



NICHOLAS BLESSING MAVENGERE

Information Systems Role in Strategic Agility

A supply chain context



ACADEMIC DISSERTATION

To be presented, with the permission of  
the Board of the School of Information Sciences of the University of Tampere,  
for public discussion in the Paavo Koli Auditorium, Kanslerinrinne 1,  
Tampere, on December 10th, 2013, at 12 o'clock.

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ACADEMIC DISSERTATION

University of Tampere, School of Information Sciences  
Finland

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Cover design by  
Mikko Reinikka

Acta Universitatis Tamperensis 1881  
ISBN 978-951-44-9290-7 (print)  
ISSN-L 1455-1616  
ISSN 1455-1616

Acta Electronica Universitatis Tamperensis 1362  
ISBN 978-951-44-9291-4 (pdf)  
ISSN 1456-954X  
<http://tampub.uta.fi>

Suomen Yliopistopaino Oy – Juvenes Print  
Tampere 2013

## **Supervisors**

Professor Mikko Ruohonen  
Professor, Business & Information Systems  
CIRCMI Research on information, customer & innovation management  
School of Information Sciences  
University of Tampere  
33014 Tampere

Emeritus Professor Pertti Järvinen  
School of Information Sciences  
University of Tampere  
33014 Tampere

## **Reviewers**

Professor Hannu Jaakkola  
Tampereen Teknillinen Yliopisto  
Porin laitos  
PL 300, 28101 PORI

Professor Christer Carlsson,  
Institute for Advanced Management Systems Research  
Åbo Akademi University  
Joukahainengatan 3-5 A,  
FIN-20520 Åbo,

## **Opponent**

Professor Hannu Salmela  
University of Turku  
20014 Turku

# ABSTRACT

Although it may seem obvious that business must respond to the pressures brought by the prevailing environment, not many companies are gaining competitive advantage and some are even failing to survive. This is witnessed by several well-known companies who have changed their chief executive officers (CEO) in the past few years in an effort to bring fresh ideas to survive the competition. For example, Nokia in 2010 changed their CEO to Stephen Elop who also was replaced on 3 September 2013 by interim CEO and Chairman Risto Siilasmaa. Reasons for this include, for instance, some scholars argue that it is disruption that is, any event that has potential to adversely affect company operation or business model, for example, technological advances that favor new rivals entering the market. In Nokia's case, increase in smartphones market segment which is significantly dominated by other players, such as, Apple's iPhone and Google's Android based devices like Samsung phones. This research seeks to input measures that could be embraced by companies operating in a dynamic and competitive environment to survive or gain competitive advantage. To be precise, strategic agility is proposed as an essential virtue companies could embrace. Strategic agility involves tactfully detecting and responding to business environment with ease, speed, and dexterity. Moreover, the prevailing business environment characterized by intense technological innovation and obsolescence, powerful customers with diverse requirements and global choices and short product life cycle in a global economy have significantly shortened market visibility and increased uncertainty. Therefore, companies are working together in supply chains to overcome the environment pressures and take advantage of emerging opportunities. In addition, companies are making use of technologies taking into consideration the innovations.

The focus of this research is to investigate how companies operating in a competitive and dynamic environment can make use of existent and emerging technologies to promote strategic agility. This is because strategic agility is argued to be an essential feature in the current business environment. Strategic agility has key dimensions strategic sensitivity, strategic response and collective capabilities. Strategic sensitivity involves collecting data that generates knowledge and clean it for accuracy and relevancy then analyze the impact of the derived knowledge and in doing so, anticipate or detect opportunities and threats in the business environment. Strategic response is the ability of an organization in collaboration with its partners to quickly and seamlessly (re)configure its resources and processes to re-act or pro-act to the business environment changes. Collective capabilities includes of an organization include ability to benefit from the combined fusion of its resources, for example, information, employees, infrastructure and partners. That is, to thrive on the gains of working together, this is more than, for example, each resource benefits individually summed up. Moreover, this research considers a supply chain environment because competition is argued to be significantly at supply chain level. Moreover, the advances in technologies make collaboration cheaper and faster and thus fostering supply chains.

The research design is such that there are three main phases. First phase titled preliminary phase is theoretical review of the research. There are many points of view considered for this phase because of various reasons, such as, conceptual model and taxonomy development, scientific motivation, theoretical basis of the research and research tools development, these include, interview guide and protocol. Second phase includes the improvement of the research tools and a review of the past empirical findings. The final phase of the research is an empirical component and involves two case studies of the research. This design is such that each phase provides input to the next phase, for instance, the strategic agility taxonomy developed in phase one is used in analysis of the empirical findings in phase two and thereby improved. Also, the improved research instruments in phase two are utilized for data collection in the major research.

All these three phases are based on qualitative research approach, for example, data is gathered from past scientific articles, company documents, online news, interviews and open ended questionnaire.

Seven academic articles were written in conducting this research as shown on the list of attached publications. First article is a conceptual paper which defines the role of information systems for strategic agility purposes in supply chain setting. This is done to provide a conceptual basis of the research, which is the foundation to the empirical studies. Second article is based on a systematic literature review which is essential in defining what past literature has covered and the gaps which future research could contribute. This also cements the scientific value of the research by highlighting the scientific contribution. The systematic literature review is a standalone research in this dissertation because the area of research is relatively new and requires a thorough analysis of past related research and thereby providing a sound scientific basis. Moreover, two articles, third and fourth articles cover in depth strategic sensitivity and strategic response. Fifth article make use of empirical findings to develop case studies of IKEA and Kesko. Also, two empirical studies done in the telecommunication industry and information technology distribution sector are covered in articles six and seven respectively.

The contribution of this research includes scientific input this is done by the development of strategic agility taxonomy and strategic agility in supply chain setting conceptual model which has been advocated for in the past literature. The conceptual model extends past proposed models in terms of spectrum and included dimensions and also the taxonomy is developed from past related literature. Moreover in the past literature, the role of IS in business has received mixed views in terms of its strategic importance. In addition, this research contributes to science by defining the role of IS in business through strategic agility reasoning. Moreover, the research topic is relatively new and does not yet have clear research tradition. Because of that the thesis contains additional contribution related to the research design of a novel topic. In addition, this IS research also seeks to input into practice and thus includes empirical works in the Telecommunication industry and Information Technology distributor sector.

**KEYWORDS:** role of information systems in business, information systems products and services, strategic agility, strategic sensitivity, strategic response, collective capabilities, supply chain, supply chain management, case study, content data analysis, qualitative research approach, conceptual-analytic research.

# ACKNOWLEDGEMENTS

Conducting PhD includes many aspects, such as, academic, professional, financial, political, social, psychological, spiritual and etc. To complete a PhD means having been able to maneuver through all these aspects and that cannot be done single handedly. Thus I take this opportunity to thank all the people who helped me in this journey. For sure, I will never be able to thank enough all the people but I appreciate all the help especially from those whom I do not disclose their names.

I would like to thank my supervisor, Professor Mikko Ruohonen. He was very supportive in all the different facets in conducting my PhD, that is, worthy academic supervisor and a very practical advisor to all the aspects during the course of the PhD journey. I feel blessed to have had Professor Pertti Järvinen, my second supervisor, in guiding and teaching me all the steps in conducting this PhD research. I enjoyed attending all the PhD graduate seminars which he hosted and am grateful to all the participants who offered valid feedback to my research. I am so thankful to Marko Mäkipää who has been a corner stone in my academic and professional journey from my master's thesis to the completion of my PhD research. I would like to thank my PhD dissertation reviewers Professor Hannu Jaakkola and Professor Christer Carlsson for their efforts, time and insightful reviews. This research was done in Research on information, customer & innovation management - CIRCOMI research unit and I had a great working experience with all my colleagues, CIRCOMIers. I am very grateful. The PhD defense opponent, Professor Hannu Salmela taught me a master's course, Management of IT partnerships, IT partnerships analysis. This course was scientific based, that is, many academic articles were utilized and this was an eye opener to the academic world.

I am very thankful for funding from Foundation for Economic Education, University of Tampere Foundation, TEKES Concepts of Operations Programme (StrAgile project), TEKES Digital Product Process Program (netPLM project), Tampere Doctoral Programme in Information Science and Engineering (TISE), Doctoral programme for Multidisciplinary Research on Learning Environments (University of Turku, external student) and CIMO who funded this research, without which this would not be possible.

My friend Marcos Tong helped me so much and he was very enthusiastic about my PhD journey. He helped me have access and gather data in one of the empirical case companies and the paper which I wrote on the case went on to be the best PhD research at the 7th European Conference on IS Management and Evaluation. Thanks Marcos! Kamrul Ahsan helped me in another case company which I did empirical research and I thank him so much. Mzkuru Chari Matiyenga did English proof reading, thanks Sinyoro. I also am thankful to my friends, IMMITErs and SACCO family for the encouragements and social interactions. I am also thankful to Paul Mugagga Semakula, Henry Mugabi, Torstein Siedel, Sami Eloranta, Adewunmi Ogunbase, Mani Rajbhandari and Anthony Mulyanti for the companionship during the PhD journey. I cherish and appreciate the spiritual nourishment from Catholic Holy Cross Parish Tampere and would like to thank all fellow members.

My mother has been there for me from my first day at school. She has been a pillar of strength in all the ups and downs of my schooling life. Thank you for the support Mhamha. I also appreciate the motivation from my brothers and sisters. My in laws are very supportive and encouraging, thank you Mzikani! My late father, who passed on 10 December when I was about twelve years old, wanted me to be academically successful. I am grateful for his support and I dedicate this thesis in loving memory of him.

There are no words which can adequately express the appreciation I have for the support, encouragement, motivation, love from my wife, Faith Euphrasia Mavengere. She has been there for me during the toils of my academic life, right from my first university struggles at University of Zimbabwe to this moment. My

sincere and special gratitude to you, my love. My sons, Nyasha Blessings and Mutsa Michael are a source of inspiration. They were an ever present oasis of happiness in the sometimes PhD desert journey. I am so thankful to my family, without you, every accomplishment will be empty.

It has been an academic journey! From my first school days at Mupamombe Primary School where my parents were not so impressed and transferred me to Tafadzwa Primary School, where I had one of my best teachers, Mr Munemo. My late father, worked with the “best teacher in Kadoma city”, whom became my final primary school teacher at Chedonje Primary School, Mr .T. Marazanye. He is a charismatic teacher, who taught me many life lessons, I am so thankful. My high school years at Gokomere High were some of the best times of my life and I had one Mathematics teacher who taught me for six years, the late Mr Makari who was both a teacher and a parent to me. I had some of the most challenging life times during my first university experience at University of Zimbabwe. I am happy and appreciate this experience; somehow it helped me to reach this point. Then I met my dear friends during my masters, IMMIT family. I am thankful to Dr. Eija Koskivaara, Prof. Hannu Salmela and Dr. Timo Leino who were some of my lecturers at master’s level. I had the opportunity to work in CIRCMI during my PhD which was a wonderful experience. This is my academic story in summary, all by God’s grace, praise be to God.

Nicholas Blessing Mavengere  
Tampere, 2 November 2013

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ARTICLE 1: Mavengere, N.B. (2013). Information Technology Role in Supply Chain's Strategic Agility, *International Journal of Agile Systems and Management*, Vol. 6, No. 1, p. 7-24

ARTICLE 2: Mavengere, N., Ruohonen, M., Mäkipää, M. (2013), The Role of Information Systems in Supply Chain Strategic agility: a systematic literature review, *Proceedings of Academy of World Finance, Banking, Management and Information Technology Conference*, 22-25 July 2013, Cape Town, South Africa, ISBN 978-0-9752272-5-1 [invited for review for book chapter publication]

ARTICLE 3: Nicholas Mavengere (2010) Strategic Sensitivity and the Role of Information Systems: Sensing in a Turbulent Environment, *Proceedings of the 8th Annual Conference on Information Science, Technology and Management*, 9-11 August 2010, Murikka Institute, Tampere

ARTICLE 4: Nicholas Mavengere (2010) Response abilities: a strategic agility requirement for supply chains, in H.W. Nicolajsen, J. Persson, L. Heeager, G. Tjørnehøj, K. Kautz, P.A. Nielsen (Eds.): *Proceedings of the 33rd IRIS Seminar (Information Systems Research Seminar in Scandinavia)*, IRIS 2010, Rebild Bakker, 21.-24. August 2010, Rebild, Denmark, ISBN 978-87-992586-1-7 (CD). [improved paper under review at *Information Resource Management Journal*]

ARTICLE 5: Mavengere, N. (submitted). Strategic agility and required information systems in supply chain setting, *Journal of Information Technology Cases & Applications Research*

ARTICLE 6: Mavengere, N. (2013). Strategic agility and the Role of Information systems in Supply Chain: Telecommunication Industry Case Study, *Proceedings of the European Conference on IS Management and Evaluation (ECIME)*, 12-13 September 2013, Sopot, Poland [selected as the best PhD research article and in consideration for publication in *Electronic Journal of Information Systems Evaluation*]

ARTICLE 7: Mavengere, N. (2013). The Role of Information Systems for Strategic Agility in Supply Chain: IT Distributor Case Study, *Academic Business World International Conference*, 22-24 May 2013, Nashville, USA

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# 1 INTRODUCTION

The prevalent business environment is characterized by advances in technology, powerful customers with unlimited global choices, information overload and increasingly complex social and political issues, such as, compliance with varying government regulations. This is offering both challenges and opportunities for companies and moreover making the competitive landscape complex. Both scholars and practitioners are continually devising ways to corporates for surviving in the competitive environment. For example, Doz & Kosonen (2008) proposed strategic agility as one such measure to survive the ever increasing competition from different dimensions, for instance, from existent and emerging competitors. Strategic agility involves tactfully detecting and responding to business environment with ease, speed, and dexterity (Tallon & Pinsonneault, 2011). In addition, companies are increasingly collaborating, for example, formation of supply chain (SC) as a measure to survive the competition.

This research seeks to contribute the ever required knowledge on how business can thrive in an increasingly complex and dynamic operating environment. The environment characteristics mentioned above and in addition to the fact that the environment is dynamic make it obligatory to constantly propose and update ways to survive the competition. Researchers have proposed ways to analyze the competition and survive, for example, five competitive forces (Porter, 2008) and dynamic capabilities (Teece et al., 1997). And recently Doz & Kosonen (2008) suggested how corporates can maneuver for strategic agility purposes. This research develops the strategic agility concept taking into consideration other related theories and SC context. Also the increasing significance of information systems (IS) in business because of technological advances, for example social computing and cloud computing, makes it essential to study. Therefore, this research seeks to show how business can survive the competitive environment by making use of strategic agility and related role of IS in a SC setting. This is because strategic agility is an essential virtue in a dynamic and complex environment and also, IS and SC are integral factors. These three research themes, strategic agility, IS role and SC are elaborated in the next sub section 1.1.

A systematic literature review (Kitchenham, 2004; Okoli & Schabram, 2010) was conducted and noted that there is increasing research on strategic agility, although different phrases were noted in the literature referring to the same concept, for example, organization agility (Tallon & Pinsonneault, 2011) and enterprise agility (Overby et al., 2006). Research in SC was also noted to be broad and diverse covering different aspects, for example, management (Spekman et al., 1998), agility (Christopher, 2000) and IS in SC environment (Gunasekaran & Ngai, 2004). For example, Dehning et al. (2007) empirically validated that SC systems improves performance, that is, gross margin, inventory turnover, market share, return on sales, and reduce selling, general, and administrative expense, after examining the change in financial performance pre and post IS adoption. However, we did not find research which seeks to highlight required IS in SC setting to promote strategic agility. The need of agility especially in a hyper-competitive environment (Sahay, 2003) has also been advocated for in research, for example, by Tallon & Pinsonneault (2011). Moreover, there is a gap noted in literature (Alvesson & Sandberg, 2011) on precisely researching on how IS could be used to foster strategic agility in SC setting in order to improve business performance. Please see article 2 for a detailed systematic literature review research report.

Information technology (IT) in this research is considered as the function within a company responsible for IT and systems. An example of an IT product referred to as IS in this study is enterprise resource planning (ERP) system and its service is integrating the company functions to facilitate the flow of information. Swanson (1994) highlighted that IT product and services impact company's processes and services to influence and reshape the organization. This research takes this into consideration and in

addition the IT's product and services influence on the business environment. Therefore, this research seeks to investigate the role of IT, specifically IT's product and services influence the business and its environment from a strategic agility point of view. Moreover this research considers also SC settings and notes inter-organizational systems (IOS), that is, IS used with two or more business partners.

The SC setting is considered in this research. This research considers strategic agility to be of value at both SC level and individual organizations that make up the SC. That is, in making business decisions in SC context, there have to be considerations of both the SC and organizational level. That is the same reasoning in this research, that strategic agility of the organizations in a SC should be related to maximize the benefits of collaborating as a chain (Burton-Jones & Gallivan, 2007). Therefore, the SC partners should have their own strategic agility plan but however it should relate to the SC strategic agility plan. Therefore, there are two related levels of analysis, i.e., microscopic (analysis from SC participants' level) and macroscopic (analysis from whole chain perspective).

## **1.1 Definition of research themes**

### **1.1.1 Strategic agility**

Strategic agility, as utilized in this research, was first coined by Doz & Kosonen (2008). They studied corporations, like Nokia, and concluded that strategic agility made up of strategic sensitivity, resource fluidity and leadership unity as essential. They wrote a book titled *Fast strategy* which informs management of the changing business environment and how strategic agility could aid companies in transformation measures for business sustainability. However, there are many related concepts noted in the literature, such as, organizational agility (Tallon & Pinsonneault, 2011) and enterprise agility (Overby et al., 2006). Article 1, is a conceptual analytic research which included development of the strategic agility construct. That is, after noting all the strategic agility related concepts the main dimensions are noted as strategic sensitivity, strategic response and collective capabilities.

BusinessDictionary.com defined strategic agility as "the ability for companies to stay competitive in their business by adjusting and adapting to new innovative ideas and using these ideas to create new products and services as well as new business models". From this definition we note the measure with the environment actors, that is, being competitive and hence the need to sense the environment derived from the strategic sensitivity component. Strategic sensitivity includes both strategic foresight (Inkinen & Kaivo-oja, 2009) important in predicting and understanding the trends, and strategic insight, which is a thorough analysis of the current environment. From the definition we also note several response initiatives, such as, adjusting and adapting to new innovative ideas, to create new products and services and new business models. These are all strategic response measures which are called as a re-action or pro-action to the environment. There is need for an adequate analysis of a response initiative by taking into consideration both internal situation and external circumstances. Thus, strategic response is a tactical solution to the prevailing and foreseen strategic opportunities and challenges. Collective capabilities includes the ability of an organization to benefit from the combined fusion of its resources, for example, information, employees, functions, infrastructure and partners. That is, to thrive on the gains of working together, this is more than, for example, each resource's benefits individually summed up. These three strategic agility also relate to Conboy (2009, p. 340) definition of agility, although he referred to IS development method it could be adopted to organizational context, that is, the continual readiness of an organization "to rapidly or inherently create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value (economy, quality, and simplicity), through its collective components and relationships with its environment".

## 1.1.2 Supply chain

SC, the basis of this research, is elaborated in this section. There are several aspects involved in SC but this research only highlights the aspects important and related to the research objective, that is, defining strategic agility of SC. For instance, an important aspect of SC is leveraging the expertise, experience, skills and capabilities of the SC partners who comprise this competitive network (Mentzer et al. 2001). The intentions in formulating a SC include making improvements and changes so as to maximize the gains from the expertise of members of the SC. The success of SC partners in doing this significantly determines their success as a SC and sustainability of their competitive advantage. These activities are also important for the strategic agility of the SC, for example, by aiding in smooth and fast reaction to the business pressures.

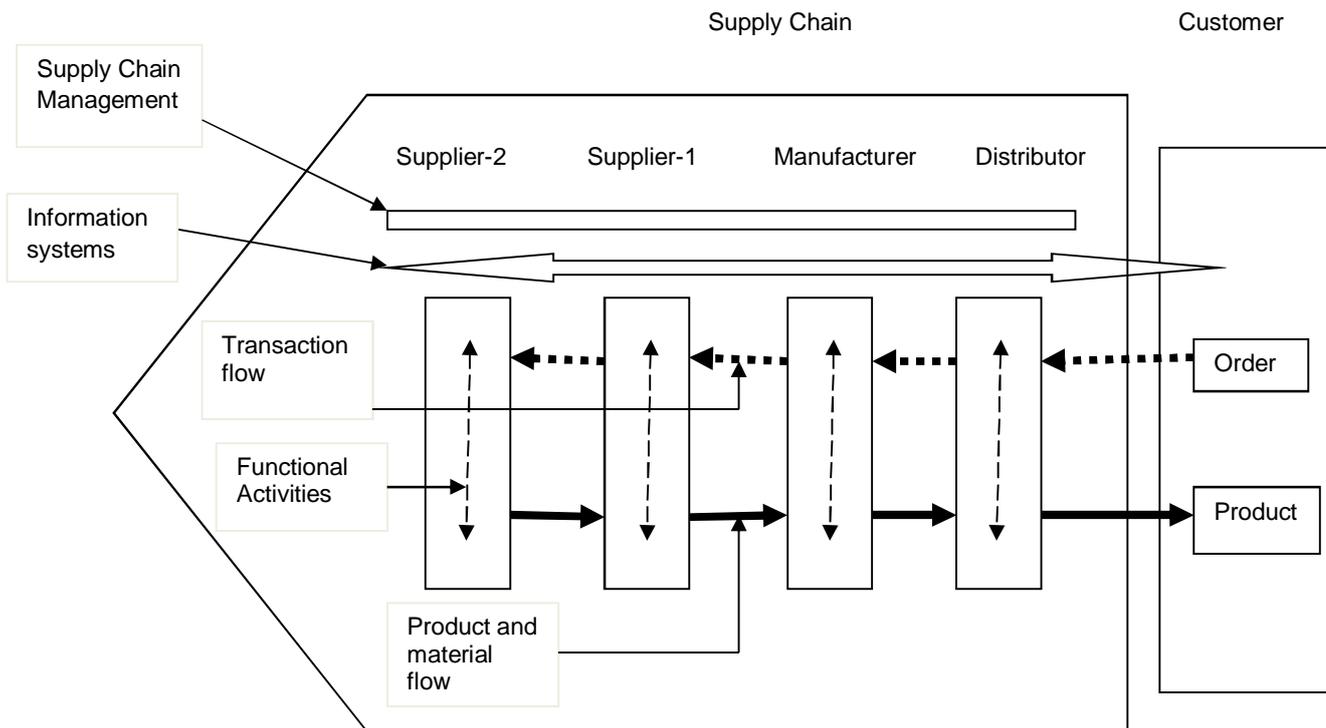


Figure 1 Supply chain model (adapted from Mouritsen et al., 2003)

Figure 1 illustrates the SC as an entire set of business processes that involves production of goods or services to the end-customers from suppliers (Mouritsen et al. 2003). The chain is triggered by the customer who places orders. These moves through successive players, such as distribution, manufacturer, and supplier-1 until the last-tier supplier as illustrated in Figure 1. Consequently, products which may be goods or services flow from the last-tier supplier until the customer as ordered. This process is governed by management who acts in two levels SC level and organizational level. Management choices include determining structure, process and as well as SC partners (Mouritsen et al. 2003). Information is a vital component of the SC and should be available to all SC partners in a bi-directional manner. Furthermore, this model illustrates the emphasis of this research that is, customer orientation as well as inter-organizational and strategic orientation. That is reflected by the decision flow from the customer until the last-tier supplier. This is the basis through which all the SC activities are done.

### **1.1.3 Information systems role**

The role and value of IT product and services or IS in business (Dewett & Jones, 2001) has received different views from researchers and practitioners. Moreover, this “has been, and is predicted to remain, one of the major research topics for IS researchers” (Schryen, 2013, p. 139). Some authors surprisingly conclude that IS do not matter (Carr, 2003). But others for instance, Sambamurthy et al., (2003) suggested that IS is crucial in enhancing business performance. Even literature which concludes that IS is crucial in business differs on how it contributes. Thus Ordanini & Rubera (2010) noted two approaches; first that IS indirectly impacts business performance through several key business features, such as, strategic agility. Second approach is that IS directly enables business performance. This study inclines to the first view that IS indirectly impacts business performance through strategic agility, a business imperative of specific interest to this research. Therefore, in defining the role of IS for strategic agility, this research considers how different IS promotes strategic agility dimensions, strategic sensitivity, strategic response and collective capabilities.

This research includes a wide range of IS that is utilized to promote various aspects of strategic agility. In addition, IS that is used in more than one organization, that is, IS that is used in SC environment also referred to as inter-organizational systems (IOS). Please note that the focus of this research is scrutinizing how these systems are currently being utilized and other potential use for strategic agility purposes. That is, how IS could add value to the organization through strategic agility reasoning. Moreover, the advances in technologies, for example, social technologies (Li and Nagel, 2011) and cloud computing means that the role of IS in business, in general, is constantly changing and thus the motivation for this research.

## **1.2 Research motivations, aims and questions**

The purpose of the research includes to increase the existing knowledge on how IS can promote strategic agility in SC. The research seeks to highlight the precise role of IT in SC for strategic agility purposes. To do so, strategic agility has to be defined as well as the roles of SC partners in promoting strategic agility needs. Moreover, Swafford et al. (2006) noted that agility research is relatively new and has received inadequate attention in the literature. Furthermore, we conducted a systematic literature review as Kitchenham et al. (2009) recommend and using Brereton et al. (2007) guide and noted there is little research which covered how IT could promote strategic agility in SC. Moreover, little empirical evidence exists in the literature to support the few proposed models (Vazquez-Bustelo et al., 2007) that addresses agility. Also, Swafford et al. (2006) argued there is no sufficient scientific input of how companies could promote agility and thus creating risks for companies trying to improve their performance. Therefore, from a practical point of view this research intends to provide academic input to how companies especially SC can make use of IT to improve strategic agility to enhance their competitiveness. Precisely the outcomes of this research includes,

1. Strategic agility taxonomy development
2. Conceptual model of strategic agility in SC
3. Contribution on defining the IS role in business with specific input on strategic agility and in SC setting
4. Proposed research design for novel IS research topics

The main research question of this research is how does IT product or service impacts strategic agility in SC? This question is tackled from different points of view with various research aims as reflected in the Table 1.

Table 1 Published articles, questions and their contribution to the research

Article Number and question(s)	Methodology	Aim	Contribution and answer
1. How does IT product or service impacts strategic agility in SC?	Conceptual-analytic research	To develop conceptual basis of the research.	Strategic agility in SC context conceptual model which provides basis of IS product and service input. IS e.g. business intelligence systems that promote strategic sensitivity are highly required for SC partners who interact with end customers. SC partners involved with product formulation needs high strategic response hence IS e.g. CAD systems. Collective capabilities are required throughout the SC and IS e.g. collaboration systems.
2. How do information systems impact strategic agility in supply chain?	Systematic literature review	To uncover past research literature and map concept-centric view of plausible future research.	Concept-centric approach adopted to draw what has been covered in the literature on IS role for strategic agility in SC setting and highlight gaps which could be addressed for future research. Gaps noted included IS impact on strategic sensitivity in SC downstream, IS impact on strategic response in SC upstream and IS impact on collective capabilities on the whole SC.
3.1 What are the business environment constructs a firm should be sensitive to? 3.2 What are the IT tools used in enhancing this sensitivity?	Conceptual-analytic research	To develop the strategic sensitivity dimension of strategic agility.	Strategic sensitivity is analyzed in depth from a strategic agility perspective. First the business environment is defined then a model is devised to highlight the main environment stakeholders which need to be sensed constantly. These include complementary products and services, new entrants and competitors. In addition, IS required to enhance strategic sensitivity, such as, data mining systems is explained and their role defined.
4.1 What are the response activities SC can engage in different environment conditions? 4.2 What is the role of IS in enhancing these response activities?	Literature and experts reviews	To develop the strategic response dimension of strategic agility.	Strategic response is critical in addressing the strategic situations encountered. From a strategic agility point of view strategic response is based on strategic sensitivity and collective capabilities and in addition IS plays a crucial supporting role. Response initiatives could be clustered into complex move, simple move and no move to depict the range and complexity of action. These clusters also relate to the environment circumstances and IS e.g. complex moves are associated with intense IS basis.
5. How do information systems promote strategic agility in supply chains?	Case studies derived from past empirical findings	To analyze past empirical findings on the topic by developing case studies based on past empirical conclusions.	IKEA and Kesko case studies are developed from past empirical findings and guided by the theoretical basis defined in preceding articles. The results include the different initiatives by the companies to promote strategic agility dimensions. IS e.g. IKEA's automated online assistant titled ask Anne and Kesko payment system were also noted in supporting the strategic agility dimensions and the SC operations.
6. How IS could be utilized to improve strategic agility in SC settings?	Case study	To develop the research by providing an empirical input.	This case highlighted the different views and perceptions of IS input to strategic agility with some business managers suggesting that IS does not matter.
7. How IS could be utilized by the IT distributor to promote strategic agility in SC settings?	Case study	To develop the research by providing an empirical input.	The value of strategic agility in changing business models i.e. emerging competitors is highlighted in this case and how IS is utilized to foster customer loyalty and thereby increase competitive advantage.

### 1.3 Relevance and contribution

The contribution to science includes evolvement of the existent literature and this dissertation confirms previous research that agility is essential virtue in a competitive environment (Tallon & Pinsonneault, 2011). Moreover, Doz & Kosonen (2008) proposed strategic agility basing on study of corporations, such as, Nokia as a key requirement. This research extends the strategic agility research to SC context. In addition the strategic agility concept is improved by development of a taxonomy basing on other past related research, for instance, Overby et al. (2006) and Sambamurthy et al. (2003). The conceptual model is an extension of strategic agility, supply chain and IS research in that it incorporates all these disciplines. The purpose of the conceptual model is to clarify how strategic agility is promoted in SC and also illustrate the IS input. In addition, strategic agility taxonomy is proposed and also required IS capabilities highlighted. This is an input to science and of interest to IS, SC and management scholars. In addition, the research results also include propositions, which can be used by other researchers to develop justifiable causal explanations.

This dissertation also inputs to practice basing on the empirical component of the research, that is, Telecommunication company case and IT distributor sector case. Also, the strategic agility conceptual model is improved basis on these empirical studies in this research. This is essential in demonstrating how the research outcomes are utilized in practice. The empirical studies help link the research to practice and a significant number of researchers, such as, Vazquez-Bustelo et al, (2007) noted as necessary on this topic. The research outcomes are of purpose to industry in the environment characterized by fast speed of change and complex nature of change (Turban et al., 2012). The results should also provide managers objective insights and practical basis for developing strategic agility and IS input.

### 1.4 Dissertation Outline

This dissertation is a compilation work comprised of seven peer-reviewed articles. In this introductory note the research topic is defined including elaborating the problem definition and importance. In addition, the gap noted in the literature which also highlights the scientific motivation of the research is also explained. The research key terms, motivation and objectives are covered. This dissertation is such that original articles are attached to the work as appendices. The rest of the chapters are as following;

- *Chapter 2:* Past related research is briefly explained in order to provide foundational basis of the research and also in highlighting the research focus.
- *Chapter 3:* The research design and methodology is elaborated in reflecting and justifying the research process. Also, the research methods used in this research are explained.
- *Chapter 4:* The results are elaborated, that includes the scientific contribution and implications to practice. Also, the summary of the articles, research limitation and recommendations for future research are included.
- *Chapter 5:* Conclusion provides a brief summary of the research.

The attached articles highlight the work that was covered in this research. The list below is the articles attached;

- Mavengere, N.B. (2013). Information Technology Role in Supply Chain's Strategic Agility, International Journal of Agile Systems and Management, Vol. 6, No. 1, p. 7-24.

- Mavengere, N., Ruohonen, M., Mäkipää, M. (2013), The Role of Information Systems in Supply Chain Strategic agility: a systematic literature review, Academy of World Finance, Banking, Management and Information Technology Conference, 22-25 July 2013, Cape Town, South Africa [invited for review for book chapter publication]
- Nicholas Mavengere (2010) Strategic Sensitivity and the Role of Information Systems: Sensing in a Turbulent Environment, Proceedings of the 8th Annual Conference on Information Science, Technology and Management, 9-11 August 2010, Murikka Institute, Tampere.
- Nicholas Mavengere (2010) Response abilities: a strategic agility requirement for supply chains, in H.W. Nicolajsen, J. Persson, L. Heeager, G. Tjørnehøj, K. Kautz, P.A. Nielsen (Eds.): Proceedings of the 33rd IRIS Seminar (Information Systems Research Seminar in Scandinavia), IRIS 2010, Rebild Bakker, 21.-24. August 2010, Rebild, Denmark, ISBN 978-87-992586-1-7 (CD). [improved paper under review at Information Resource Management Journal]
- Mavengere, N., (submitted). Strategic agility and required information systems in supply chain setting, Journal of Information Technology Cases & Applications Research
- Mavengere, N., (2013). Strategic agility and the Role of Information systems in Supply Chain: Telecommunication Industry Case Study, Proceedings of the European Conference on IS Management and Evaluation (ECIME), 12-13 September 2013, Sopot, Poland [selected as the best PhD research article and in consideration for publication in Electronic Journal of Information Systems Evaluation]
- Mavengere, N., (2013). The Role of Information Systems for Strategic Agility in Supply Chain: IT Distributor Case Study, Academic Business World International Conference, 22-24 May 2013, Nashville, USA

The dissertation author's contributions in the dissertation publications are such that he solely wrote all the articles except for the second article. In the second article, the author was the main researcher in that he designed the research process and was the main writer of the research report. The co-authors participated in the gathering and quality appraisal of the systematic literature review articles on top of the supervisory role in the research process.

## 2 PAST RELATED RESEARCH

In this section theories and concepts which relate to this study are briefly discussed. In doing so, how the theories relate to this study is noted and moreover, the motivation to pursue this research is also highlighted. There are many theories and concepts noted that relate to this study and these are chosen because they both provide the foundational basis of the research and help to illustrate the focus of the study. The past related research to be discussed in this section includes, resource based view approach, dynamic capabilities, "IT does not matter" research and flexibility concept.

### 2.1 Resource-Based View Approach

The firm's resources and the ability to effectively and efficiently utilize them have input on the competitive advantage of the company. More so, from a strategic agility point of view resources should enable and promote, for example, sensing and responding efforts. In addition, the firm's ability to sense and respond to the environment's threats and take advantage of the opportunities is deeply rooted on the resources available. Therefore, it is important to analyze the resources that are available in order to determine plausible strategic agility measures. In this research, resource based view is used as a tool to analyze the potential of a broad range of firm resources (Barney, 1991) to respond the external environment. Barney (1991, p. 101) suggested that firm resources include "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc; controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness".

Barney (1997, p. 145) noted that "resource based view is based on four basic tenets, which constitute the VRIO model: value (V), rareness (R), imitability (I), and organization support (O)". A valuable resource enables the firm to implement strategies that improve its efficiency and effectiveness (Barney (1991). Moreover, valuable resources are of more strategic importance if they are rare, that is, few or none of competitors or potential competitors have them. And firms should take note of valuable and rare resources that cannot be easily imitated by competitors and thus such resources offer competitive advantage. The valuable, rare and difficult to imitate resources should be utilized effectively in order to be sources of competitive advantage for the firm.

### 2.2 Dynamic Capabilities

Dynamic capabilities approach is an extension of resource based view in dynamic markets. Thus dynamic capabilities approach serves companies operating in a competitive characterized by continual changes, for example, new innovative products, new regulations, new competitors and new dimensions of the competition which have the constant threats or opportunities. Teece et al. (1997, p. 516) defined dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". This research takes dynamic capabilities into consideration from several points of views, for instance, the consideration of both internal and external components is taken into consideration in developing the strategic agility taxonomy.

There is debate in the literature on what exactly are dynamic capabilities and thus research such as by Wang & Ahmed (2007) on the review and research agenda on dynamic capabilities, Eisenhardt & Martin (2000) titled "dynamic capabilities: what are they?" and Winter (2003) on understating dynamic capabilities. Wang & Ahmed (2007, p. 10) suggested dynamic capabilities to relate to ways firms conducts itself in defining dynamic capabilities as "a firm's behavioral orientation to constantly integrate, reconfigure, renew

and recreate its resources and capabilities, and most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage". From this definition we note that dynamic capabilities relate to the changing environment and developing firm strengths in line with the changes in the environment. The firms' strengths are reflected by the ability to gain competitive advantage and this happens through the different response efforts.

Dynamic capabilities are embedded in processing, that is, explicit structures made up of combination of resources that can be readjusted as required by the changing environment (Wang and Ahmed, 2007). Thus capabilities refer to the firms' capacities to (re)deploy resources and (re)develop processes in integration and adapting to the environment. Eisenhardt & Martin (2000) argue that dynamic capabilities are identifiable processes which are visible, for example, product development, strategic decision making and alliances. Teece et al. (1997) suggested that processes, positions and paths available to an organization determine its competitive advantage. That is, paths available for an organization depending on the managerial and organizational process mapped by its assets position define the competitive basis of the firm. Organizational and managerial processes enable collaboration and learning is fostered in the experience. In addition, the processes should be reconfigurable due to the required transformational capabilities because of the changing nature of the environment. On defining the strategic posture of the firm Teece et al. (1997, p. 521) suggested that "the strategic posture of a firm is determined not only by its learning processes and by the coherence of its internal and external processes and incentives, but also by its specific assets".

### **2.3 "IT does not matter" - research**

Nicholas Carr wrote a widely and deeply debated article titled IT doesn't matter in 2003. He noted that IT is currently the backbone of commerce. But the core functions of IT namely data storage, data processing, and data transportation is now available to all and thus not the basis for acquiring competitive advantage. The value of IT and availability means that all the players have it and this means that there are becoming costs of doing business, that is, commodity factors of production with no strategic value. Figure 2 below illustrates the other services, these are, railways and electric power, that were commoditized and how IT is following the same trajectory. Providing the example of railways and electric power, illustrated in Figure 2, Carr (2003) argued that no company today can function without electricity and even a brief lapse can have devastating effects. But nevertheless, no company bases its strategy on electricity. This is the same argument for IT that it's required for operations but no longer offers strategic value.

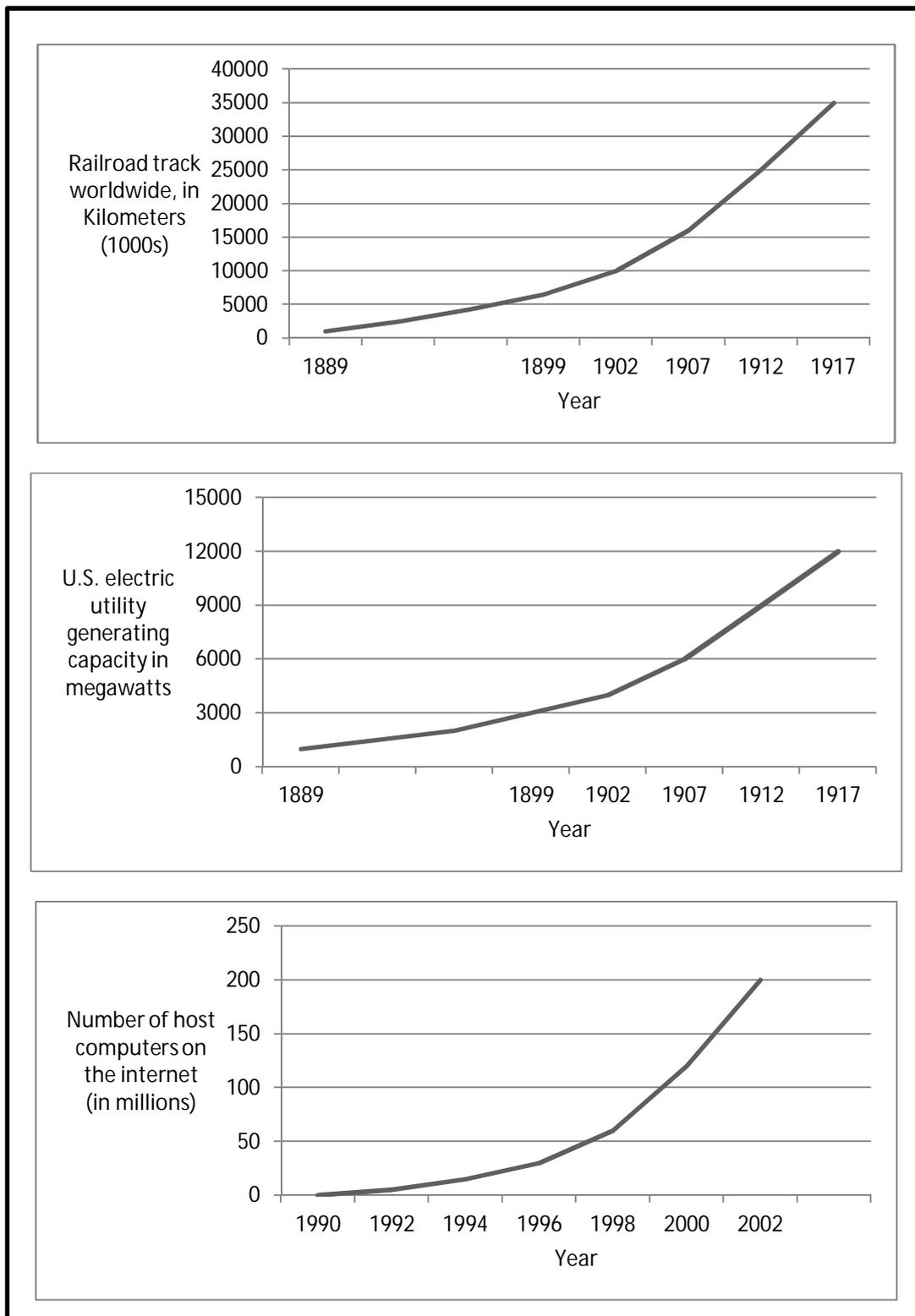


Figure 2 Trajectory of railways, electric power and information technology (adopted from Carr, 2003)

However, Sambamurthy et al. (2003) argue that IT plays a crucial role in enhancing business performance and thus of strategic value. Researchers also differ in arriving to this conclusion, for example, Ordanini & Rubera (2010) noted that there are two approaches first, that IT impacts directly business performance and second that it impacts indirectly. Specifically this research seeks to highlight IT task in enhancing strategic agility, which is a business imperative especially in a competitive environment.

## 2.4 Flexibility concept

Flexibility concept in organizational context is widely confused with agility to the extent that some scholars argue that there is no difference. This research seeks to differ from this view, although appreciating the fact that flexibility is closely related to agility concept as will be explained in this sub-section. This research shares the same view as Conboy (2009) who suggested that flexibility concept underlies to the agility concept.

BusinessDictionary.com defines flexible system as “the ability of a system, such as a manufacturing process, to cost effectively vary its output within a certain range and given timeframe”. This definition notes the time and quantity limits set in being flexible. Thus in organizational context flexibility is planned to a certain defined extent which relates to sustainability of the flexibility feature. The part which relates to agility on the definition is ability to vary, that is, to be capable to adapt to change or embrace change. Conboy (2009, p. 336) defined flexibility in information systems design method context which can be adopted to the organizational context as the ability of an organization “to create change, or proactively, reactively, or inherently embrace change in a timely manner, through its internal components and relationships with its environment.” This comprehensive definition considers responsive measures meant to influence change in attaining flexibility. Moreover, the definition includes the internal and external elements in the flexibility agenda. In addition, the definition notes the important of flexibility in a defined timeframe.

There are several authors who attempt to distinguish flexibility and agility. Conboy (2009) suggested several distinctions between flexibility and agility as follows. Sharafi and Zhang (1999) quoted from Conboy (2009) suggested that flexibility and speed are two components of agility. Another distinction between agility and flexibility is in terms of limit of the change process, that is, for agility the assumption is that the change is continuous, and embracing it is an ongoing activity whereas for flexibility change is within a defined range. As in this research, agility strongly includes knowledge and learning in the literature and this is not the case for flexibility concept. Some consider agility in organizational context to mean to apply flexibility in different functions of the organization.

An example to illustrate flexibility concept is when a store which sells winter clothing, for example PRISMA, orders extra snow boots during the winter season anticipating high levels of snow. Whether the snow levels are high leading to high demand of the snow boots or not the store is prepared for an influx of customers in need of the snow boots. Contrary, agility concept relates to an unexpected event, for instance, the earthquake and tsunami that struck Japan in March of 2011, as the event was largely unpredicted, stores would not have ordered extra supplies in advance. Thus, the test of the store’s agility is ability to meet demand, for example, how fast its vendors will deliver more supplies (<http://smallbusiness.chron.com>). These examples illustrates the flexibility includes changes within defined spectrum of anticipated events but agility is ability to make some changes in line with unexpected external surprises. Flexibility is much more relevant in stable environment in which the business forecast is accurate. Agility is very important in turbulent business environment in which market visibility is limited and unpredictable strategic circumstances are frequent.

### 3 RESEARCH DESIGN AND METHODOLOGY

The research topic is relatively new and does not yet have clear research tradition. Because of that the research design, illustrated in Figure 3, is a scientific contribution in that it proposes a research approach to novel research topics. The three main phases of this research, illustrated in Figure 3, are preliminary research, minor research and main research. All these three phases utilize a qualitative research approach in an attempt to relate to the existent social phenomenon and address the research question which is based on current competitive industry challenges. Conboy et al. (2012, p. 113) noted that "IS qualitative research aims to empirically investigate a variety of phenomena concerning IS through qualitative data from a variety of sources, such as interviews, observations, design efforts, interventions, and archival materials. Qualitative research methods have been used widely in prior IS research and there is a rich portfolio of knowledge available to support qualitative IS research". In addition, qualitative research approach is used because the research area is relatively new (Swafford et al. 2006) and there is not much in the literature on the study topic. The three phases of this research, preliminary, minor and major research shown in Figure 3 are iterative and interactive.

The first phase, preliminary research is an investigation of the literature on what has been covered, existent gaps and definition of the research themes, these are, strategic agility, role of IS and SC. Four papers were written in this first phase, paper 1, 2, 3 and 4 on the list of attached publications. Because the research themes are relatively new, paper 1 is necessary for developing a strong theoretical foundation of the research. There are many differing views on the research themes although some views are related and therefore, paper 1 defined the research themes as utilized in this research. In addition, conceptual models for the research are developed in paper 1. Moreover, the literature review is done in uncovering the gaps in the literature and thus a more focused and thorough review referred to as systematic literature review (Kitchenham et al. 2009) was conducted leading to paper 2. The motivation for conducting a systematic literature review is that there was no existent purely review study on the topic and as advised by Järvinen (2008) there is room for such a research. Paper 3 and 4 are in depth examination of strategic sensitivity and strategic response.

The second phase, minor research included making use of existent empirical literature to develop two case studies in paper 5. This is essential in motivating the study and relating it to industry. In this phase, research instruments, such as, interview protocol and guide and open-ended questionnaire were also developed and reviewed in a workshop with scholars and practitioners at the University of Tampere.

The main research, phase 3, is made up of two case studies. This is so in order to enable cross referencing between the two cases in disseminating the study results. The cases were chosen from competitive industries, telecommunication and IT industries which fit the study environment. Moreover, the case companies both service and product providers which offered broad spectrum to the research. Below is an explanation of the different methodologies used in the three phases.

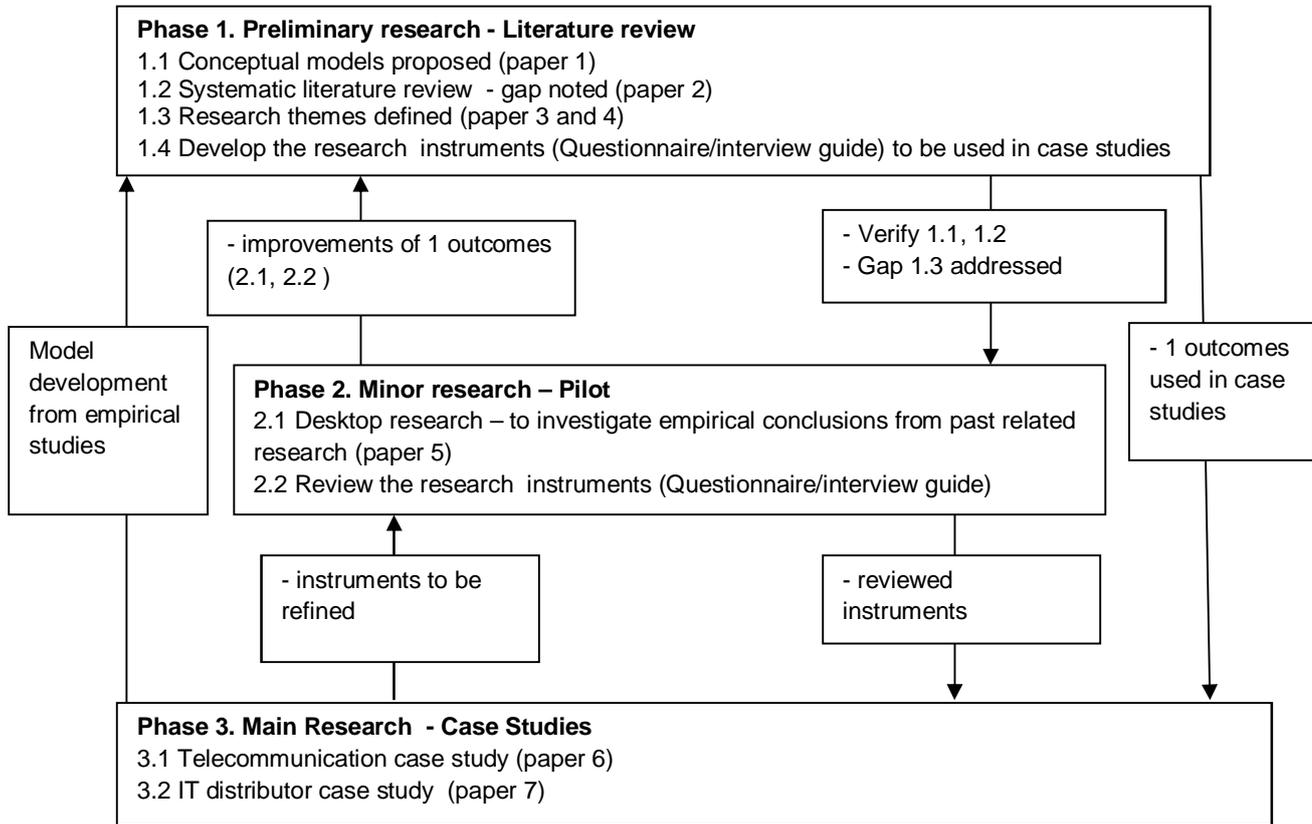


Figure 3 Research design

### 3.1 Conceptual analytic research methodology

The conceptual analytic research is used in paper 1, in the list of published articles and is done as defined by Järvinen (2012). There are different sources of knowledge in developing a theory, model or framework. For instance, empirical data could be analyzed to develop a theory and this approach is called grounded theory. Another way of generating theory is through literature review that is, making use of past research to generate knowledge. This is the procedure which was used in this research and Järvinen (2012) conceptual analytic research guidelines were utilized. The literature review is a significant aspect of the research in which strategic agility is defined, required IS capabilities highlighted, conceptual model developed. This is because strategic agility is a relatively new topic and there is a need to create a conceptual model to build a strong theoretical foundation of the concept. In addition, the model would aid industry in promoting their strategic agility concerns. A significant number of researchers such as Swafford et al. (2006) have argued the need for conceptual models that address different aspects of agility. Therefore, this research also seeks to develop models useful in aiding practitioners make use of IS to improve their strategic agility abilities.

The conceptual analytic research is a theoretical research and thus like Järvinen (2012) the view of theory by Gregor (2002, p. 15) is adopted, who suggested “theory answers a human need to make sense of the world and to accumulate a body of knowledge that will aid in understanding, explaining and predicting the things we see around us, as well as providing a basis for action in the real world”. This research generates a body of knowledge from the conceptual analytic research to explain how strategic agility relates to supply chain and thereby define the role of IS in the real world. In doing so this relationship of strategic agility, SC and IS role is explained in addition proposals are forwarded to gain competitive advantage in a competitive business environment.

Järvinen (2012, p. 19) argued that “a theory should include

- (1) a boundary that describes the domain of interest
- (2) key constructs within that domain
- (3) the values those can take one and
- (4) the relationship among key constructs”.

In this research the boundary is defined from the business environment which illustrates where the research is most relevant, that is, dynamic and competitive environment, for example, telecommunication industry. Constructs are the building blocks in theory formulation and in this research the dimensions of strategic agility which are strategic sensitivity, strategic response and collective capabilities are part of the key constructs as well as SC and IS role.

### **3.2 Systematic Literature review methodology**

Webster & Watson (2002) argued need for a proper literature review to any academic research. Moreover, they noted that literature review has different roles, for example, enables theory development and reveals areas where research is needed. In this research, both these roles of literature review have been incorporated because the research domain is a relatively new. The sub-section above titled conceptual analytic research methodology, explains how the use of literature review was utilized in this research for the purpose of theory development. In this sub-section we explain how literature review was utilized to reveal areas where research is needed.

There are different ways of conducting a literature review depending with the purpose, such as, “a theoretical background for subsequent research; learning the breadth of research on a topic of interest; or answering practical questions by understanding what existing research has to say on the matter” (Okoli & Schabram, 2010, p. 3). Thus a literature review could be part of an article or thesis as an introductory section (for example see Section 2) and a review could also be standalone research, that is, purely literature review research, this is paper 2 in the list of publications. Okoli & Schabram (2010) in explaining the need for systematic literature review guidelines for IS research explained the different types or ways of reviewing literature and the only difference between all the literature reviews (purely SLR paper, literature review as part of paper and literature review as part of PhD thesis) is scope and rigor.

A stand-alone systematic literature review is conducted because there is no prior systematic literature research on the topic and thus the need for one to understand what has been covered in the past in order to highlight and propose required future research. Järvinen (2008) suggested that before conducting a detailed purely literature review research there is a need to ascertain if there is no such a research on the topic. “A systematic review is a means of evaluating and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest.” (Kitchenham, 2004, pg IV).

A rigorous stand-alone literature review, according to Fink’s (2005) quoted from Okoli & Schabram, (2010), has four essential factors namely:

1. Systematic in following a methodological approach,
2. Explicit in explaining the procedures by which it was conducted,
3. Comprehensive in its scope of including all relevant material, and hence
4. Reproducible by others who would follow the same approach in reviewing the topic.

The systematic literature review component of this research, paper 2 followed a systematic methodological guidelines defined by Okoli & Schabram, (2010). The guidelines have explicit steps which are explained in paper 2. The systematic literature review is comprehensive in covering the articles that relates to this

research, although the articles precise to the topic are limited due to the newness of the research area. The main steps in conducting the review are;

- Planning – includes defining purpose of the review as well as review protocol and training.
- Selection – involves searching the literature and practical screening to select the articles which fits best the research.
- Extraction – gathering data from the articles and this includes quality appraisal of the articles and then data is collected from the screened articles.
- Execution – the collected data is analyzed to derive findings and writing the report.

### **3.3 Desktop research - Review of Practice**

Paper 3 in the list of published articles is a desktop research which makes use of empirical conclusions from past related research to draw case studies of two companies operating in competitive industries. Desktop research is used for developing the research with empirical conclusions from past related research. These case studies are used both for learning about the case and for drawing out empirical evidence to the proposed conceptual model. The desktop research drew data from mainly past scientific articles as well as company website, reports and blogs and online news. Desktop research of review of past empirical literature is essential to link the research with facts established from practice. The advantage of the desktop research is quick access to data but the disadvantage is that the data is secondary data which needs thorough analysis to address the research concerns. The motivation of engaging desktop research (based on past empirical studies) as part of the PhD research is a way of preparing before starting primary empirical research.

### **3.4 Case study methodology**

Yin (2009) argued that when a research problem is of contemporary nature with little or no control and requires extensive in-depth description of a social phenomenon case study could be the relevant research methodology. However the strengths and limitations of case study should be taken into consideration. Hence, the motivation of engaging case studies in this research to intensively uncover the research themes in line with the dynamic business environment. Flyvbjerg (2011) analysed the case study methodology and highlighted what he termed misunderstanding, that is, wrong interpretations from the methodology. The misunderstandings are derived even from the wrong ways or inaccurate description of what a case study is. Although case study definitions are partly incorrect or wholly incorrect for some, there are some correct points, for example, case study is a study of individual units with set boundaries, contains detailed or in depth analysis of the unit, cases evolve with time, can be used in preliminary stages of research as well as theory building and testing. The five misunderstandings noted by Flyvbjerg (2011) are;

- General, theoretical knowledge is more valuable than concrete case knowledge.
- One cannot generalize on the basis of an individual case; therefore, the case study cannot contribute to scientific development.
- The case study is most useful for generating hypotheses; that is, in the first stage of a total research process, while other methods are more suitable for hypotheses testing and theory building.
- The case study contains a bias toward verification, that is, a tendency to confirm the researcher's preconceived notions.
- It is often difficult to summarize and develop general propositions and theories on the basis of specific case studies.

In view of these misunderstanding, case study definition is derived from Yin (2009, p. 18) who noted the scope, data collection and analysis for case studies in two fold technical definitions, these are merged into one below;

“A case study is an inquiry that

- investigates a contemporary phenomenon in depth and within its real-life context, especially when
- the boundaries between the phenomenon and context are not clearly evident
- copes with the technically distinctive situation in which there will be many more variables of interest than data points and as one result
- relies on multiple sources of evidence, with data needing to converge in a triangulation fashion and as another result
- benefits from the prior development of theoretical propositions to guide data collection and analysis”.

Case studies research could be done from different perspectives and each perspective has to follow certain principles in order to meet research objectives. Barton Cunningham (1997) suggested intensive case studies, comparative studies and action research cases, illustrated in Table 2 as possible options in doing case studies. In this research both the intensive and comparative case types are utilized. The intensive case type is used in developing the individual cases which were published, article 6 and 7. And in this dissertation the two cases are jointly analyzed, that is comparative case type.

Table 2 Different study principles for different types of cases (Barton Cunningham, 1997)

	Type of case study		
	Intensive cases	Comparative cases	Action cases
<b>Purpose</b>	To develop theory from intensive exploration	To develop concepts based on case comparisons	To develop concepts which help facilitate the process of change
<b>Assumption</b>	Creativity through comparison with existing theories	Comparison of cases leads to more useful theory	Theory emerges in the process of changing
<b>Example</b>	Dalton (1959)	Eisenhardt (1989)	Trist (1951)
<b>Situation</b>	Usually evolves out of a researcher's intensive experience with culture or organization	Usually concepts are developed from one case compared with another case	Developing theory to assist practices and future social science
<b>Types</b>	Narratives Tabulation Explanatory Interpretative	Case comparisons Case survey Interpretative comparisons	Diagnostic A.R. Experimental A.R.

Siggelkow (2007) argued the need to choose a case that allows one to gain certain insights on the topic under study and thus the choice of the telecommunication and IT distributor cases. Furthermore, he suggested that there are at least three uses of case research namely motivation, inspiration and illustration. Cases are used for motivation to generate interest to the research question. Because of the rich case data, cases can be for inspiration by drawing theoretical insights. On the other hand, cases could be used for illustration in making a conceptual contribution. In this study cases were chosen and used for all these aspects, that is, motivation, inspiration and illustration. The telecommunication industry case is drawn from

a very dynamic and competitive area and the case company was undergoing transformation as a measure to survive. The IT distributor case offered insights of a changing business environment due to factors like globalization and advances in technology. In the case studies data collected from company documents, reports, website and interviews were utilized. The case study protocol is as illustrated in Appendix 3.

Eisenhardt (1989) proposed a process of building theories from case study research which was used as a key guide in the empirical component of this research. Table 3 illustrates the process of building theory from case study and also the steps which were taken in this research.

Table 3 Process of building theory from case study research (adapted from Eisenhardt, 1989)

Step	Activity	Reason	Events in this research
Getting started	Definition of research question Possibly a priori constructs	Focuses efforts Provides better grounding of construct measures	Articles 1,2,3,4 written in preparations
Selecting cases	Neither theory nor hypotheses Specified population  Theoretical, not random, sampling	Retains theoretical flexibility Constrains extraneous variation and sharpens external validity Focuses efforts on theoretically useful cases-i.e., those that replicate or extend theory by filling conceptual categories	Net Power and TechnoDeal cases selected as they fit the research aspirations e.g. both in dynamic and competitive business space.
Crafting instruments and protocols	Multiple data collection methods  Qualitative and quantitative data combined Multiple investigators	Strengthens grounding of theory by triangulation of evidence Synergistic view of evidence Fosters divergent perspectives and strengthens grounding	Research instruments developed in preliminary research phase and further developed in the minor research phase.
Entering the field	Overlap data collection and analysis, including field notes  Flexible and opportunistic data collection methods	Speeds analyses and reveals helpful adjustments to data collection Allows investigators to take advantage of emergent themes and unique case fields	Data collection, coding and analysis done jointly.
Analyzing data	Within-case analysis  Cross-case pattern search using divergent techniques	Gains familiarity with data and preliminary theory generation Forces investigators to look beyond initial impressions and see evidence thru multiple lenses	Each case was done separately and articles published (6 and 7). Cross-case analysis done in this thesis.
Shaping hypothesis	Iterative tabulation of evidence for each construct Replication, not sampling, logic across cases Search evidence for "why" behind relationships	Sharpens construct definition, validity, and measurability Confirms, extends, and sharpens theory Builds internal validity	The strategic agility taxonomy, strategic agility in SC and role of IS model were constantly developed iteratively using both literature and data gathered.
Enfolding literature	Comparison with conflicting literature  Comparison with similar literature	Builds internal validity, raises theoretical level, and sharpens construct definitions Sharpens generalizability, improves construct definition, and raises theoretical level	Related literature, such as, Doz & Kosonen (2008) and Carr (2003) were used in comparison.

Reaching closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small	The cases presented knowledge to a saturation extent in developing the strategic agility taxonomy and models proposed.
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Eisenhardt & Graebner (2007, p. 28) noted that “as research moves away from everyday phenomena such as work practices to intermittent and strategic phenomena such as acquisitions and strategic decision making, interviews often become the primary data source”. Thus, interviews were mainly used as source of data in the case studies in this research. Interviews were conducted in the two case studies. The interviews were semi-structured and the questions which were used as a guide to the interviews are as listed in Appendix 1, 2 and 4. Moreover, interviews offer rich empirical data which covers historical accounts, current issues and future foreseen trends. However, interview could offer biased data which is derived from the views of the interviews. This could be reduced by having a diverse list of interviewees. For instance in this research, interviewees were numerous, from different functions and had diverse experience and views. Moreover, this research included documents, for example, internet news, company website and publications as source of case data and thus enabled triangulation in verifying the gathered data.

### 3.5 Data analysis - Content data analysis

Content data analysis is the main data analysis technique used in this research. Content analysis is a structured research tool for studying recorded communications and used for deriving meaning and relationships. In this research, this technique is used to analyze data from interviews and documents. Neuendorf (2002, p. 10) defined content analysis as “a summarizing, quantitative analysis of messages that relies on the scientific method (including attention to objectivity, inter-subjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented”.

Hsieh & Shanon (2005) suggested that there are three types of content analysis namely, conventional content analysis, directed content analysis and summative content analysis. Table 4 illustrates the different coding scheme derivations from the proposed content analysis approaches.

Table 4 Major coding differences among three approaches to content analysis (Hsieh and Shanon, 2005)

Type of Content Analysis	Study Starts With	Timing of Defining Codes or Keywords	Source of Codes or Keywords
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Keywords are identified before and during data analysis	Keywords are derived from interest of researchers or review of literature

Conventional content analysis is used usually on a relatively new topic with little or no existent theoretical basis. Thus researchers derive categories from gathered data, for example, data collected from open ended interviews. In addition interviews are unstructured and data analysis includes reading several times all the data to try to derive meaning. Observation is also an important technique in conventional content analysis as it also provides insights to a new phenomenon. The second content data analysis technique termed directed content analysis was utilized in this research. Directed content analysis starts with theory, where the codes are derived. This is as illustrated in Appendix 1 and 2 where the research questions were derived from the developed meaning of strategic agility and the perceived role of IS for strategic agility. The third content analysis approach technique summative content analysis involves "identifying and quantifying certain words or content in text with the purpose of understanding the contextual use of the words or content. This quantification is an attempt not to infer meaning but, rather, to explore usage" (Hsieh and Shanon, 2005, p. 1283).

## 4 RESULTS

The results of the PhD study are derived from the separate related studies which make up the PhD dissertation as illustrated in the research design. The summary of these studies are illustrated in Sub-section 4.3. Before that the contribution to science and practice is highlighted in Sub-sections 4.1 and 4.2 respectively. Also, Sub-section 4.4 highlights the research limitations and recommendations for future research. The PhD study is made up of three phases shown in Table 5.

Table 5 PhD research phases, aims and objectives and outcomes

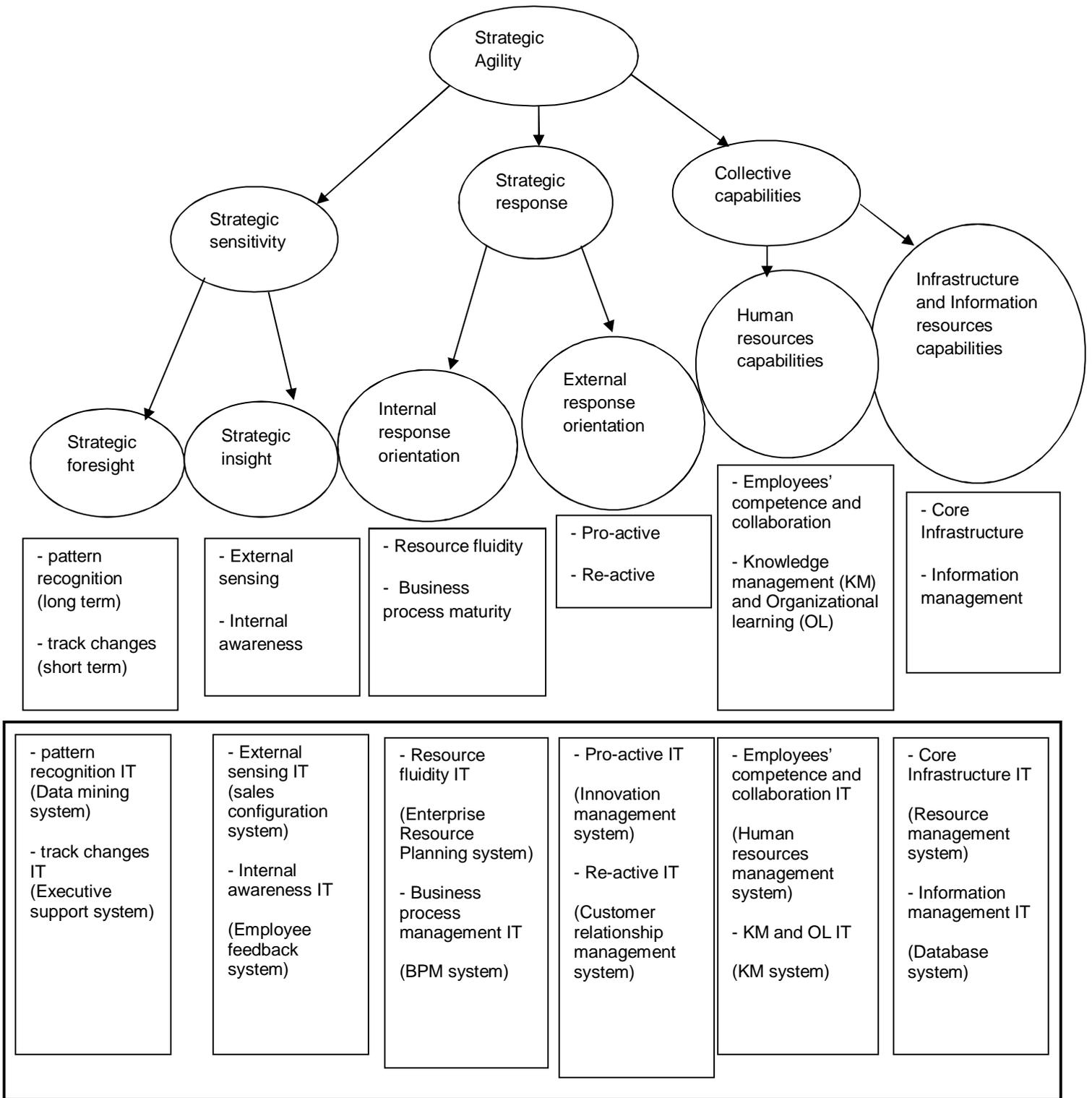
PhD Phase	Aims and Objectives	Related paper (s) from list of publications	Outcomes
1 Preliminary research	To uncover literature on the topic and note the research gap as well as develop conceptual models. Develop the research instruments (interview guide) to be used in minor and major research.	1, 2,3,4	Four studies; first a conceptual analytic research, second a systematic literature review, third and fourth paper which are definitions of research themes.
2 Minor research	Review the research instruments (interview guide) used in main research, as well as, review of the past empirical research on the topic by developing and making use of case studies.	5	Two case studies of IKEA and Kesko, derived from past empirical studies
3 Major research	Empirical input to the research.	6,7	Two case studies, a Telecommunication company and IT distribution company

The contribution of the research is highlighted as:

- Contribution to Science
  - ✓ Development of conceptual models related to agility which has been advocated for in the literature, for example by Swafford et al. (2006)
  - ✓ Contributing in defining the role of IS in business in general by specifically reflecting on the role of IS in enhancing strategic agility in SCs. Schryen (2013) noted this as a major IS research topic both now and in the future.
  - ✓ The research topic is relatively new and does not yet have clear research tradition. Because of that the thesis contains additional contribution related to the research approach (Chapter 3)
- Contribution to practice – implications to practice
  - ✓ Telecommunication industry case
  - ✓ IT distributor case
  - ✓ Cross case analysis

## **4.1 Contribution to science**

After noting the various differing but related views on strategic agility in literature, strategic agility taxonomy, Figure 4, is developed as the basis and context for this research. The developed taxonomy is part of the conceptual basis of this research. Webster & Watson (2002) suggested that taxonomies play a role in describing the relationships between the categories. Thus, the taxonomy relates the different dimensions and sub-dimensions of strategic agility. The taxonomy was developed taking into consideration strategic agility literature, such as, Doz & Kosonen (2008), Overby et al. (2006) and Sambamurthy et al. (2003). Nickerson et al. (2013, p. 336) suggested that “taxonomies play an important role in research and management because the classification of objects helps researchers and practitioners understand and analyze complex domains”.



Required IS Capabilities and examples of IS used

Figure 4 Taxonomy of strategic agility and the required IS capabilities (Article 5)

Strategic sensitivity includes strategic foresight and strategic insight as shown in Figure 4. Strategic foresight is appreciation, learning and anticipation of unveiling environment trends (Inkinen & Kaivo-oja, 2009). Strategic foresight is focus on the future both the long term, that is, pattern recognition and short term, that

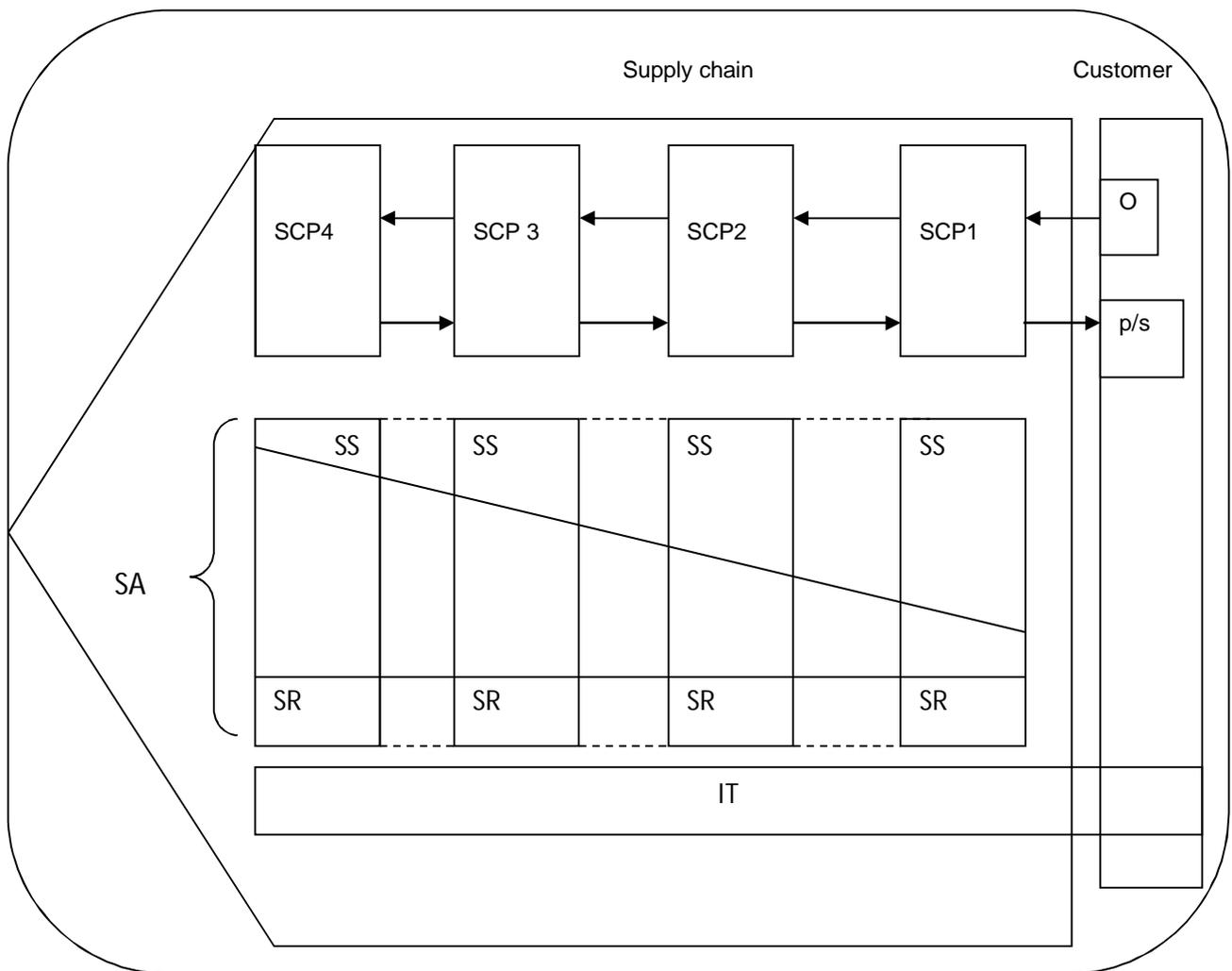
is, track changes. IS that promote strategic foresight, for example in pattern recognition are data mining systems and in tracking changes are executive support systems. Strategic insight has a present focus and involves drawing knowledge from complex strategic situations as they uncover and analyzing to be able to benefit from the situation (Doz & Kosonen, 2008). In an organizational context strategic insight has to be both outside view (external sensing) and inside view (internal awareness). Internal awareness is essential for highlighting the organization strengths and weaknesses in light of the environment defined in external sensing. Point of Sale (POS) system is an example of IS that aids strategic sensitivity by external sensing and from internal awareness perspective employee feedback systems are of value as shown in Figure 4.

In line with the unfolding strategic situation, companies need to strategically respond in order to gain competitive advantage. The response efforts have to be viewed from an internal point of view and as well as from an external point of view as illustrated in Figure 4. This is needed for exhaustive analysis of the response in that different analytical scopes are used. Considering an external response orientation a response could either be pro-active and re-active to the business environment. Re-active is an effort to respond to the dynamic environment requirements and on the other hand, pro-active is an attempt to drive the market. IS that can promote external response orientation are, for example, Innovation management system for pro-active and Customer relationship management system for re-active aspects. Internal response orientation is an internal analysis of the response effort and that would be made up of resource fluidity and business process maturity. Resource fluidity involves the configuration and redeployment of resources timely after consideration of the internal capabilities and external environment requirements (Tallon & Pinsonneault, 2011). Business process maturity is the degree to which work activities are considered effective, controllable and predictable. Enterprise Resource Planning system could aid in promoting resource fluidity and business process management systems are useful for attaining required business process maturity.

All the other essential capabilities for strategic agility not classified in strategic sensitivity and strategic response make up the collective capabilities dimension, illustrated in Figure 4. Human resources capabilities and infrastructure and information resources capabilities are the main elements of collective capabilities dimension. Human resources capability is a measure of the ability of the workforce to effectively and efficiently do their duties. IS could play a significant role in promoting human resource capabilities, for example, expert systems could help in fast and effective decision making. Knowledge management and organizational learning are other elements of human resources capabilities sub-dimension. Knowledge management includes knowledge acquisition, indexing, filtering and linking, distribution and application (Alvali & Leidner, 2001). Organizational learning is constantly important especially nowadays where organizations should continuously adapt in line with environment demands. Knowledge management (Baldi and Heier, 2009) and organizational learning could be promoted by Knowledge management systems. An organization with the required infrastructure and information resources for its core functions is able to better carry out its functions. Information management capabilities are important for an organization to adequately utilize its information resource. Resource management systems promote core infrastructure and information management in a competitive business environment.

New model of strategic agility is developed as advocated for in the literature (Swafford et al., 2006). This is done after noting insufficient academic literature which covered the research topic, as evidenced from the systematic literature review, as elaborated in Article 2. Therefore, it is important to develop a model which covers the gap noted of insufficient scientific literature on strategic agility. Figure 5 illustrates the strategic agility in SC model. This model addresses strategic agility in SC context and there is related past research, for example, Christopher (2000) but the past research did not cover strategic agility as illustrated in the taxonomy above and thus lacking some of the integral elements. This is also due to the constantly changing business environment.

**Business Environment**



**Key**

SA	strategic agility	SS	strategic sensitivity	SR	strategic response
CC	collective capabilities	O	order	IT	information technology
SCP	supply chain partner	p/s	product / service		

Figure 5 Strategic agility in supply chain conceptual model (Article 1)

Figure 5 is the conceptual model of key features of strategic agility in a supply chain context. The successive partners in the supply chain from downstream, for instance, could be retailer, wholesaler, distribution, manufacturer, and supplier-1 until the last-tier supplier. First it is important to note that the proposed strategic agility structure of each supply chain partner is demonstrated by the rectangle underneath the supply chain partners. Strategic agility is of value for both SC and individual SC participants. However, as shown in Figure 5, the strategic agility of the organizations in a SC are related depending on the role of each participant and this is so to maximize the benefits of collaborating as a chain. Hence, the SC participants should have their own strategic agility plan but however it should relate to the SC strategic agility plan. Therefore, there are two levels of analysis i.e. microscopic (analysis from SC participants' level) and macroscopic (analysis from whole chain perspective).

Strategic agility is composed of strategic sensitivity, strategic response and collective capabilities. Collective capabilities are of the same dimension in all the supply chain partners. Strategic sensitivity and strategic response are of varying dimensions depending on the role of the partner in the chain. IT provide the foundation of strategic agility especially in a SC context and it extends from the SC to the customer, for instance through electronic commerce. Collective capabilities are shown as the base of all the other strategic agility elements in Figure 5, because it is the basis of the other strategic agility elements. The same high degree or extent of collective capabilities is required from all the partners in the chain because it is equally important for all the partners.

There is a gradual increase of strategic sensitivity from the SC upstream to the downstream, that is, from suppliers to customers in Figure 5. This is because the upstream SC partners are the ones who most relate with the customers. The assumption is that the SC is customer oriented. That is all the SC operations are focused on meeting the customer requirements. And these requirements are dynamic hence the need for strategic sensitivity to capture the changes in customer taste. This is supported by Sambamurthy et al. (2003) who argued that customers serve three important roles; source of innovation ideas, co-creator of design and development of innovation products and services, and test-user of the products and services.

After sensing the environment, for example, customer taste through “strategic sensitivity” the chain needs to respond. Strategic response is gradually increasing from the downstream to the upstream of the SC, that is, from the customer to the suppliers in Figure 5. The assumption is that the downstream of the chain is more involved with the production of products and services. Hence, there is a need for strength or ability to quickly change the products or services as demanded by the environment. Though the customers are significant actors in analyzing the environment it is important to stress that there are other environment pressures such as global economy and competition, ethical issues and technological innovation and obsolescence. Furthermore, Porter (2008) suggested that competition is from rivalry competitors as well as from customers, suppliers, potential entrants and substitute products. Moreover, technological innovation can also be a strategic response by the SC. It is also important to stress that too much emphasis on customers only in analyzing the business environment could lead to disruption as elaborated by Christensen (Tidd et al., 2005). This is about changes brought about by emerging players in the industry through, for instance, new technologies thus toppling the industry leaders who have an advanced way of operating and fails to make the transition. The advanced way of operating includes focusing on customers and understanding their requirements and developing innovations as defined by the market.

The model, Figure 5, incorporates the business environment because it is an important factor when examining strategic agility of a SC. The business environment or business pressures include powerful customers, information overload, compliance with government regulations and deregulations, changing workforce, need for real-time operations and social responsibility. These are the factors which the SC needs to be sensitive to and be able to respond in order to gain competitive advantage or survive.

This research is of interest to IS, SC and business strategy scholars. IS scholars are constantly engaged in research which seeks to address and relate to the business environment, for example, in line with engaged scholarship research proposed by Van de Ven (2007). This research takes this view as it makes an effort to address IS input in business specifically taking the strategic agility view point. SC scholars taking a management perspective would also be interested in the SC component of the research and the proposed value derived from IS and strategic agility. This is also the same as business strategy scholars, as this research considers strategy to be fundamental in all the organizational aspects of agility, response and sensing the environment. Because of the rapid changes in a high speed of the environment (please read more about this in Article 3) strategy needs to be incorporated in agility and thus strategic agility, in response and thus strategic response and in sensing the environment and thus strategic sensitivity. This is also necessary due to the increasing complexity of the business environment due to, for example, technology innovation and obsolescence, globalization and information overload.

- *Role of IS for strategic agility*

The role of IS in business in general has received mixed views. However all the different opinions agreed on the fact that IS application in business is required but its value is viewed differently. Carr (2003) suggested that “IT does not matter” meaning that IS is now a commodity just like electricity in which every business competitor has it and has lost its strategic importance. Thus he suggested that management should spend less on IS, follow and not lead on IS investments because of high risk of failure due to rapid obsolescence and to focus on vulnerabilities, not opportunities. This generated a broad and intense debate among the IS research community.

In this study the role of IS in business has been taken into context considering the strategic agility dimensions, strategic sensitivity, strategic response and collective capabilities. IS plays a crucial role of strategic value in promoting each of these dimensions. However, as noted by Overby et al. (2006) IS can also hinder strategic agility, for instance, monolithic and incompatible IS could hinder data access and thus limiting sensitivity and thus affecting the response efforts. Below is an explanation of IS role for each of the strategic agility dimensions noted in this study both from literature and in the empirical component.

There are some aspects of strategic sensitivity which are mainly done by IS, for example data gathering especially at a global scale. The telecommunication company, Net Power noted that they make use of an outsourced company for data gathering. The company collects data about products, services, competitors, suppliers and customers, that is basically all the information relevant to the competition. And by making use of an outsourced company, that company is making use of experts reflecting how much they value the exercise. However, when the company has the data they analyze it and disseminate it to all relevant decision making bodies. Business intelligence systems are useful for analyzing data gathered and also aids in forecasting as well as map past and present circumstances. This is important for holistic view to strategic sensitivity that is considering the past, present and future circumstances which defines the competitive environment. Other ISs useful for strategic sensitivity include data mining systems for business pattern recognition, sales configuration systems for gathering data from customers and employee feedback systems for internal awareness (Article 1).

Depending with the response efforts IS could be used in different capacities for strategic response. For instance, the response efforts could be classified in three categories namely no move, simple move and complex move (Overby et al., 2006). IS play differing roles in these different response categories. For example, no move means a calculated inactivity comprised of planning and IS that enhance effective decision making, such as, executive IS are useful in this category. Simple move, such as, increase or decrease in price or production could be aided by IS, for example, in a nation or regional wide company prices can be easily and quickly adjusted at all the companies by making use of IS, such as, extranet. Another example of simple move is when Bayern Munich Football Club won the 2013 European football champion league the demand of the team shirt of the scorer, Arjen Robben was high and Bayern Munich Football Club had to increase production and sold a significant amount online. IS are much more required in a complex move which required related efforts from different stakeholders. And thus IS, for example, enterprise resource planning systems would enable coordinated efforts by different company departments in making a complex move.

Collective capabilities, such as, human resources competences and collaboration are strongly influenced by how well the ISs are deployed and managed. For example, e-learning could offer a global company a channel to train employees in different parts of the world quickly and at low cost and thus enhancing employee competences. Moreover, social technologies and networks promote interaction which would enhance collaboration (Li and Nagel, 2011). Moreover, knowledge management systems and resource management systems depending with its application foster collective capabilities by enabling storage and access of resources that promote competitive advantage.

## 4.2 Contribution to practice – implications to practice

This research includes empirical studies which researchers such as Vazquez-Bustelo et al, (2007) noted as necessary on agility related research. The empirical component of the research is on companies in Telecommunication industry and IT distribution sector. The research also includes strategic agility conceptual models which are of importance to different industries as they offer solution to the challenges brought up with the present dynamic business environment.

### 4.2.1 Telecommunication industry case

The telecommunication industry is very competitive with complex products and services which are merging with other industries, such as, television, music, banking, entertainment and automotive. This vast and broad range of industries complementing with telecommunication industry has brought a lot of strain to companies who have been in the industry for some time. On the other hand, the level of innovation and obsolescence both in products and services is high resulting in the constant need for strategic agility.

This study included a case study from one of the leading companies in the telecommunication equipment and networking sector. The company, Net Power's (pseudonym because of confidentiality issues) products and services include mobile broadband, operations support systems, transport systems, customer experience management and network implementation. The study included eight interviews with senior level managers. NetPower is undergoing transformation or reengineering, that is, there are trying to optimize their processes and improving the competences of their human resources. This effort is also a reflection of the intense competition that requires drastic measures to gain competitive advantage or even to survive. The reasons for intense competition in the industry are also elaborated below by Net Power head of research and development.

*[Head of research and development:] In our field the competition is so tough. There are couples of reasons for this; one is that this is a very standardized industry, so together we develop different standards for the interfaces between different equipment and different functions of the equipment. And then operators can buy different equipment from multiple vendors and still have them interoperate because of the standards. And the other thing is that there are not so many suppliers and in that sense it is not hugely competitive like in some consumer goods there maybe 100s of suppliers but here there are just a few 6 or 7 suppliers but the problem is there are kind of 600 customers in the whole world and these are enterprises they are not consumers and the most important one are very big companies much bigger than us in revenue and there are extremely professional in purchasing so we have very skilled customers who are very good at negotiating and putting the vendors against each other which is possible because of the standards so this is what makes it very competitive, we have very good buyers.*

Strategic agility is crucial for survival in the telecommunication industry. The business environment is such that competition is derived from different dimensions and the constant need to complement products with other industries' products calls for strategic agility. Strategic sensitivity is required to be on constant look out for threats and opportunities in an environment where they arise so quickly that failure is always on the door. For example strategic sensitivity element internal awareness was necessary for Net Power to recognize that their human resources were lagging behind. Moreover the company's transformation efforts are strategic response to the competition. The implication of these views is that the managers need to be aware and understand the environment that includes products and services beyond their defined spheres of operation. In addition, collective capabilities include unity of purpose by leadership as suggested by Doz & Kosonen (2008).

There were conflicting views from managers on the value of IS to the company. Some business managers subscribed to the view suggested by Carr (2003) elaborated above that IS is now a commodity that does not bring competitive advantage. They argued that, for instance, IS is only necessary for collecting market information and analysis and eventually a knowledgeable person has to make informed decisions. And the later brings in competitive advantage. On the other hand, IS managers argued that IS application can be a differentiating factor in the competitive environment. They also argued that due to the collaborative nature of business, IS is crucial for business.

*Organizational / Managerial Implications:*

The Telecommunication industry is very dynamic and their products and services are increasingly complex. The industry is also facing threats and opportunities from complementary products and services enabled by advancing in technologies, for example, voice over Internet Protocol, VoIP. Taking this into consideration, strategic sensitivity is essential for Telecommunication companies in order to be up to date with the changes in the environment. Moreover, companies need to constantly make swift responses to survive the competition which calls for strategic response. Therefore, management in different functions and with different responsibilities has to consider how strategic agility could promote their functions and moreover in line with competition. Advances in IS also mean constant experiments in the Telecommunication on how value could be derived from IS adoption. The Telecommunication SC is complex and competitive and thus constant engagement of partners and potential partners is advocated for.

**4.2.2 IT distributor case**

The IT industry is very competitive in different points of view. For instance competition could be from direct competitors who make the same products and another view point is competition from alternative product which can perform the same tasks, for instance, laptops and tablets. On the products from other industries are also competing with IT products, for example, smart mobile phones. Therefore, players in the industry have to continuously innovative in terms of products and services to survive the multi-dimensional competition. This study included an IT distributor case study. The IT distribution sector is part of the IT industry with the main tasks of buying products from manufacturers and selling it to retailers, government, educational institutes or any buyers who buy IT equipment in bulk. Example of companies in the sector in Finland include ALSO ([www.also.fi](http://www.also.fi)) and F9 ([www.f9.fi](http://www.f9.fi)). The case company in this study, TechnoDeal (pseudonym because of confidentiality issues) operates in a SC environment as illustrated in Figure 6.

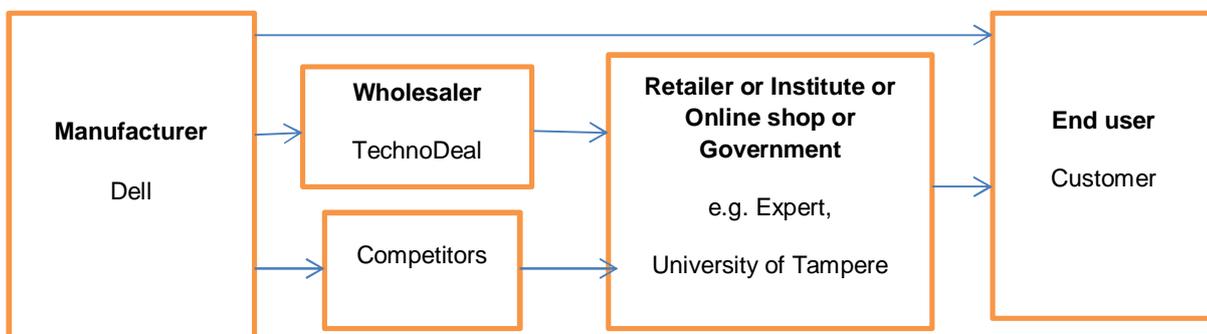


Figure 6 Simplified TechnoDeal SC (Article 7)

### Organizational / Managerial Implications:

One of the highlights of this case is emerging competition from manufacturers, mainly from China, who makes products for customers, for example retailers, to brand themselves see [www.alibaba.com](http://www.alibaba.com). These players mean that the SC and business model in the IT industry changes and significantly reducing value or totally cutting off IT distributors from the chain. The implication of this is that IT distributors must be innovative in terms of service provision and business models and constantly find ways to increase their value in the chain. Moreover, strategic agility dimensions, for example strategic sensitivity, would provide constant information to the management on the business changes and strategic response is an essential virtue in this dynamic environment.

### 4.2.3 Cross case analysis

The two cases provided insights on the research themes, strategic agility, SC and the role of IS. There are some common features between the two cases, for instance, their operating environments are dynamic and highly competitive and their products and services are complex. In this sub-section the two cases are simultaneously analyzed to highlight the research themes differences and similarities in an effort to develop the themes with empirical aspects as shown in Table 6.

Table 6 Net power case and TechnoDeal case cross case analysis

	<b>Net Power Case</b>	<b>TechnoDeal Case</b>
Strategic sensitivity	Uses both internal efforts and external agents in sensing mechanism. External agents constantly provide company with information that relate to the company, its competitors and all other essential stakeholders and environment features e.g. emerging products and regulators.	Collects information from several stakeholders especially customers in trying to develop customer loyalty from serving well the customers. In addition, knowledge of the available and upcoming products important in serving the customers, thus sensitivity to the supply side also important.
Strategic response	Net Power is going through transformation a huge response effort which could also be viewed as an effort to boast strategic agility.	TechnoDeal constantly improves and initiates new business models and services in trying to gain competitive advantage.
Collective capabilities	Essential elements, such as, leadership competence makes a difference in the competitive environment.	Efficiency and effectiveness of services constantly reviewed in line with improving collective capabilities.
Supply chain	SC is complex and cooperation includes with competitors in standards development. Collaboration with new partners, for instance, to offer complementary products and services.	The SC model is dynamic and TechnoDeal faces lots of pressures from emerging companies that sell directly to retailers to put brands on their products.
IS role	IS role is perceived differently by business and IT managers. Some business managers argue that IS is of no strategic value which is a different view from the IT managers.	IS is used for different purposes including serving the customers, making it flexible and easier to make transactions.
Organizational/Managerial implications	Strategic agility is essential in the industry and managers need to have internal awareness, such as, opportunities offered by IS and also SC benefits to tackle environment pressures.	Management needs to be innovative in their service provision and constantly seek ways to add value to their products.

### 4.3 Summary of published articles

In this section the results from each article are summarized. The relationship between the articles is as explained in the methodology chapter.

#### *ARTICLE 1: Information Technology Role in Supply Chain's Strategic Agility*

This paper offers the conceptual basis of the research. That is, the strategic agility construct is developed related IT services are mapped in a SC environment. Moreover, in this article propositions are developed as suggested by Yin (2009, p. 18) that "case studies benefits from the prior development of theoretical propositions to guide data collection and analysis". Thus this article offers a strong foundation for the whole research and more so for the empirical component. The developed strategic agility construct noted three main dimensions namely, strategic sensitivity, strategic response and collective capabilities. These dimensions are further scrutinized in the paper and in addition the role of IT and IT examples for each dimension are highlighted. Strategic agility in a supply chain is covered in the paper and a conceptual model is proposed. The model highlights the different requirements of strategic sensitivity, strategic response and collective capabilities in SC environment considering the tasks of the different SC partners. The developed propositions are based on the conceptual model of strategic agility in SC setting. The propositions include all the strategic agility main dimensions, these are, strategic sensitivity, strategic response and collective capabilities in SC context. In addition, further research focus articulated by suggested research questions are also included.

#### *ARTICLE 2: The Role of Information Systems in Supply Chain Strategic agility: a systematic literature review*

This article is a systematic literature review of the whole research. Okoli & Schabram (2010, p. 1) noted that reviews of research literature are conducted for a variety of purposes, such as, "theoretical background for subsequent research; learning the breadth of research on a topic of interest; or answering practical questions by understanding what existing research has to say on the matter". Therefore, there are different ways of doing and reporting a literature review, for instance, a literature review in an introductory section of a research paper and rigorous stand-alone literature review. The review in this research is a rigorous stand-alone literature review because the research domain is a relatively new and stands to benefit from a thorough literature review. In the paper, the research themes, strategic agility, SC and the role of IS are first elaborated. Then the systematic literature review process is explained in detail. Webster & Watson (2002) suggested two ways in presenting literature review results, these are, concept-centric in which concepts determine the organizing framework of a review and author-centric approach in which summary of the relevant articles is presented. This review followed the concept-centric approach in which the strategic agility concept is reviewed in SC in addition to noting the role of IS. Research questions were also suggested after noting the gaps in literature.

#### *ARTICLE 3: Strategic Sensitivity and the Role of Information Systems: Sensing in a Turbulent Environment*

This paper is an elaboration of one of the main dimensions of strategic agility which is strategic sensitivity. Strategic sensitivity is essential for keeping in touch with the changes in the business environment. The dynamism of the environment makes strategic agility constantly required for strategic agility purposes. The article notes the different business environment as determined by the changes in terms of nature of change and speed. The different environment mean different company profiles operating, for instance, in an environment characterized by slow speed of change of simple nature, operations-driven companies thrive but in a fast speed of change of complex nature strategic agility is required. The article also notes Porter

(2008) five competitive forces as sensing should encompass all the essential environment stakeholders and entities. In addition, sensitivity to the internal strength and limitation is important for awareness of firm's ability to respond to the external pressures and thus the resource based view is utilized in this article in drawing internal awareness.

*ARTICLE 4: Response abilities: a strategic agility requirement for supply chains*

This article, as Article 3 above, is an elaboration of another strategic agility main dimension namely strategic response. Response to the business challenges is a difficult task executive management face in attempting to survive the competition. This article categorizes different response initiatives and highlights that response should be based from strategic sensitivity. In addition, strategic response is much more complicated in a SC environment because of the broader spectrum of factors to be considered in SC context. IS play various roles in supporting strategic response noted in this article, such as, computer-aided-design systems in design phase and business intelligence systems in decision making. A model which considers the different response initiatives in different market conditions is proposed. The need to respond to the environment either by reacting to the changes in the environment or by pro-acting to influence the environment is emphasized.

*ARTICLE 5: Strategic agility and required information systems in supply chain setting*

This article makes use of past empirical findings to draw two case studies namely IKEA and Kesko. These are relatively successful companies and leaders in their industries hence the motivation to choose these cases. Moreover, there is vast literature on these two companies which is also an additional motivational factor. The article contains taxonomy of strategic agility and required IS capabilities. The article provided empirical insights to the preliminary theoretical component. In fact, it is an essential link between the theoretical part of the research and the empirical component. The two cases offered interesting and diverse strategic agility insights considering the issues, such as, difference in SC setting, difference in industries from which the cases are derived. And a cross case analysis in the articles highlights these issues.

*ARTICLE 6: Strategic agility and the Role of Information systems in Supply Chain: Telecommunication Industry Case Study*

The article makes use of empirical data to develop the models proposed from the theoretical phase of the research. Eight senior level managers with vast experience, between six and twenty years in the industry were interviewed in this study. In addition documents were also used as source of data in this case. The study reinforced the strategic agility models and offered some practical insights. The competitive landscape meant that collaborating is essential in an attempt to add value to the customers with a global choice. The study also uncovered the different views on the value of IS from business managers and IS managers. Some business managers suggested that IS is only important for operations only, for example, IS used for data collection only in strategic sensitivity measures. IS managers differed and argued that company and industry as a whole is driven by IS and innovation in IS meant increasing significance.

*ARTICLE 7: The Role of Information Systems for Strategic Agility in Supply Chain: IT Distributor Case Study*

The IT industry is very interesting in this research because of its dynamic nature, product innovation and obsolescence. The IT distribution sector is not very visible because it operates in a business-to-business environment, that is, its customers and suppliers are other business players. Thus, research on the sector is of interest to uncover its value in the IT industry and value chain. In addition, this sector is under threat from the emerging companies which sells products directly to retailers to put their own brands. The results include that the IT distributor has to constantly derive innovative solutions in terms of service provision

and business models to withstand the competition. Moreover, their value to the SC has to be significant, for instance, knowledge sourced from the customers delivered to the suppliers and knowledge of new products offered delivered to the customers.

#### **4.4 Limitations of study and future recommendations**

The business environment characterized by low speed of change and linear nature of change is a stable and predictable environment. In this environment, companies are operation driven (Doz & Kosonen, 2008) and success is guaranteed for players who focus on their core functions and deliver products as requested by customers. Pun (2001) called this environment as repetitive environment and described this as serene environment with little or no changes at all. In addition he noted that in a free market economy, very few industries are operating in this environment. However, Overby et al. (2006) noted that firms operating in traditionally regulated industries such as the energy industry, for example electricity smart grids sector, has experienced this type of environmental stability. Furthermore, Pun (2001), suggested that not-for-profit organizations, such as, museums operate in this environment. This study is of limited value in this stable and predictable environment.

This study considers a SC context and there are two related levels of analysis first the individual members that make up the chain and the chain as a whole. This was well catered for in the theoretical component of the research. However, in the empirical component there were challenges to gather data from the whole chain. This was because of limited time and budget. This is a research limitation in terms of spectrum of the SC analysis although in the second case data included from supplier, focal company and customer, this was not the whole chain as there are significant players, such as, emerging competitors from which data was not derived. Therefore, further studies are recommended to include more stakeholders in the empirical SC investigation.

This research is qualitative research with advantages, such as, rich detailed data from which to draw comprehensive conclusions which helps in developing concepts and theories. In addition, qualitative research, for instance, interviews as a data collection technique offers appropriate platform for new areas of research and complex topics. This research benefited from this as the topic is relatively new and needed input which could be further elaborated by the interviewees. Moreover, the wide range of the data collection source offered diverse knowledge. However, there are some notable limitations in using qualitative research approach, such as, difficulties in replicability of the research, subjectivity involved in analyzing the data and expensive in terms of time and money, for example, in transcription of recorded interviews. Hence, it would be recommendable for future research to also embrace quantitative approach, for instance, in testing the proposed conceptual models and propositions. Also, a mixed research approach is further recommended for future research because of the different research dimensions considered on top of the benefits, such as, multiple forms of data collection offers rich and diverse data which would offer another point of to this research topic.

## 5 CONCLUSION

In summary, the results presented in this research suggest the need for management of companies operating in competitive and dynamic industries to embrace strategic agility as a measure to survive the competition and gain competitive advantage. Strategic agility is made up of key dimensions strategic sensitivity, strategic response and collective capabilities. Strategic sensitivity involves collecting data that generates knowledge by cleaning it for accuracy and relevancy then analyzes the impact of the derived knowledge and thereby anticipates or detects opportunities and threats in the business environment (Van Oosterhout, 2010; Dove, 2001). Strategic response is the ability of an organization in collaboration with its partners to quickly and seamlessly (re)configure its resources and processes to re-act or pro-act to the business environment changes. Collective capabilities of an organization include ability to benefit from the combined fusion of its resources, for example, information, employees, infrastructure and partners. That is, to thrive on the gains of working together, this is more than, for example, each resource benefits individually summed up.

The SC context considered illustrated the issues to be considered when collaborating with partners both at organizational level and at SC level. For example, there have to be related strategic agility concerns within the SC depending with the role and task of the individual SC partners. First, SC partners tasked with selling the end products who are in constant interaction with the customer needs to be highly strategically sensitive. IS, for example, social technologies and business intelligence systems could play a significant role in gathering and analyzing data from the customers and other key environment stakeholders (Li and Nagel, 2011). Second, SC partners whose tasks are mainly product formulation should have the ability to change product in line with the changes in product specifications and thus high strategic response. Note though that both strategic sensitivity and strategic response are required by all SC partners but at differing levels in the chain. Advances in technologies, for instance, cloud computing network as a service promotes strategic agility, for example, collective capabilities by enhancing collaboration in SC setting.

This research is important in drawing measures to build a sustainable solution to challenges facing industries encountered in a turbulent environment. This is very relevant as the prevailing business environment is bringing both challenges and opportunities to the business community. Thus, this research addresses both the academic and industry demands by developing conceptual models which are important in addressing prevailing industry challenges.

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# APPENDIX

## Appendix 1 Strategic agility framework constructs and questions

### 1.1 Strategic Sensitivity

Sub-construct	Variables	Question	Literature
Strategic foresight	Pattern recognition (long term)	1. The Organization does trend recognition (including identifying disruptions, discontinuity and anticipate defining moments)?	Inkinen and Kaivo-oja (2009)
		2. The organization does plausible future scenarios development?	Schoemaker (1995)
	Track changes (short term)	3. The organization is able to recognize opportunities that quickly arise?	Inkinen and Kaivo-oja (2009)
		4. The organization is able to recognize challenges that quickly arise?	Inkinen and Kaivo-oja (2009)
Strategic insight	External sensing	5. The organization gathers customer requirements?	Sambamurthy et al., (2003)
		6. The organization exchanges knowledge with external environment (e.g. Universities)?	Turban et al. (2012)
		7) The organization gathers information about substitute products and suppliers?	Doz & Kosonen (2008)
		8) The organization gathers information about competitors and new market players?	Doz & Kosonen (2008)
	Internal awareness	9. The organization assesses its limitations? (organization's weakness)	Porter, (2008)
		10. The organization assesses its abilities? (organization's strength)	Porter, (2008)

## 1.2 Strategic response

Sub-construct	Variables	Questions	Literature
Internal response orientation	Resource fluidity	1. The organization tracks resource utilization and minimizes waste? (resources optimization)	Turban et al. (2012)
		2. The Organization is able to quickly and easily adjust resources (after disruption and discontinuity)?	Doz & Kosonen, (2008)
	Business process maturity	3. The organization's business processes are well defined, managed and measured?	Elzinga et al., (1995)
		4. The Organization's processes are standardized to enable plug and play connectivity (within the organization and with outside partners)?	Elzinga et al., (1995)
		5. The organization updates its business processes in relation with the business environment changes?	Elzinga et al., (1995)
External response orientation	Business reaction to environment	6. The organization has ability to respond to changes in aggregate customer demand?	Turban et al. (2012)
		7. The organization has the ability to respond to competitors' new products or services?	Porter, (2008)
		8. The organization has ability to respond to changes in other business environment constructs? e.g. regulation changes, substitute products, new entrants	Turban et al. (2012)
	Business pro-action to environment	9. The organization does innovation to drive or lead the market? (change the market)	Kaplan & Winby, 2009
		10. The organization does innovation to improve its operations in order to be market leader? (organizational self change)	Kaplan & Winby, 2009

## 1.3 Collective Capabilities

Sub-construct	Variables	Question	Literature
Human resources capabilities	Employees' competence and collaboration	1. Employees improve their individual and organization performance (e.g. through training or collaboration)?	Van Oosterhout, (2010)

		2. Organization uses multi-functional teams (in problem solving)?	Van Oosterhout, (2010)
	Knowledge management and Organizational learning	3. Organization stores information derived from past experience on how best to deal with customer problems?	Alavi & Leidner, (2001)
		4. The organization retains information to be used to improve its operations?	Alavi & Leidner, (2001)
		5. Employees innovate, store and retrieve knowledge (e.g. how to do a task)?	Alavi & Leidner, (2001)
Infrastructure and Information resources capabilities	Core Infrastructure	6. The Organization has assets to enable it to do its core functions?	Barney, (1991)
		7. Organization tracks its core infrastructure worthiness and obsolescence?	Barney, (1991)
	Information Management	8. Employees give feedback on product and service delivery process?	Sambamurthy et al., (2003)
		9. The organization gathers and utilizes information from customers?	Sambamurthy et al., (2003)
		10. The organization gathers and utilizes information from external e.g. partners, universities?	Porter (2008)

## Appendix 2 Information systems role for strategic agility and questions

### 2.1 Information systems for strategic sensitivity

Sub-construct	Variables	Question	Literature
Strategic foresight required IS	Business Intelligence systems	1. The Organization has IT which aids in trend recognition (e.g. Business Intelligence systems)?	Watson & Wixom (2007)
		2. The organization has IT to support in development of plausible future scenarios? (e.g. Business Intelligence systems)?	Watson & Wixom (2007)
	Business performance management systems	3. The organization IT enables recognition of opportunities that quickly arise? (e.g. business performance management systems)	Doz & Kosonen (2008)
		4. The organization IT enables recognition of challenges that quickly arise? (e.g. business performance management systems )	Doz & Kosonen (2008)
Strategic insight required IS	Social Media Technologies and Customer Relation Management Systems	5. The organization IT enables maximum knowledge exchange with outside world? (e.g. social media technologies)	Alavi and Leidner (2001), Li et al. (2011)
		6. The organization has IT to gather customer requirements? (e.g. customer relation management systems)	Sambamurphy et al. (2003), Li et al. (2011)
		7) The organization uses IS to gather information about substitute products and suppliers? (e.g. Social Media Technologies)	Li et al. (2011)
		8) The organization uses IS to gather information about competitors and new market players? (e.g. Social Media Technologies)	Li et al. (2011)
	Strengths, Weaknesses Opportunities, and Threats - SWOT analysis tools	9. IT enables the organization to assess its limitations (organization's weakness)? (e.g. SWOT analysis tools)	Alavi and Leidner (2001)
		10. IT enables the organization to assess its abilities (organization's strength)? (e.g. SWOT analysis tools)	Alavi and Leidner (2001)

## 2.2 Information systems for strategic response

Sub-construct	Variables	Questions	Literature
Internal response orientation required IS	Resources scheduling systems	1. The organization has IT that keeps track of resource utilization and supports in minimizing waste (resources optimization)? (e.g. resources scheduling systems)	Tarafdar & Gordon (2007)
		2. IT helps to quickly adjust resources (after disruption and discontinuity)? (e.g. resources scheduling systems)	Tarafdar & Gordon (2007)
	Business Process Management Systems	3. IT aids business processes so that they are well defined, managed and measured? (e.g. business process management systems)	Raghu & Vinze (2007)
		4. IT is used in process standardization to enable plug and play connectivity (within the organization and with outside partners)? (e.g. business process management systems)	Raghu & Vinze (2007)
		5. IT is used in developing business processes in relation with the environment? (e.g. business process management systems)	Raghu & Vinze (2007)
External response orientation required IS	Competitive intelligence systems	6. The organization has IT which supports response action to changes in aggregate customer demand? (e.g. customer relationship management system)	Gunasekaran & Ngai, (2004)
		7. The organization has IT which supports reaction to competitors' new products or services? (e.g. competitive intelligence systems)	Gunasekaran & Ngai, (2004)
		8. The organization has IT which supports response action to changes in other business environment changes? E.g. regulation changes (e.g. competitive intelligence systems)	Gunasekaran & Ngai, (2004)
	Market and business planning systems	9. IT supports innovation to drive or lead the market (change the market)? (e.g. market planning systems)	Sambamurphy et al. (2003), Li et al. (2011)
		10. IT supports innovation to improve the organization's operations in order to be market leader? (organizational self-change) (e.g. business planning and control systems)	Sambamurphy et al. (2003), Li et al. (2011)

## 2.3 Information systems for Collective Capabilities

Sub-construct	Variables	Question	Literature
Human resources capabilities IS requirements	Employees' support systems and collaboration systems	1. IT is used to aid employees in doing their tasks and to improve their competences? (e.g. Electronic performance support systems)	Dewett & Jones (2001)
		2. The IT support multi-functional teams? (e.g. Group Decision Support Systems)	Alavi and Leidner (2001),
	Knowledge management systems and Organizational learning IT	3. Organization IT stores information derived from past experience on how best to deal with customer problems? (e.g. customer relationship management system)	Bhatt and Grover, (2005)
		4. IT supports employees to innovate, store and retrieve knowledge? (e.g. knowledge management systems)	Alavi and Leidner (2001)
		5. The organization retains information in IT to be used to improve its operations? (e.g. Database systems)	Bhatt and Grover, (2005)
Infrastructure and Information resources capabilities required IS	Resource management systems	6. IT is used in tracking the core infrastructure worthiness and obsolescence? (e.g. resource management systems)	Dewett & Jones (2001)
		7. IT is used to aid use of organization's core infrastructure? (e.g. Enterprise resource planning - ERP systems)	Alavi and Leidner (2001)

	Information Management Systems	8. IT is used for employees' feedback on product, service or delivery process? (e.g. Employee Feedback System)	Dewett & Jones (2001),
		9. The organization IT facilitates gathering information from customers? (e.g. customer relationship management systems)	Sambamurphy et al. (2003)
		10. The organization IT aids in gathering and utilizing information from external e.g. partners, universities? (e.g. extranet)	Sambamurphy et al. (2003)

## Appendix 3: Case Study Protocol

Step	Activity
1	Case preparation including informal and formal meetings with contact person.
2	Informing interviewees by emailing two reports before the interviews – 1. Background on the research and the research procedure and 2. interview focus
3	First round of interviews: 1) semi-structured interviews conducted with business focus or IT focus or both depending with profile of interviewee 2) recorded interviews are transcribed, that is, to make a written copy of taped interviews 3) correction of transcript by interviewee if needed 4) triangulation - doing several interviews with same focus in the same case study
4	Preliminary presentation results to company contact person, validate initial results
5	Second round of interviews: follow up questions done by emails
6	Feedback final results

## Appendix 4: Supply Chain Questions

1. What is your role in the supply chain?
2. How do you relate / communicate in the chain? (emails, telephone, IS system)
3. Do you share information in the chain?
  - 3.1 What are your estimates on the level of sharing? Why?
  - 3.2 Information systems used in sharing?
4. What is your opinion of transparency of the chain? (knowing what each partner is doing)
  - 4.1 Do you have high levels of knowledge of your suppliers and customers?
  - 4.2 IS to track SC partner? (e.g. stock levels)
5. Is there any supply chain member with the task of gathering market information?
  - 5.1 Is the gathered information shared with all SC members?
  - 5.2 IS used???
6. Is there any supply chain member with the task of doing business forecast?
  - 6.1 Is the forecast shared through the chain?
  - 6.2 IS used???
7. Do you include all the SC members in the innovation process?
  - 7.1 (if yes) What is the role of each member?
  - 7.2 IS used to aid chain innovation?
8. What do you perceive as the most important features or characteristics of SC members who are in contact with the customers?
9. What do you perceive as the most important features or characteristics of SC members tasked with product formulation?
10. What do you perceive as the most important features or characteristics of the whole SC?
11. What is the most important use of IS in the chain?

## ATTACHED PUBLICATIONS

ARTICLE 1: Mavengere, N.B. (2013). Information Technology Role in Supply Chain's Strategic Agility, *International Journal of Agile Systems and Management*, Vol. 6, No. 1, p. 7-24

ARTICLE 2: Mavengere, N., Ruohonen, M., Mäkipää, M. (2013), The Role of Information Systems in Supply Chain Strategic agility: a systematic literature review, *Academy of World Finance, Banking, Management and Information Technology Conference*, 22-25 July 2013, Cape Town, South Africa [invited for review for book chapter publication]

ARTICLE 3: Nicholas Mavengere (2010) Strategic Sensitivity and the Role of Information Systems: Sensing in a Turbulent Environment, *Proceedings of the 8th Annual Conference on Information Science, Technology and Management*, 9-11 August 2010, Murikka Institute, Tampere

ARTICLE 4: Nicholas Mavengere (2010) Response abilities: a strategic agility requirement for supply chains, in H.W. Nicolajsen, J. Persson, L. Heeager, G. Tjørnehøj, K. Kautz, P.A. Nielsen (Eds.): *Proceedings of the 33rd IRIS Seminar (Information Systems Research Seminar in Scandinavia)*, IRIS 2010, Rebild Bakker, 21.-24. august 2010, Rebild, Denmark, ISBN 978-87-992586-1-7 (CD). [improved paper under review at *Information Resource Management Journal*]

ARTICLE 5: Mavengere, N., (submitted). Strategic agility and required information systems in supply chain setting, *Journal of Information Technology Cases & Applications Research*

ARTICLE 6: Mavengere, N., (2013). Strategic agility and the Role of Information systems in Supply Chain: Telecommunication Industry Case Study, *Proceedings of the European Conference on IS Management and Evaluation (ECIME)*, 12-13 September 2013, Sopot, Poland [selected as the best PhD research article and in consideration for publication in *Electronic Journal of Information Systems Evaluation*]

ARTICLE 7: Mavengere, N., (2013). The Role of Information Systems for Strategic Agility in Supply Chain: IT Distributor Case Study, *Academic Business World International Conference*, 22-24 May 2013, Nashville, USA

## **NOTES ON THE ATTACHED ARTICLES**

1. Article 3 – diagrams, Figure 1 to 3, are missing on pages 1- 4, 1-5 and 1-7 respectively. These figures are attached on last page of the paper
2. Article 5 – paper under review – asked for resubmission after the 1st round of reviews
3. Article 6 – diagram, Figure 2, page 233 missing information. This figure is attached on last page of the paper