

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 extent 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 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

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

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 (Hilletoft, 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

softer benefits and few studies, if any attempt to view the adaptation literature using alternative theories (as in the previous section).

Table 2: Summary of adaptation literature

Source	Research question	Supply chain structure and decision level	Factors involved	Managerial insights
Albadvi (2004)	Define a national strategy model for information technology (IT) development in developing countries	Service - country level national strategy	Key technologies, socio-economic sectors and applications	Increase investment in e-education, e-research, e-office and e-information services.
Anderson et al., (2006)	Whether IT does create value that is reflected in the market value of firms and in their future profitability.	Automate, informate and transform industries, strategy	Shareholder value and Y2K spending	Companies that spent more during the Y2K period increased in value and improved their earnings performance
Aral et al., (2012)	Test the dependence of performance benefits of IT and incentive schemes.	US major human capital management (HCM) vendor - adoption of a specific technology (HCM) solutions found in typical enterprise resource planning (ERP) systems.	Information technology (IT), performance pay, and human resource (HR) analytics practices	Demand for HCM is significantly higher in firms that have adopted the performance pay and HR analytics practices
D'Arcy & Devaraj (2012)	Understand relationship between formal and informal sanction deterring technology misuse as well as predispositions and contextual factors.	US computer users, tactical	Certainty severity, social desirability pressure, moral beliefs, virtual status, employment level and technology misuse intention.	Employees that spend a greater number of working days away from the office are more inclined toward technology misuse.
Boulesnane & Bouzidi (2013)	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.	Firm level strategic decision making	Innovation, knowledge management, collective intelligence	IT mediates the relationship between capability and effective decision making and superior value creation.
Chari et al.,(2008)	Do IT investments pay off in the context of corporate diversification is economically significant?	Strategy and firm level manufacturer	IT investment, diversification and firm performance	Performance impact of IT investment is greater for firms with greater levels of diversification.
Chuang et al., (2009)	To investigate the effect of compositions of managerial/demographic characteristics of the top management team (TMT) on the extent of information technology (IT) adoption in small businesses (SMEs)	US small and medium size enterprises. Strategic	Top management characteristics – Composition of age, education and group heterogeneity Extent of IT adoption	age average and the education average of TMT in small businesses are significant predictors of the extent of IT adoption
Daugherty et al., (2005)	How companies can develop and exploit reverse logistics for positive advantage? How resource commitment and information technology capabilities impact performance.	Automobile Aftermarket Industry, Strategic	Resource commitment, IT capability, economic performance and service quality.	Resources are targeted to building a firm's information technology capabilities and to enhance firm performance.
Ding et al., (2010)	Investigate IT effects on inputs and whether it reduces communication costs.	Service – Academic scientist publication, tactical	Research productivity, co-authorship gain, IT measures and scientist characteristics	IT increases research productivity and enhances collaboration.
Fawcett et al., (2011)	How IT can be exploited to obtain a distinctive SC advantage.	Managers affiliated to professional associations	Information sharing culture, supply chain connectivity, supply chain collaboration, customer satisfaction, operational performance	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.
Gao & Hitt (2012)	Examine the relationship between IT and trademarks, one of the most important intangible assets of a firm.	Manufacturing firms, strategic	Trademarks, IT measures, total assets, R&D expenditure, advertising expenditure, labour cost, and stock price volatility	IT is associated with higher levels of trademark applications, suggesting an increased rate of product introduction.
Gordon & Tarafdar (2007)	Explores how an organization's IT competences influence its ability to innovate	Service and manufacturing firms, strategic	Information and knowledge management, project management, collaboration and communication, business involvement, innovation (initiation, development and implementation)	IT competencies helps organisation to be more innovative.
Gunter et al., (2006)	How to improve collaborative planning in supply network by preserving autonomy of each member and utilization of information technology	Forestry and timber industry supply network, strategic	Supply chain management systems, coordination and collaboration.	Lateral agreement of goals and exchange about availability of alternatives improved supply chain management systems.
Hazen& Byrd(2012)	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	Logistics industry, strategic	Environmental factors, organisational factors, logistics innovation, competitive advantage and logistics innovation diffusion.	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.
Heim & Peng(2010)	Examine the impact of IT use on the structure, practices, and performance of manufacturing plants	High performance Manufacturing firms, strategic	Process variables, productivity, organisation structure, cooperation, employee configuration, customisation orientation, integration between function, inter-functional design efforts and customer satisfaction	SPC-related intelligence perhaps has had an even stronger effect upon discretionary work practices than has IT-based dynamic intelligence

Ho & Mallick (2010)	Provide 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
Ilie 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.
Jeffers(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 centred approach will enhance the financial performance of firms
Lee (2004)	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.
Lai 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 SPL firms significantly influences both resource commitment and managerial participation in the development of IT capability which support competitive advantage
Lin& Chuang(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, Computer capital, value added of a firm,	Identified dynamic patterns of IT values measured by productive efficiency.
Lin & Kao (2013)	How to include country level and firm level variables in partial adjustment valuation approach?	Country level and firm level, strategic	Gross domestic product, traditional capital, traditional labour, IT capital	Proposed a new partial adjustment approach.
Mahring & Kcil(2008)	What is the actual information technology project escalation process?	Bank industry, strategic	Drift, unsuccessful incremental adaptation, rationalised continuation.	Development of new process model for IT project escalation
Mishra 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 return and risks.	IT capability is the important antecedent for the relationship between inventory efficiency and stock market returns.
Mithas et al., (2010)	Examine how visa and immigration policies are related to the salaries of American and foreign IT professionals employed in the United States.	Individual, IT professionals, strategic	IT experience, education, visa status, cash compensation, type of industry, IT intensive.	Non-US citizen 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, cash compensation, type of industry, IT intensive.	Firm value MBA more than IT experience. Firm specific skills are not important.
Mojsilovic et al., (2007)	How to manage outsourcing projects from the vendor perspective that maximises 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
Premkumar & Bhattacharjee (2004) (2008)	Empirically compare the relative ability of two competing theories (technology acceptance model and expectation-disconfirmation theory) to explain IT continuance intention.	Service – University students, tactical	Perceived usefulness, perceived ease of use, expectation, disconfirmation, performance, satisfaction and intention.	Satisfaction has less effect on integrated model.
Ravichandran & Liu(2011)	Examine the impact of environmental factors such as industry clock speed and information intensity on IT investment strategy	Firms within fortune 1000 list, strategic	Environmental factors, managerial processes and IT investment strategy	IT investing behaviour is a multifaceted phenomenon. Environmental factors matter during strategic choice, involvement of senior management in IS planning is correlated with IT investment strategy.
Rosacker & Rosacker(2010)	Investigate IT applications in public organisations	Public organisations, strategic	IT project management, public sector organisational culture, government IT project management.	Need best business practices
Russell and Hoag(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)	Analyse IT information style and its influence on shop floor workers wellbeing.	Tile production companies, strategic	IT implementation style (introduction of IT, 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 wellbeing 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.		telecommunication infrastructure, education, openness to external knowledge, intellectual property rights, GDP and cost of investment capital	significant relationships between investment, openness to trade, and telecommunications infrastructure
Siskos et al. (2007)	Propose integrated procedure for the evaluation of information technology knowledge and skills,	Individual adaption - Greek educational system, operational	Project of task management, problem solving, analysis, design, development, testing-maintenance, implement, documentation, studies and non-formal vocational training	The procedure evaluates candidate classification, requiring a strict predetermined procedure, which guarantees objectivity and clarity
Susarla (2012)	Investigate the role of decision rights delineated ex ante that enable Pareto improving amendments	IT outsourcing and post contract adaption and governance, strategic	Pareto improving amendments and terminations. Flexibility provisions, re-deployability rights and termination for convenience rights.	This study addresses post-contract governance and examining the way firms manage adaptation within a contract is an important question
Tafti 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, arms' length, joint venture, non-equity alliance and Tobin's q.	Open communication standards are associated with greater proclivity to form 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 stock 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 & Florou (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 emphasize the higher level of flexibility strategy and the middle level of cost strategy
Wells 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 innovativeness for IT, perceived novelty, perceived risk, perceived reward, attitude and behaviour intention.	Deeper understanding of the influence of affective beliefs provides organizations with an opportunity to leverage various interventions to facilitate user adoption
Chung and Wee (2010)	Investigate the impact of the green product design, the deteriorating 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.
Forman et al (2007)	Examine the customer evaluation of IT solution from the perspective of users of the solution	US automotive supply chain, operational	Independent variables - Goal related factors (near and long term consequences, satisfaction with existing system), cognitive factors (attitude towards technology and users domain understanding), affective factors (satisfaction with supplied solution) Dependent variables - User evaluation of performance of IT solution	Belief of positive consequence for using the technology would make users to positively evaluate and likely to adopt. Softer side of sales approach matters highly than solution.
Hilletofth (2011)	What are the key elements, benefits and requirements to succeed with demand supply chain management	Appliance manufacturer, strategic	Elements - Market orientation, value creation, coordination, differentiation, innovativeness, responsiveness, cost-efficiency of demand and supply processes Benefits- Enhanced competitiveness and performance (demand and supply chain)	Creation, delivery and coordination of customer value
Jing and Zhao (2014)	Explore how business value of IT in supply chain is co-created in downstream 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 SEBIs 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, privileged) and use of SEBIs	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 organisation affect the relationship between external institutional pressures and the degree of assimilation	Focal firms, tactical and operational	Potential absorptive capacity, realised absorptive capacity, assimilation, top management participation and beliefs and external pressures (mimetic, coercive and normative)	Importance to training and support, common understanding of systems and usage behaviour, continuous development of potential and realised capacity will benefit ERP success.
Zahay and Handfield (2004)	Likelihood of learning and sharing in adopting B2B technologies	Upstream involving tier-1 suppliers, strategic	Learning and technology process based on commodity importance value	Information sharing in supply base and predisposition to adopt new technologies. Assessment of soft skills will determine the competitive advantage

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 Burca 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 (Karhman 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

Source	Research question	Supply chain structure and decision level	Factors involved	Managerial insights
Bahl & Rivard(2005)	Validate measures of the risk factors associated with outsourcing IT operations.	Canadian organisations	Transaction, client and supplier	Calculated IT outsourcing operation's risk by multiplying the overall uncertainty score with the costs' score.
Bardhan et al., (2007)	Explore the pathways through which IT impacts project-level performance measured in terms of speed, quality, and cost.	B2B North American private and public organisation	IT Usage, project environment, alignment, project competence, project performance	Providing insight into how to integrate IT into innovation-intensive operational activities for improving project execution competence and productivity
Bienstock et al.,(2008)	Assess logistics information technology use and acceptance as an essential component of an expanded model of logistics service quality (LSQ).	Manufacturing firms	Perceived usefulness of technology, perceived ease of use of technology, intentions to use technology, use of technology	Results provided evidence of approximately equal relationships between perceived ease of use (PEOU) and perceived usefulness (PU) and intentions to use information technology tools.
Bourlakis & Bourlakis(2005)	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.	Greek food multiple retail market	Retailers logistics operation, retailers IT operations, retailer integrated distribution strategies and operation.	The paper will assist to understand that fully absorbed information technology and logistics strategies and operations will be rewarded with superior pecuniary and operational efficiency benefits.
Burca et al.,(2006)	To investigate the relationship between service practices, service performance, business performance and information technology (IT) sophistication.	Ireland service companies	Service practices, information technology sophistication, service performance and business performance	Studies the interaction effects of IT sophistication in a contingency framework of service practice-service performance relationship.
Byrd et al.,(2008)	Investigate the direct and indirect impact of IT at both the intermediate and organization levels.	US Publically traded companies	IT infrastructure, logistics information system impact on the supply chain and firm performance	A superior IT infrastructure was shown to be directly related to both firm performance measures, and also indirectly through an intervening variable, LIS's impact.
Cao and Dowlatshahi (2005)	Explore the impact of the alignment between virtual enterprise (VE) and IT on business performance under agile manufacturing setting.	Extractive and manufacturing industry	Virtual enterprise, information technology, alignment and business performance	Established that the alignment between VE and IT had a positive impact on business performance.
Cao and Hoffman(2011)	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.	Extractive, manufacturing and utilities companies	Alignment of virtual enterprise, alignment of IT, alignment between VE and IT.	This study examined alignment-performance issues associated with virtual enterprise (VE) and IT from the perspective of how functional-level IT strategic planning should align with and support business-level VE strategies.
Chen et al.,(2006)	Develop a DEA non-linear programming model to evaluate the impact of IT on multiple stages along with information on how todistribute the IT-related resources so maximise efficiency.	Hypothetical data set from previous study	Fixed asset, employees, IT investment, deposit, profit and loan recovered.	Developed new models for evaluating IT impacts on firm performance when intermediate measures are present.
Chen and Lin (2009)	Develop three factor constant elasticity of substitution frontier model	Panel data from 15 countries	GDP, non-IT capital and non IS labour.	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.
Devaraj et al.,(2013)	Examine the role of IT on patient flow and its consequences for improved hospital efficiency and performance	US Hospitals	IT investment, swift patient flow, even patient flow and hospital performance	Analysis of data from 567 U.S. hospitals shows that IT is associated with swift 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.
Dewan et al.,(2007)	Develop empirical proxy measures of information technology (IT) risk and empirically analyze IT returns: production function and market value specifications.	Sample of fortune 1000 firms	production function and market value specifications	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.
Gunasekaran et al.,(2006)	Develop IT/IS evaluation framework that better reflects the new business environment.	Previous studies	IT/IS evaluation and justification. Evaluation of IT/IS implementation of projects, evaluation criteria and techniques and tools.	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.
Jeffers et al.,(2008)	Propose a configurational perspective of how information technology (IT) assets and capabilities affect firm performance.	3PL companies	IT application, shared knowledge, business work practices, open communication, customer	Tested the impact of explicit and tacit IT resources interactions with two non-IT resources (open

			service process performance and financial performance	communication and business work practices). Found complementarities between shared business-IT knowledge and business work practice and between the scope of IT applications and an open communication culture in affecting the performance of the customer-service process in addition to evidence of substitutability
Kahraman et al.,(2007)	Develop a multi-attribute decision making model for evaluating and selecting among logistic information technologies.	Logistics company	Tangible benefits, intangible benefits, policy issues and resources.	Offered a structured hierarchical model for logistic information technology evaluation and selection to view tangible benefits, intangible benefits, policy issues and resources.
Karwan & Markland(2006)	Argue that public sector operations success depends on dimensions of information technology applied in conjunction with a unified set of service operations concepts.	Service sector – Dept of motor vehicle	Service strategy, service delivery system and performance measure	Reported that measures of effectiveness vary widely and are absolutely essential to the satisfaction that citizens have with government services at all levels.
Ko & Osei-Bryson (2006)	Investigate the investment on IT to justify the business value.	Large US firms	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.
Lai et al.,(2008)	Study 3PL providers IT capability and how IT capability affects their competitive advantage.	Chinese logistics companies	IT strategy taxonomy memberships, 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.
Laura & Duchessi(2007)	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).	Services, industrial and financial sectors	IS Maintenance, Project management, vendor support, organisational arrangement, business planning, IS-User interaction, IS management rule, functional management role, application complexity, application suitability, application analysis, std integration and benefits	Demonstrates how to build an IT implementation BN from survey data.
Lec (2004)	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.
Lin & Chiang(2011)	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.	25 countries panel data	GDP, 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 utilize national characteristics while formulating IT investment strategies.
Love et al.,(2004)	Use structured case approach that includes indirect costs to gain an understanding of how a construction firm embrace the IT evaluation process.	Construction company	External & internal factors, benefit 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.
Millet & Gogan(2006)	Propose problem structuring using dialectical processes such as organizing versus disorganizing potential of information technologies.	Software selection at a business college	Structuring, unstructuring, groping and adjusting.	Examines four processes such as structuring, unstructuring, groping, and adjusting. Implications for the design of decision support systems are discussed.
Nazmoglu & Ozsen (2009)	Define and analyze risks within information technologies (IT) in service delivery.	IBM Service Delivery	Operational, key performance indicators, tolerances, critical success factors, outcomes and dashboards	The risk identified is "dissatisfied customers", "delayed solutions", and the third is "low employee morale".

Oh et al.,(2012)	This study examines the impacts of the use of IT by retail firms in integrating channel activities for selling to customers.	Singapore retailers	Cross channel human resource capability, IT enabled retail channel integration capability, exploitative competence, explorative competence, environmental dynamism and firm performance	Integrating organizational resources, retail firms can attain better performance by developing exploitative and explorative competences and that in dynamic environments, especially possession of explorative competence is particularly rewarding.
Perunovic et al., (2012)	Study how IT impacts vendor capabilities and propose a method to calculate impact of IT on capabilities and IT on performance.	Software development and electronic manufacturing service industries	Information technology, competences, capabilities and objectives	Proposed model and insights on how IT enables competences, enhances capabilities and contributes to the fulfilment of vendor objectives.
Prajogo & Olhager(2012)	Investigate the integrations of both information and material flows between supply chain partners and their effect on operational performance. In particular the role of long-term supplier relationship as the driver of the integration.	Australian firms	Long term relationship, information technology, information sharing, logistics integration and performance	Supply chain integration involves "hard" and "soft" information exchange mechanisms for physical material flow between the two parties.
Radhakrishnan et al (2008)	examines the relationship between IT and business value from a process-oriented perspective	Computer related equipment manufacturer	Information technology, management processes, operational processes, management process capabilities, operational process capabilities and firm performance	IT can improve firm-level financial metrics reflecting operational and management processes
Seol et al.,(2008)	This study attempts to examine the impact of information technology (IT) on organizational efficiency in public services using a new approach.	Local government in Korea	IT budget, number of servers and PCs, proportion of IT educated professional, proportion of electronic approval and proportion of electronically distributed documents	The approach emphasizes the dominant IT variables, prioritizes IT investments and predicts degrees of efficiency.
Sriram & Stump (2004)	Develop an integrated model of the antecedents and outcomes of IT investments in the context of organizational purchasing.	National association of purchasing management	Competitive environment, IT investment, quality orientation, communication frequency, relationship quality, purchasing costs, purchasing cycle time and purchasing process improvements	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."
Tohidi & Tarokh (2006a)	The study focus on how to build an effective teamwork upon team size and information technology.	Assembly line	Number of team members, fraction of a time unit of information, fraction of time an individual can spend and output of team	Proposed a model to determine the value of teamwork performance versus information technology and team size.
Tohidi & Tarokh (2006b)	Investigate the role of teamwork and IT to improve production.	Assembly line	Number of team members, fraction of a time unit of information, fraction of time an individual can spend and output of team	Analyzed the effectiveness of value of teamwork performance versus information technology and team size.
Torkzadeh et al., (2008)	Reports on confirmatory analysis and factorial invariance tests of the impact of information technology instrument.	Manufacturing and service	Customer satisfaction, management control, task innovation and task productivity	The impact of information technology on individual level of work has high reliability.
Wagner et al(2014)	Outline the potential of social media and their affordances in supporting knowledge creation within organizations.	Social media	Knowledge creation theory and Social media affordances	The study provides an innovative perspective on how social media and their affordances may support knowledge creation.
Walden & Hoffman(2007)	Shows how operations researchers can effectively manage the production costs of computing services.	IT function of multiple firms	Employees utility, cost effort	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 classical economics with TCE.
Dong et al. (2009)	Try to understand the value of information technology (IT) in supply chain contexts	Manufacturing firms	Digitally enabled SCM and performance improvement	IT can create value in supply chain contexts. Managerial skills and partner support are significant value drivers in supply chains. competition shapes IT value creation
Eng (2004)	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	E-market place companies	Procurement cost, global sourcing, reduced lead time, efficiency of exchange information, inventory, faster time to market, stock out, service level and customer information	companies to integrate their internal and external supply chain activities and share strategic information
Lin and Tseng (2006)	direct and indirect impact of supply chain participation strategy (SCPS), information technology application (ITA), manufacturing participation strategy (MPS) on customer satisfaction (CS) and organizational performance (OP)	Chinese manufacturing corporations	Organisational performance, customer satisfaction, manufacturing participation strategy, information technology application and supply chain participation strategy	Manufacturing participation strategy planning plays a pivotal role in achieving organisational performance in implementing the supply chain system.
Muller and Seuring (2007)	to address the intersection between supply chain coordination and information technology (IT)	Conceptual thought	IT based transaction cost, impact of IT on SCM and integration is SCM	The reduction of transaction costs is dependent on the form of supplier integration.
Qrunflieh et al (2012)	examine alignment between supplier management practices and information systems (IS) strategies and its effects on supply chain integration and supply chain flexibility	US Manufacturing firms	Lean and agile supplier practice, IS for efficiency and flexibility, supply chain integration and flexibility	lean (agile) supplier management practices are positively associated with supply chain integration (flexibility)
Tarafdar and Qrunflieh (2009)	identify processes associated with "Tactical IT-Business Alignment",	Manufacturing and service firms	Alignment at the level of projects, aligning decision	characterize two levels at which IT-business alignment

	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
Wang et al. (2011)	to understand the rationale behind a particular type of electronic logistics marketplaces (ELM) termed ‘collaborative ELM’.	UK fast moving consumer goods industry	Technology provider, shipper and carriers	complexity of communication is reduced and a number of benefits have been achieved by both shippers and carriers
Yao and Zhu (2012)	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	US Manufacturing	IT in focal industry, EL use with buyer and supplier industry and inventory demand variance ratio	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

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

Source	Research question	Supply chain structure and decision level	Factors involved	Managerial insights
Dowlatshahi & Cao(2006)	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.	Extractive and manufacturing industry	Virtual enterprise, information technology, alignment and business performance	Overall success of AM depends on how well the companies engaged in this endeavour consider the importance and the use of synergy among the agility enablers.
Paulraj & Chen(2007)	Explore the impact of strategic buyer–supplier relationships and information technology on a firm’s external logistics integration and agility performance.	US Manufacturing industry (SIC – 34-39)	Strategic buyer supplier relationships, information technology, external logistics integration, agility performance	Found significant relationships between the antecedents, external logistics integration and agility performance.
Chakravarty et al. (2013)	proposes two distinct roles to understand how IT competencies shape organizational agility and firm performance	B2B electronic market place	Firm performance, entrepreneurial agility and adaptive agility	IT enables 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.
Gligor et al. (2015)	Examine the association between firms supply chain agility (FSCA), cost efficiency and customer effectiveness across various environmental situations.	Manufacturing and other firms	Firm supply chain agility, customer effectiveness, cost efficiency, environmental munificence, environmental dynamism and environmental complexity.	Provide a better understanding of how FSCA contributes to firm financial performance.
Gligor and Holcomb (2012)	Empirically establish the link between supply chain agility and firm performance	Manufacturing and retail firms	Supply chain coordination, supply chain cooperation, supply chain communication, supply chain agility, operational performance and relational performance	Cooperation leads to coordination and communication thereby impact supply chain agility. Supply chain agility doesn’t impact operational and relational performance
Gligor and Holcomb (2012b)	Explore the role of logistics capabilities in achieving supply chain agility	Manufacturing, and supply chain	Manufacturing, organisational and supply chain agility	Agility has been referred as manufacturing flexibility, supply chain speed, or lean manufacturing. Logistics capabilities in achieving supply chain agility has not been addressed
Lee (2004)	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.
Lin et al (2006)	Development of the absolute agility index	Manufacturing	Agility drivers, agile enterprise, agility capability and agility enablers	Developed a method to address agility measuring, stressing the multi-possibility and ambiguity of agility capability measurement.
Overby et al (2006)	Illustrates the enabling characteristics of enterprise agility, the specific influence of IT and digital options on enterprise agility, and a method for measuring enterprise agility.	Firm level	Information technology, digital options, enterprise agility.	Decompose agile factors, suggests how IT support sensing and responding components of agility.
Swafford et al. (2008)	Explores whether supply chain flexibility and supply chain agility leads to increased performance	Firm level	Information technology integration, supply chain flexibility, supply chain agility, competitive business performance	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.S
Qrunfleh and Tarafdar (2012)	Examine the role of strategic supplier partnership and postponement respectively, on the relation between lean and agile supply chain strategy and supply chain responsiveness	USA manufacturing firms	Lean supply chain strategy, agile supply chain strategy, strategic supplier partnership, postponement, supply chain responsiveness and firm performance	Strategic supplier partnership fully mediates the relationship between a 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
Tseng and Lin (2011)	How should the appropriate agile enablers be adopted to develop enterprise agility? How close is the Enterprise to becoming agile? How can the enterprise effectively improve its agility?	Electronic company	Agility drivers, agility capabilities and agility providers	Proposed QFD-based framework to logically link up and deal with issues of the interface and coordination among the agility provider, capability and driver

Vickery et al (2010)	Investigate the roles of supply chain information technologies(SCIT) and supply chain organisational initiatives (SCOI) in engendering agility and business performance in manufacturing firms	Tier 1 automotive supplier in the USA	Supply chain information technologies, supply chain organisational initiatives, agility and firm performance	No direct separate impact of SCIT on agility. Greater agility was found to be a complete mediator that leads to enhanced firm performance
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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; Qrunfleh 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.

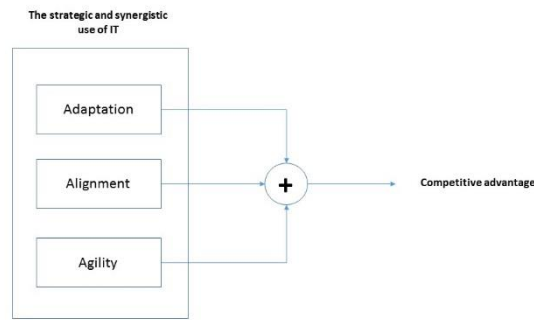


Figure 2: The synergistic use of IT for adaptation, alignment, and agility in supply chains to achieve competitive advantage

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 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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