capabilities, innovation, outsourcing, logistics, performance), scholars should aim at capturing the impact on both financial/economic and non-financial and softer measures (including positive and negative measures, for instance, stress and wellbeing).

4. Studies should not use only quantitative methods of data collection and analysis that are cross-sectional and confine the 3A’s and the IT attributes in variables, but also longitudinal and qualitative studies that examine the impact of IT over time. In this vein, better theories will be developed that explain the role of IT in supply chain related phenomena.

5. Our review revealed that compared to adaptation and alignment, studies on IT agility are scarce. Therefore, we call for more studies (both quantitative and qualitative, cross-sectional and longitudinal) to further investigate the role of IT in agility.

6. Our conceptualization of the literature could be further developed by conducting interviews with practitioners to understand the role of IT within supply chains. Comparing and contrasting the findings with our review conceptualization would provide further insights and
help in developing a holistic overview of the role of IT in three-As within supply chains to achieve competitive advantage.

7. Future research could also use a panel of purchasing scholars to identify gaps in the field and then compare and contrast with the discussions of this study to further the edge of current knowledge in the use of IT for logistics and supply chain advantage.

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