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ABSTRACT

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Abstract

Accessing information quickly has become more and more important. Mobile devices can nowadays be used to perform and accomplish tasks more efficiently. Logistics companies can benefit from mobile applications in many ways. Many logistics areas, such as warehouse managing and transportation, concentrate on the physical movement of goods. The benefits of mobile applications are emphasised in those environments where portability and real-time information are of great use.

The business IT alignment framework offers an approach to researching companies business and IT strategies and execution. The enterprise mobile applications may bring many advantages but also disadvantages to organisations utilising them. In this thesis, the business It alignment framework is used in the context of researching the utilisation of enterprise mobile applications in the case organisations. The utilisation of mobile applications in logistics is studied in this research by using the qualitative research method. Research data has been gathered from semi-structured interviews with case company employees responsible for logistics mobile application projects. The logistics areas where mobile applications are used are warehouse management and transportation. A new logistics IT alignment measurement tool was developed for the purposes of this study, as no such a tool existed before. The tool utilises the previous business IT alignment literature. Companies or researchers can utilise this tool in determining their logistics IT alignment level.

This study finds that there are multiple important features that companies should take into account when developing and implementing logistics mobile applications. Ease of use and user friendliness are the most important of them. In addition, information quality and efficiency and effectiveness should be considered. Many companies also benefit from end device independence. Companies can get many advantages from logistics mobile applications. These advantages are for example better information quality, real-time information and cost reductions by consuming less paper. High logistics IT alignment supports in gaining these advantages.

Key words	supply chain management, logistics, mobile technology, business IT alignment
Further information	

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TIIVISTELMÄ

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Tiivistelmä

Nopean tiedonvälityksen merkitys kasvaa jatkuvasti. Mobiililaitteita voidaan nykyään käyttää erilaisten tehtävien suorittamiseen tehokkaammin. Logistiikkayritykset voivat hyötyä mobiilisovelluksista monilla tavoilla. Monilla logistiikan aloilla, kuten varastonhallinnassa ja kuljetuksessa, keskitytään tavaroiden liikkumiseen. Mobiilisovellusten hyödyt korostuvat ympäristöissä, joissa kannettavuus ja reaaliaikainen informaatio ovat hyödyksi.

Strategisen yhteensopivuuden malli tarjoaa lähestymistavan yritysten liiketoiminta- ja informaatioteknologiastrategioiden ja niiden toteutuksen tutkimiseen. Yritysten mobiilisovellukset voivat tuoda monia hyötyjä, mutta myös haittoja, niitä hyödyntäville organisaatioille. Tässä tutkielmassa käytetään strategisen yhteensopivuuden mallia tutkittaessa yritysten mobiilisovellusten käyttöä tutkimusyrityksissä. Mobiilisovellusten hyödyntämistä logistiikassa tutkitaan tässä tutkimuksessa käyttäen laadullista tutkimusmenetelmää. Tutkimusaineisto on kerätty teemahaastatteluista logistiikan mobiilisovellus -projekteista tutkimusyrityksissä vastaavien henkilöiden kanssa. Logistiikan alat, joilla mobiilisovelluksia käytetään, ovat varastonhallinta ja kuljetus. Tätä tutkimusta varten on kehitetty uusi logistiikan ja IT:n strategisen yhteensopivuuden arviointityökalu, koska sellaista ei ollut aikaisemmin. Työkalu hyödyntää olemassa olevaa strategisen yhteensopivuuden kirjallisuutta. Yritykset ja tutkijat voivat hyödyntää tätä työkalua arvioidessaan logistiikan ja IT:n strategisen yhteensopivuuden tasoaan.

Tämän tutkimuksen mukaan on monia tärkeitä ominaisuuksia, jotka yritysten tulisi ottaa huomioon kehittäessään ja ottaessaan käyttöön logistiikan mobiilisovelluksia. Helppokäyttöisyys ja käyttäjäystävällisyys ovat niistä tärkeimpiä. Lisäksi tiedon laatu, sekä tehokkuus tulisi ottaa huomioon. Monet yritykset hyötyvät myös laiteriippumattomuudesta. Hyötyjä, joita yritykset voivat saavuttaa mobiilisovelluksillaan, ovat esimerkiksi parempi tiedon laatu, reaaliaikainen tieto ja vähentyneen paperinkulutuksen mahdollistamat kustannussäästöt. Korkea logistiikan ja IT:n strateginen yhteensopivuus tukee näiden hyötyjen saavuttamista.

Asiasanat	toimitusketjut, logistiikka, mobiiliteknologia, BITA, SAM
Muita tietoja	

UTILISATION OF MOBILE TECHNOLOGY IN LOGISTICS

Master´s Thesis
in Operations and Supply Chain Management

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Table of contents

List of figures

List of tables

List of abbreviations

BITA	Business IT alignment
CRM	Customer relationship management
EMA	Enterprise mobile application
ERP	Enterprise resource planning
IS	Information system
IT	Information technology
PAF	Procurement alignment framework
RFID	Radio frequency identification
UI	User interface

Key concepts

Business IT alignment

The unifying of a company's information technology strategies and business strategies.

Enterprise mobile application

Systems that are designed for employees of a certain company to gain access to their internal information technology systems.

1 INTRODUCTION

1.1 Background of the study

Accessing information quickly has become more and more important. Mobile devices, such as smartphones, tablets or other hand held devices, can nowadays be used to perform and accomplish tasks more efficiently. (Tai et al. 2016, 142.) Logistics companies can benefit from mobile applications in many ways. Many logistics areas, such as warehouse managing and transportation, concentrate on the physical movement of goods. The benefits of mobile applications are emphasised in those environments where portability and real-time information are of great use.

Enterprise mobile applications (EMA) are systems that are designed for employees of a certain company to gain access to their internal information technology (IT) systems. The main goals being to improve the companies' competitiveness and increase their efficiency. (Unhelkar and Murugesan 2010, 33). Despite the growth in popularity of mobile device usage for business purposes, only limited amounts of research on this topic exist (Legner et al. 2016, 817). These studies are mostly general views or concentrate on a field other than logistics such as electronic procurement (Gebauer and Shaw, 2004, 19-41) or sales (Tai et al. 2016, 141-157). According to previous literature, the most important features of enterprise mobile applications are support, connection and security (Gebauer and Shaw 2004, Nah et al. 2005, 87; 22; Natchetoi et al. 2008, 27; Al Bar et al. 2011, 60-61; Legner et al. 2016, 821).

Enterprise mobile applications have many advantages. Employees have ubiquitous access to their companies' information systems (IS). They are no longer tied to fixed workplaces. EMAs allow users to manage projects and documents, conduct enterprise resource planning (ERP) and provide customer relationship management (CRM). (Chung et al. 2014, 606.)

Enterprise mobile applications have been found to increase efficiency and effectiveness (Pavin and Klein 2015, 219; Tai et al. 2016, 141) and provide cost reductions for example by decreasing paper usage (Car et al. 2014, 217; Pavin and Klein 2015, 227). EMAs also help provide real-time information (Car et al. 2014, 218; Chung et al. 2015, 93; Pavin and Klein 2015, 219; Tai et al. 2016, 142). Another advantage researchers have found is increased accessibility (Bangert 2013, 31; Car et al. 2014, 208; Gurtner et al. 2014, 185; Chung et al. 2015, 93; Pavin and Klein 2015, 2019).

Enterprise resource planning systems integrate different business functions, and processes in organisations (Tai et al. 2016, 142). The significance of ERP systems has increased in the last two decades (Francoise et al. 2009, 387-388; Luftman et al. 2012, 200). ERP systems based mobile applications have been studied by multiple researchers

(Natchetoi et al. 2008, 27-32; Bangert 2013, 30-33; Tai et al. 2016, 141-157). Tai et al. (2016, 141) concluded that ERP mobile applications enhance the productivity of processing operations in sales and distribution.

The concept of Business IT alignment (BITA) offers an approach to studying the utilisation of mobile applications in logistics. Business IT alignment or strategic alignment refers to the unifying of a company's information technology strategies and business strategies (Henderson and Venkatraman 1993, 472-282; Luftman et al. 1993, 198-221; Luftman and Brier 1999, 109-122). The goal of the alignment is to increase a company's performance (Luftman et al. 1993, 198; Aversano et al. 2012, 462; Gerow et al. 2014, 1178). Though not widely used in logistics, business IT alignment can be utilised broadly within different industry sectors, e.g. pharmaceuticals, services, or education and there is some research in logistics that utilises BITA (Van de Wijngaert et al. 2008, 71-80; Luftman et al. 2017, 34).

As the role of information technology in logistics continues to grow (Karagöz and Akgün 2015, 23) BITA offers a framework for understanding the responsibilities and capabilities of logistics and IT collaboration. Van de Wijngaert et al. (2008, 71) suggest that business IT alignment aids the logistics domain especially in investment decision making. The investment potential of new technologies in ventures such as logistics mobile applications, demands expertise from both logistics and IT departments as well as collaboration between them. Organisations that have high logistics IT alignment can benefit greatly in these situations.

The case organisations of this thesis operate in warehouse management and transportation fields. Concerning warehouse management, the key questions are: what is in the warehouse and where are the items placed in the warehouse (Connolly 2008, 108). Technologies utilised in warehousing include information labels and their reading devices, back-office database systems, picking assisting technologies such as pick-by-light or pick-by-voice as well as cranes or trucks (Connolly 2008, 108). These technologies are often utilised through logistics mobile applications or alongside them.

The key object in transportation is delivering goods at the right time, to the right place, in proper condition, with optimised costs (Ritvanen et al. 2011, 106). Transportation planning systems are used to achieve this goal. Logistics mobile applications for transportation are often connected to these systems and help in communicating between the drivers or other end users and the transportation planners. They provide real-time and high quality information to both parties.

The business IT alignment framework offers an approach to researching companies business and IT strategies and execution. The enterprise mobile applications may bring many advantages but also disadvantages to organisations utilising them. In this thesis, the BITA framework is used in the context of researching the utilisation of enterprise mobile applications in the case organisations.

1.2 Research purpose and objectives

The main concepts of this study are business IT alignment and enterprise mobile applications especially from a logistics view. The purpose of this research is to better understand mobile application usage in logistics and its relation to companies' business, IT and logistics strategies. This research pays attention to the motives behind logistics mobile application usage and the possible benefits or drawbacks related to their use.

The utilisation of mobile applications in logistics is studied in this research by using the qualitative research method. Research data has been gathered from semi-structured interviews with case company employees responsible for logistics mobile application projects. The logistics areas where mobile applications are used are warehouse management and transportation.

Research data has been analysed to draw out patterns and form a concept of the topic. To understand the wide research topic better, two research questions (RQ1-2) have been formed and they are outlined below:

RQ1: What are the motivators of the adoption of enterprise mobile applications in logistics?

RQ2: How are the expectations regarding mobile applications fulfilled and why?

Research question one (RQ1) aims at testing and understanding the objectives and vision behind the decision to develop and or deploy logistics mobile applications. Research question two (RQ2) aims at testing and understanding whether the objectives and vision tested by RQ1 have been realised or not and what are the reasons behind this.

1.3 Structure of the thesis

In the second and third chapters, the concepts of business IT alignment and enterprise mobile applications are viewed based on literature. Next, a theoretical frame of reference is constructed and the research propositions are given.

In the fifth chapter, the methodology of the empirical study is introduced by going through the research design, data collection and analysis and trustworthiness of the research. The results of the study are presented in chapter six. The conclusions and discussion along with all references and appendices are presented at the end of the thesis.

2 BUSINESS IT ALIGNMENT

Business IT alignment was already being mentioned in the late 1970's (Luftman and Brier 1999, 110; Aversano et al. 2012, 462). At the beginning of the 1990's, Henderson and Venkatraman (1990, 1-34; 1993, 472-282) and Luftman et al. (1993, 198-221) introduced the strategic alignment model. Later Luftman and Brier (1999, 109-122) defined the same model with the term business IT alignment.

Business IT alignment means unifying a company's information technology strategies and its business strategies (Henderson and Venkatraman 1993, 472-282; Luftman et al. 1993, 198-221; Luftman and Brier 1999, 109-122). The goal of the alignment is to increase a company's performance (Luftman et al. 1993, 198; Aversano et al. 2012, 462; Gerow et al. 2014, 1178). The business IT alignment model can be utilised in a wide scope of different industry sectors, e.g. pharmaceuticals, services, or education (Luftman et al. 2017, 34). Even though it has been an object of study for more than two decades, business IT alignment is still seen as challenging (Becker et al. 2015, 387) and the alignment model is widely used in current research as well (Becker et al. 2015, 387; Cerchione and Esposito 2016, 287; Deepak and Saji 2016, 413; Zhang et al. 2016, 363; McAdam et al. 2017, 7172).

A company is aligned when it has invested in the right information technology software and hardware and its IT is targeted at the right processes and business areas at the right moment (Venkatraman 1989, 942-946). Misalignment is caused by concentrating too heavily on only one aspect of alignment or concentrating on temporarily fixing the alignment instead of continuously working towards enhancing it (Luftman et al. 1993, 198; Gerow et al. 2014, 1178). Higher business IT alignment leads to higher performance for companies (Gerow et al. 2014, 1178). In addition it may increase profitability and create a sustainable competitive advantage (Baker et al. 2011, 299). On the other hand, misalignment could lead to wasted resources and unsuccessful IT initiatives causing unfavourable financial and organisational outcomes (Chen 2010, 10; Ravishankar et al. 2011, 39).

Business alignment represents the depth of the connection between business strategies and business infrastructure and processes, whereas IT alignment refers to the depth of the connection between IT strategies and IT infrastructure and processes. Cross-domain alignment refers to bridging higher and lower levels of the strategic alignment model from business strategy to IT infrastructure and processes or IT strategy to business infrastructure and processes. (Gerow et al. 2015, 470.)

2.1 Strategic alignment model

The strategic alignment model proposed by Henderson and Venkatraman (1990, 6-9; 1993, 476) is used in later studies as well (Van de Wijngaert et al. 2008, 72; Gerow et al. 2015, 467; Coltman et al.2015, 91). Improvements have been suggested to the original model (Van de Wijngaert et al. 2008, 72; Gerow et al. 2015, 470). The strategic alignment model is described in Figure 1 below.

The four dominant alignment perspectives identified in the strategic alignment model are 1) strategy execution 2) technology transformation 3) competitive potential and 4) service level alignment. The strategy execution alignment perspective describes the alignment between business strategy, organisational infrastructure and processes and IT infrastructure and processes. According to this perspective, top management should act as a strategy formulator and the IT manager as a strategy implementer. (Henderson and Venkatraman 1993, 477.)

The technology transformation alignment perspective defines the alignment between business strategy, IT strategy and IT infrastructure and processes. Opposite to the strategy execution, this perspective is not ruled by the current organisational structure, but instead the goal is to identify the best IT competencies through correct positioning in the IT market and by identifying the right internal IT service architecture. (Henderson and Venkatraman 1993, 477-478.)

The competitive potential alignment perspective is concerned with the alignment between IT strategy, business strategy and organisational infrastructure and processes. This perspective supports the adaptation of business strategy to emerging IT capabilities. Top management should act as business visionaries articulating how new IT competencies could affect business strategy. The IT manager's role is to be a catalyst, the person that finds and presents new trends and opportunities in the IT environment. (Henderson and Venkatraman 1993, 478-479.)

The service level alignment perspective describes the alignment between IT strategy, organisational infrastructure and processes and IT infrastructure and processes. The focus of this perspective is to build a world class IT service organisation. Analysing customer needs and current products and services is necessary. The top management's role is to prioritise and allocate scarce resources thoughtfully. The role of IT management is executive leadership. (Henderson and Venkatraman 1993, 479-480.)

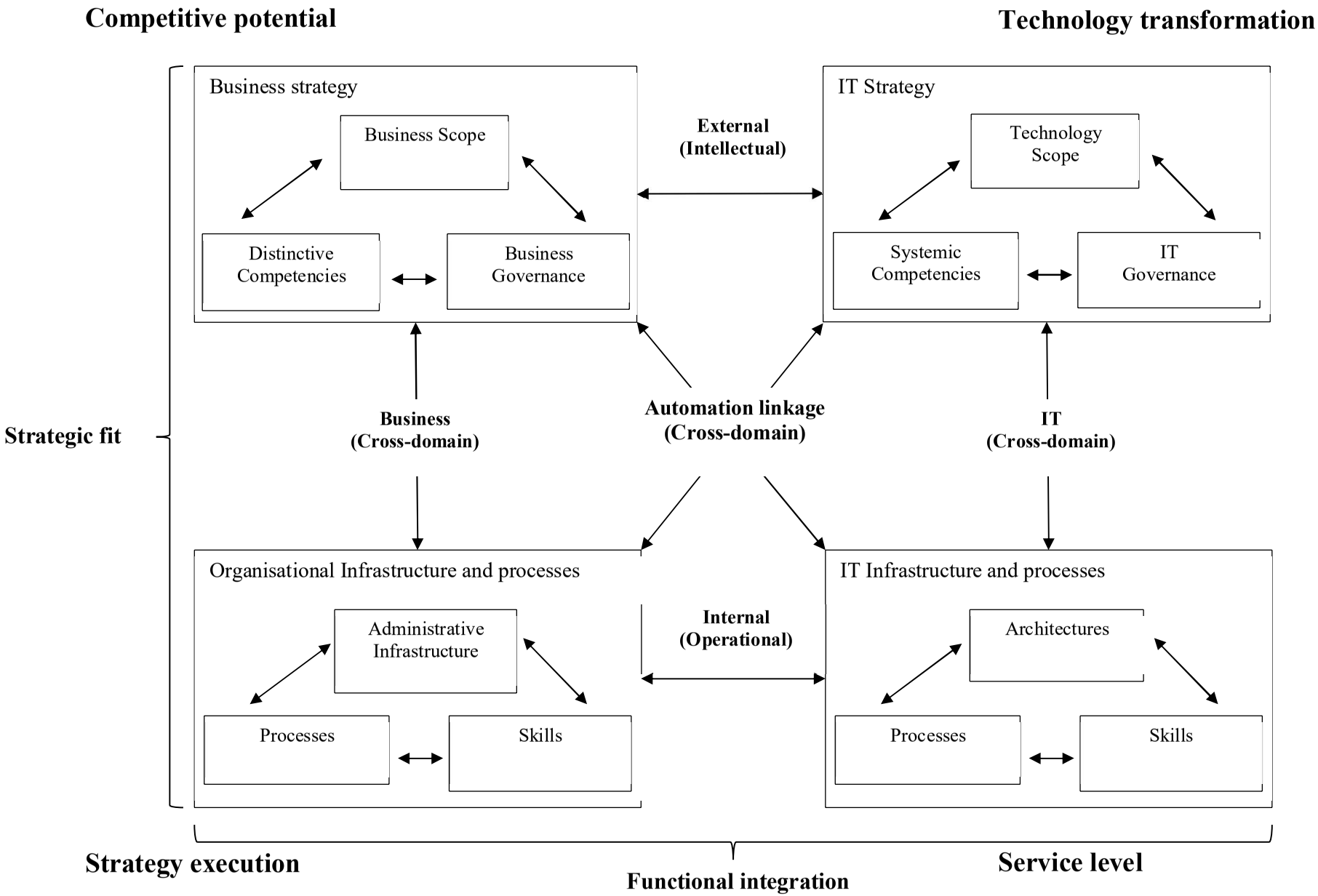

Figure 1 Strategic Alignment model (modified from Henderson and Venkatraman 1993, 476; Gerow et al. 2015, 467)

In addition to the alignment perspectives described above, the strategic alignment model can be perceived through different alignment domains. A company's strategic fit can be divided into external and internal domains. An external domain describes a company's relationship with the market, for example, decisions on strategic capabilities that a company uses as a competitive advantage. The internal domain represents a company's own business processes and competencies. Functional integration includes both the business and IT domains. External positioning and internal arrangement are important in both cases. (Henderson and Venkatraman 1993, 474-476.)

Gerow et al. (2015, 470) generated new definitions for the strategic alignment model's domains, emphasising the different levels of alignment, strategic and operational. Their goal was to ease the distinguishing between different types of alignment. The external domain is renamed intellectual alignment. According to the new definition, it describes how business strategy and IT strategy support each other. The internal domain or operational alignment describes how business and IT infrastructures and processes align with each other. The new definitions emphasise the difference in the stages of alignment between intellectual and operational alignment. Intellectual alignment is a higher, more strategic level of alignment, whereas operational alignment concentrates more on lower level operational activities. (Gerow et al. 2015, 470.)

2.2 Twelve components of alignment

The strategic alignment model presented above is divided into four areas of focus: business strategy, organisational infrastructure and processes, IT strategy and IT infrastructure and processes (Henderson and Venkatraman 1993, 476). Each of these areas consists of three components. Together they are called the twelve components of alignment (Luftman and Brier 1999, 111). The twelve components of alignment are:

- "Business strategy:
    1. business scope,
    2. distinctive competencies,
    3. business governance
- Organisational infrastructure and processes:
    4. administrative structure,
    5. processes,
    6. skills
- IT strategy:
    7. technology scope,
    8. systemic competencies,
    9. IT governance

- IT infrastructure and processes:
  10. architecture,
  11. processes,
  12. skills”

Business scope is a wide concept. It consists of a market that includes competitors as well as potential competitors, products and services, clients and customers and the location where a company competes in (Luftman and Brier 1999, 111). According to Coleman and Papp (2006, 242) business scope includes everything that could have an effect on a company’s business environment. Distinctive competencies create a company’s competitive edge. These might be a sales and distribution channel, brand or cost and pricing structure (Luftman and Brier 1999, 111). They are the capabilities that make it possible for an organisation to compete with others (Coleman and Papp 2006, 242). Business governance is the division of responsibilities and roles between management, the board of directors and stakeholders (Luftman and Brier 1999, 111). It also takes into account governmental regulations (Coleman and Papp 2006, 242).

A company may organise itself in several ways, for example in a horizontal, vertical or functional structure. This is taken into account in the administrative structure part of the twelve components of alignment. Processes are the way a company’s day-to-day business activities are handled. (Luftman and Brier 1999, 111.) For example, value added activities and process improvements belong to this component (Coleman and Papp 2006, 243). Skills consist of a company’s HR discipline and company culture (Luftman and Brier 1999, 111).

Important information technologies and applications build the technology scope. Systemic competencies are the capabilities that make IT services special compared to other companies. (Luftman and Brier 1999, 111.) This includes, how easily the business can access information that it needs for its strategy (Coleman and Papp 2006, 243). IT governance determines how the responsibility for IT is shared internally and externally (Luftman and Brier 1999, 111). This involves, how resources and risks are distributed. The prioritization and selection of IT projects belongs to this component. (Coleman and Papp 2006, 243.)

The policy according to which software, hardware, applications and data management is organised is called architecture in the twelve components of alignment (Luftman and Brier 1999, 111). The process component is very similar to the process component in organisational infrastructure and processes but is IT based (Coleman and Papp 2006, 243-244). Processes are the practices used to manage a company’s IT infrastructure. Similar to organisational infrastructure, in IT infrastructure, HR competencies and culture are classified as skills. (Luftman and Brier 1999, 111.)

Luftman and Brier (1999, 110) argue that the relationships between the twelve components define business IT alignment. Where Henderson and Venkatraman (1993,

472-484) concentrate on the connections between the four areas of focus, Luftman and Brier (1999, 109-122) concentrate on the components that are more specific.

2.3 Alignment enablers and inhibitors

Business IT alignment has been studied using a more management emphasised approach. Luftman and Brier (1999, 109) presented the enablers and inhibitors of business IT alignment. The order of their importance was researched by conducting a survey with senior business executives from various functional areas from over 500 companies over the course of six years. The enablers of business IT alignment in order of importance are:

- "Senior executive support for IT
- IT involved in strategy development
- IT understands the business
- Business/IT partnership
- Well-prioritized IT projects and
- IT demonstrates leadership.

The recognised inhibitors of business IT alignment in order of importance are:

- IT/business lack close relationships
- IT does not prioritize well
- IT fails to meet its commitments
- IT does not understand business
- Senior executives do not support IT and
- IT management lacks leadership."

According to Luftman and Brier (1999, 118) successful organisations weigh IT and business equally. In order to achieve this, there must be mutual respect and support between IT and business and they must both be supported by executives. Organisations must concentrate on developing the right skills (Luftman and Brier 1999, 118). Projects must be well prioritised and IT has to demonstrate leadership.

Yang et al. (2011, 1-16) tested Luftman and Brier's business IT alignment enablers and inhibitors in practice in their research of medium sized organisations in Korea. They found that companies can better deploy their IT strategy when they have taken business IT alignment inhibitors and enablers into consideration. Researchers suggest that inhibitors can be changed into enablers by identifying existing issues in a company. (Yang et al. 2011, 13.)

Kurti et al. (2013, 92) found that the alignment enablers that are related to human dimension are the most important ones. In their research, the human dimension is compared to social dimension and intellectual dimension. Those are for example management support for IT, IT business skills and IT leadership skills. (Kurti et al. 2013,

91-92.) Also Tunuguntla et al. (2016, 307) concentrated on human resources in their research. By investing and focusing in building human resources, business value could be gained. This is due to IT understanding the business better and business understanding the IT better. (Tunuguntla et al. 2016, 307.)

Avison et al. (2004, 227) ad to the list of Luftman and Brier. They brought up starting development in tandem as one of the enablers of the alignment. IT not knowing its customers is an inhibitor that they introduce. (Avison et al. 2004, 227.)

2.4 Supply chain perspectives in BITA

Turban et al. (1999, 10) and Scheper (2002, 5) extended the business IT alignment framework with four business perspectives. The business perspectives are strategy and policy, monitoring and control, organisation and processes and people and culture.

Van de Wijngaert et al. (2008, 71-80) combined logistics research with business IT alignment. They developed a business IT alignment framework for the logistics domain, which includes the four business perspectives of Turban et al. and Scheper. In addition, a fifth perspective, information technology, was added. The framework was tested in a case study of radio frequency identification (RFID) adoption. The framework is described in Table 1 below. (Van de Wijngeart et al. 2008, 73.)

Table 1 Business IT alignment framework for logistics domain (Van de Wijngeart et al. 2008, 73)

Maturity *Dimension*	**Pre-Supply Chain**	**Functional Orientation**	**Internally Integrated**	**Externally Integrated**	**Value Chain Integrated**
Strategy and Policy	Logistics only at the basic level	Unsegmented supply base with no formal supply chain partners	Segmented supply base and organized core suppliers	Discussions with trading partners on how to attract customers	Strategy formulation based on a full view of the value chain
Monitoring and Control	Little to no authority outside the shipping area	Monitoring of performance of processes across a limited lateral span of control taking a range of improvement actions	High level of formal control over a greater lateral span of related logistic functions	Monitoring of 1st-tier chain partners	Value chain monitoring & control, real-time inventory
Organization and processes	Logistics defined as shipping	Logistics defined as shipping and warehousing	Logistics defined as shipping warehousing and customer service functions	Just In Time production /delivery, Vendor Managed Inventory	Automated connections between organizations
People and Culture	Clerical style logistics	Run by 'military style' logisticians	Run by (Chief) Logistics Officer	Awareness of the importance of external linkages	Value Chain awareness
Information Technology	Notepad, Word	Barcodes, basic Order Management	Warehouse Management System, Enterprise Resource Planning	Electronic Data Interchange, Customer Relationship Management, Supply Chain Management	Global network

The business IT alignment framework for the logistics domain is based on five dimensions that are divided into five maturity levels. The dimensions are 1) strategy and policy, 2) monitoring and control, 3) organisation and processes, 4) people and culture and 5) information technology. The maturity levels are a) pre-supply chain, b) functional orientation, c) internally integrated, d) externally integrated and e) value chain integrated. The different maturity levels are defined accordingly (Van de Wijngeart et al. 2008, 73):

- "Pre-supply chain; the lowest level of maturity; often the state of a starting organisation.
- Functional orientation; an organisation starts to improve its logistic functions; improving merely at an operational and functional level (within departmental boundaries).
- Internally integrated; the organisation starts to improve its logistics by aligning different functions and organizational entities.
- Externally integrated; the focal point shifts to customers and suppliers, optimizing across the borders of the company becomes the key issue.
- Value Chain Integrated; the company integrates with the full supply chain. The most important property of this level is the end-consumer driven integration from start to end of the value chain."

Beukers et al. (2006, 323-330) combined business IT alignment with procurement and created a procurement alignment framework (PAF). PAF utilises the five business perspectives as well. The framework is described in Figure 2 below.

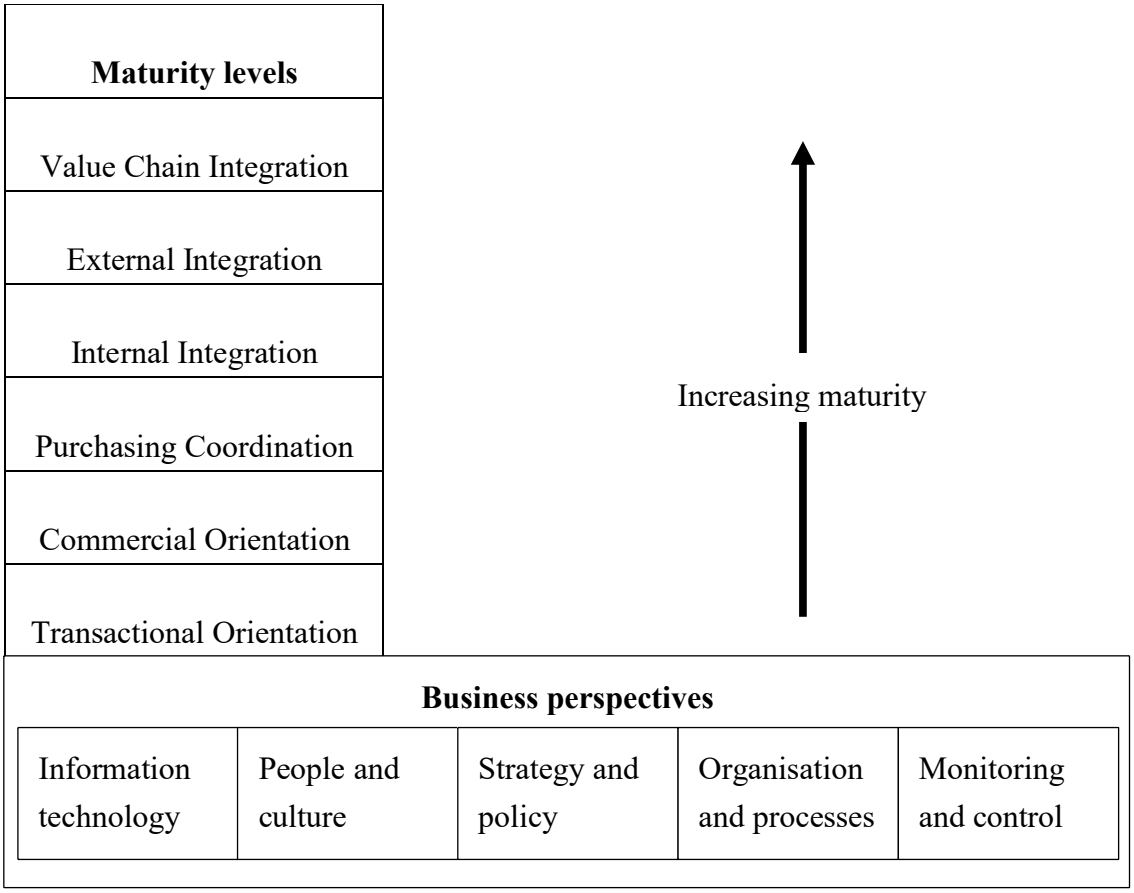

Figure 2 Two dimensional procurement alignment framework (modified from Beukers et al. 2006, 325)

Similar to Van de Wijngeart's et al. (2008, 73) business IT alignment framework for the logistics domain, the procurement alignment framework is based on maturity levels. Other basic factors of the procurement alignment framework are the levels of alignment between perspectives and the segmentation of alignment and maturity. The different maturity levels in PAF are transactional orientation, commercial orientation, purchasing coordination, internal integration, external integration and value chain integration. The five business and IT perspectives in PAF are the company's procurement strategy and policy, organisation and processes, monitoring and control, people and culture and IT. The level of alignment between perspectives describes the balance of maturity level between the perspectives. A company is more aligned when different business perspectives share the same maturity level. If different perspectives have different maturity levels, they are not aligned. On top of the two dimensional perspective – the maturity level model, there is a third dimension, segments. Different segments symbolise different spend categories in the procurement alignment framework. The division of

segments optimises the procurement by enabling the procurement officers to concentrate on their specific areas. (Beukers et al. 2006, 325.)

Though approaching the business IT alignment in supply chain management from different angles, Beukers' et al. procurement alignment framework and Van de Wijngeart's et al. business IT alignment framework for logistics domain share some common views. They are both based on the Turban's et al. and Scheper's business perspectives added with the information technology. They both have maturity levels as one dimension. Three highest maturity levels are the same in these frameworks. The goal for an organisation is to reach the highest maturity levels but the most important is to have balance between the maturity levels of different business perspectives.

2.5 Logistics IT alignment model

In this thesis, a logistics IT alignment model was developed by modifying Henderson and Venkatraman's strategic alignment model. The Logistics IT alignment model is described in Figure 3 below.

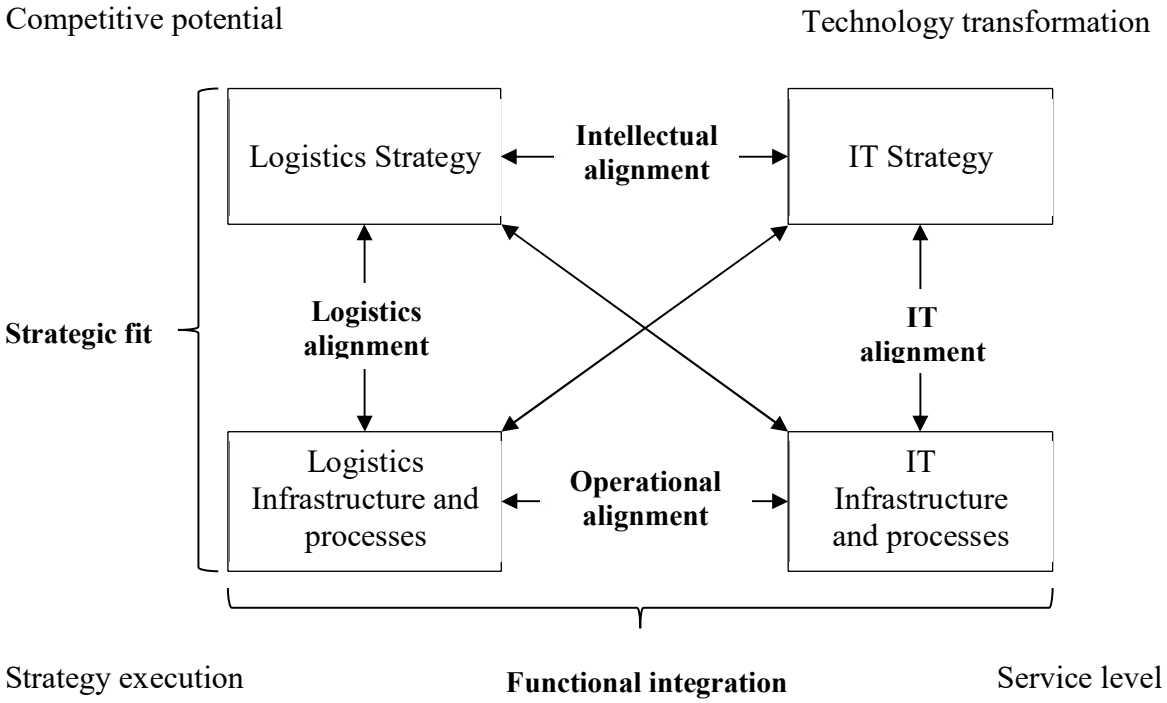

Figure 3 Logistics IT alignment model

Strategic fit is divided into two domains, intellectual alignment and operational alignment. Intellectual alignment describes how logistics and IT support each other. For

example, when a logistics firm has strong IT focus and IT and logistics functions synergise. Operational alignment is executed on a more functional level where logistics and IT infrastructures and processes are aligned. Using an IT tool in logistics execution is an example of operational alignment.

Functional integration is divided into logistics alignment and IT alignment. Logistics alignment is alignment between logistics strategy and operations. IT alignment describes how IT strategy and execution are in harmony. There are also cross alignments between the four focus areas.

The four dominant alignment perspectives of logistics in the IT alignment model are similar to the original strategic alignment model.

- The strategy execution perspective concentrates on formulating and implementing logistics IT strategy.
- The technology transformation perspective focuses on finding the most valuable information technology solutions. It is important to understand a company's logistics strategy and its existing IT competencies in order to find solutions that advance its objectives in an effective manner.
- The competitive potential alignment perspective concentrates on uniting logistics strategy and IT competencies. The role of top management is to act as visionaries and the role of IT management is to bring up potential IT solutions.
- The service level perspective focuses on continuously improving the logistics IT portfolio.

3 ENTERPRISE MOBILE APPLICATIONS

Multiple studies have been conducted in the area of mobile technology during the last decade. The focus of this thesis is on enterprise mobile applications. For example, Al Bar et al. (2011, 60-65), Gurtner et al. (2014, 177-188) and Legner et al. (2016, 817-831) have studied this area. However, these studies tend to be either general views of the topic or they concentrate on a field other than logistics, such as electronic procurement (Gebauer and Shaw, 2004, 19-41) or sales (Tai et al. 2016, 141-157).

Enterprise mobile applications are systems that are designed for employees of a certain company to gain access to their information technology systems in order to improve competiveness and increase efficiency (Unhelkar and Murugesan 2010, 33). Some examples of enterprise mobile applications are Skype for Business (communications), iZettle Go (money transfer), and F-Secure Freedom for Business (security).

3.1 Components of enterprise mobile applications

In Table 2 below, there is a list of some of the most important features of successful enterprise mobile applications according to different authors.

Table 2 Important features of successful enterprise mobile applications

Author	**Features**
Al Bar et al. 2011	a) devices b) connections c) application platform capability d) support and management e) security
Gebauer and Shaw 2004	a) functionality b) portability c) system performance and user support
Gurtner et al. 2014	a) convenience b) perceived quality c) enjoyment d) perceived ease of use e) perceived usefulness
Legner et al. 2016	a) system quality b) information quality c) process quality d) service quality e) use f) user satisfaction g) individual benefits h) management support
Nah et al. 2005	a) efficiency b) effectiveness c) customer satisfaction d) security e) cost f) employee acceptance
Natchetoi et al. 2008	a) timely and easy to access system b) transparency between connection modes c) loose-coupling system d) lightweight composition and development e) low total cost of ownership

Multiple authors agree that support is one of the most important features for enterprise mobile applications (Gebauer and Shaw 2004, 22; Al Bar et al. 2011, 60-61; Legner et al. 2016, 821). Connection is another feature that is mentioned by multiple authors (Natchetoi et al. 2008, 27; Al Bar et al. 2011, 60-61). Nah et al. (2005, 87) and Al Bar et al. (2011, 60-61) both agree that security is very important as well.

Legner et al. (2016, 821) list system, information, process and service quality as important features whereas Gurtner et al. (2014, 177) view quality from the end user's

perspective as perceived quality. User satisfaction is mentioned using slightly different terms by Gurtner et al. (2014, 177), Legner et al. (2016, 821) and Nah et al. (2005, 87). Costs are mentioned by Nah et al. (2005, 87) and Natchetoi et al. (2008, 27).

Only Al Bar et al. (2011, 60-61) mention devices. Other authors concentrated on the information systems themselves. Lightweight composition and development (Natchetoi et al. 2008, 27), efficiency and effectiveness (Nah et al. 2005, 87) and portability (Gebauer and Shaw 2004, 22) are also features that are not mentioned by multiple authors.

3.2 Advantages and disadvantages of enterprise mobile applications

Despite the increase in the usage of mobile technologies for business purposes, many companies have difficulties in implementing them successfully (Legner et al. 2016, 817). In TTable 3 Implications of enterprise mobile applicationsbelow there is a comparison of the advantages and disadvantages of enterprise mobile applications.

Table 3 Implications of enterprise mobile applications

Advantages	Disadvantages
Efficiency Cost reductions Effectiveness Accessible Simple Easy to use Streamlined processes Increased productivity Easier supply chain management Real time information Functionality Multi-platform use Flexibility Productivity	Dependence on IT Security concerns Dependence on internet connection Risky invest due to technology getting outdated quickly Increased surveillance and control over employees Increased telecommunications costs Applications not getting user acceptance

Multiple advantages of enterprise mobile applications are mentioned in different studies. Accessibility (Bangert 2013, 31; Car et al. 2014, 208; Gurtner et al. 2014, 185; Chung et al. 2015, 93; Pavin and Klein 2015, 2019) and real-time information (Car et al. 2014, 218; Chung et al. 2015, 93; Pavin and Klein 2015, 219; Tai et al. 2016, 142) are the most commonly mentioned advantages. Increased productivity (Car et al 2014, 217; Pavin and Klein 2015, 225), efficiency (Pavin and Klein 2015, 219; Tai et al. 2016, 141)

and effectiveness (Gurtner et al. 2014, 177; Pavin and Klein 2015, 219) were also noticed by multiple researchers.

The usage of enterprise mobile applications may cause cost reductions in, for example, administrative costs, printed materials and by replacing some job positions (Car et al. 2014, 217; Pavin and Klein 2015, 227). In their study on supply chain management in the hospitability industry, Car et al. (2014, 208-211) found simplicity, ease of use, streamlined processes and easier supply chain management to be advantages of EMA. Functionality, multi-platform use and flexibility were mentioned as advantages by Gurtner et al. (2014, 185).

There are some disadvantages or risks mentioned by authors in EMA. Companies have to take risks when investing into mobile technologies due to rapid technological change. Applications may get outdated quickly. Many applications have not managed to gain user acceptance. (Legner et al. 2016, 817.) Al Bar et al. (2011, 64) raise the topic of authentication and permissions. One must consider who has access to the mobile applications and who assigns the permissions. This affects data security. (Al Bar et al. 2011, 64.) The dependence on internet connections may also be seen as a risk. Some applications demand a continuous internet connection in order to function properly. (Beji and Nelkadhi 2008, according to Al Bar et al. 2011, 64.) According to Pavin and Klein (2015, 219) enterprise mobile applications may increase employers surveillance and control over their employees. Applications also often increase telecommunications costs (Pavin and Klein 2015, 227).

3.3 ERP mobile applications

Enterprise resource planning systems integrate different business functions, for example logistics and processes, in organisations (Tai et al. 2016, 142). The significance of ERP systems has increased in the last two decades (Francoise et al. 2009, 387-388; Luftman et al. 2012, 200). Many studies in mobile business applications research concentrate on applications based on ERP systems (Natchetoi et al. 2008, 27-32; Bangert 2013, 30-33; Tai et al. 2016, 141-157). Though Pavin and Klein (2015, 220) argue that most of the papers concentrate on technical features and architecture, not on organisational changes and effects or their business value.

Tai et al. (2016, 141) concluded that ERP mobile applications enhance the productivity of processing operations in sales and distribution. In their quantitative analysis of ERP processing times in three different scenarios, they concluded that ERP mobile applications might run significantly faster than traditional ERP systems (Tai et al. 2016, 150). The structure of a mobile ERP system is described in Figure 4 below.

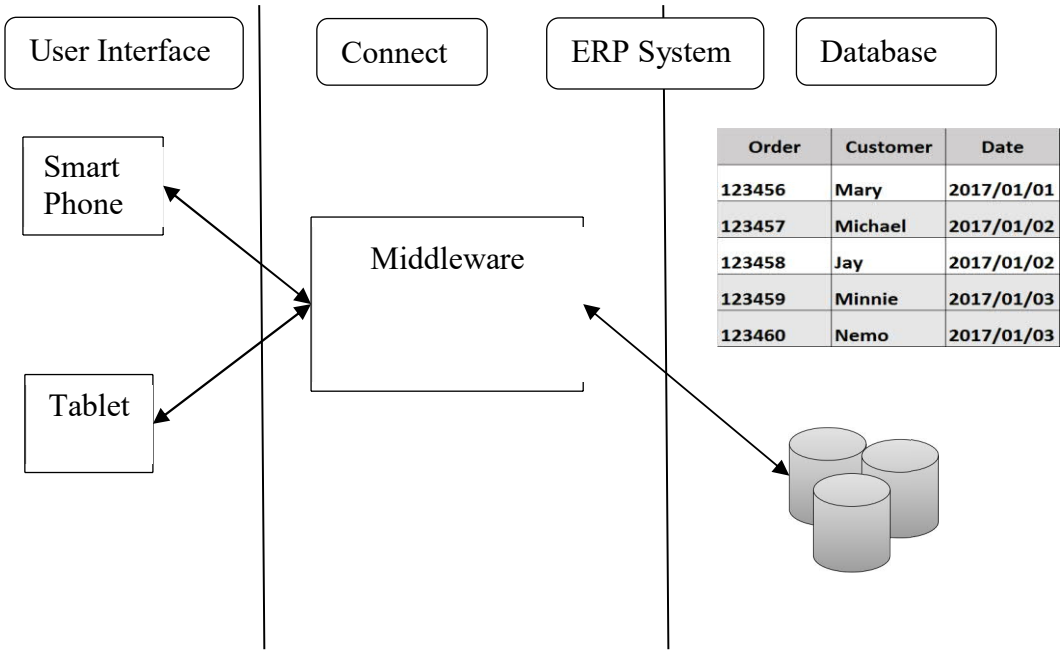

Figure 4 Mobile ERP system

A basic mobile ERP system consists of three tiers: user interface (UI), connect and database. The ERP system itself is between the connect and the database tiers. In the first tier, users may access the ERP system via an application program's user interface by using mobile devices, for example smartphones or tablets. In the second tier, the application program is connected to the core system using middleware. In the third tier, the ERP database is accessed to connect to the storage of business related information such as the master data of transactional data. (Tai et al. 2016, 144.)

In their research Tai et al. (2016, 156) raised two issues for further research. Both of them are warehouse-related. Studying logistics mobile application options for inventory including stock-level inquiry, regular inventory or periodic inventory was suggested. Also applications' and devices' abilities to read stock products' labels or tags rather than manual input should be studied. (Tai et al. 2016, 156.)

3.4 Logistics mobile applications

In this research, the term logistics is considered as the activity of transporting goods including warehousing in between. In order to examine enterprise mobile applications usage especially in logistics tasks, the key points are gathered together in Figure 5 Logistics below.

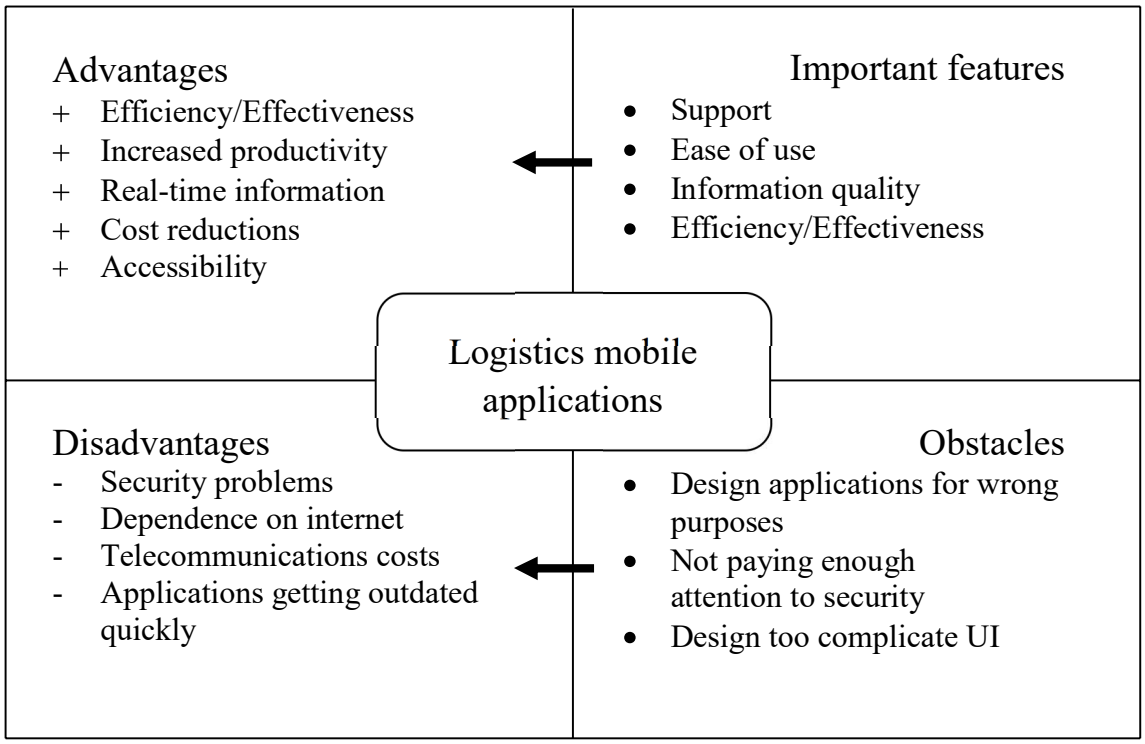

Figure 5 Logistics mobile applications

The advantages of enterprise mobile applications in logistics are efficiency and effectiveness, increased productivity, real-time information, cost reductions and accessibility. Efficiency and effectiveness may be gained from time saved by employees being able to carry information technology solutions with them. This decreases the need to switch from stationary IT equipment to actual logistics tasks. This can lead to cost reductions from time saved. Accessibility enables getting information from information systems during logistics tasks. Real-time information might be an advantage especially in logistics planning in rapidly changing environments. Employees being able to upload their work to information systems means more people can reach it real-time. All of the advantages mentioned above enable increased productivity.

The disadvantages include security problems, dependence on internet connections, telecommunications costs and applications getting outdated quickly. Higher costs are caused by increased amounts of mobile devices. Rapid technological change may cause applications getting outdated quickly. An application's dependence on internet connections may cause problems, for example in warehouses that do not have internet connection inside and where it is hard to set up there. In transportation, it may be a disadvantage when countries' borders are crossed. Security problems may be caused by access and authentication. The most important features in logistics enterprise applications are support, ease of use, information quality and efficiency and effectiveness.

Considering the advantages, disadvantages and important features presented above, obstacles that should be avoided in the development of enterprise mobile applications are

designing applications for wrong purposes, not paying enough attention to security and designing too complicated user interfaces. Designing applications for wrong purposes prevents gaining the potential efficiency and effectiveness improvements and increased productivity. Not paying enough attention to security leads to security problems. Since security has risen as one of the key topics in the IT field, this obstacle may be discussed in many logistics applications development projects. Designing too complicated UI hampers an applications' ease of use and accessibility.

4 THEORETICAL FRAME OF REFERENCE AND RESEARCH SETTING

The business IT alignment connected to logistics mobile applications forms the basis of this research. Their connection is illustrated in Figure 6 Theoretical frame of referencebelow. The research questions (RQ1-2) and propositions (P1-3) are visualised there as well.

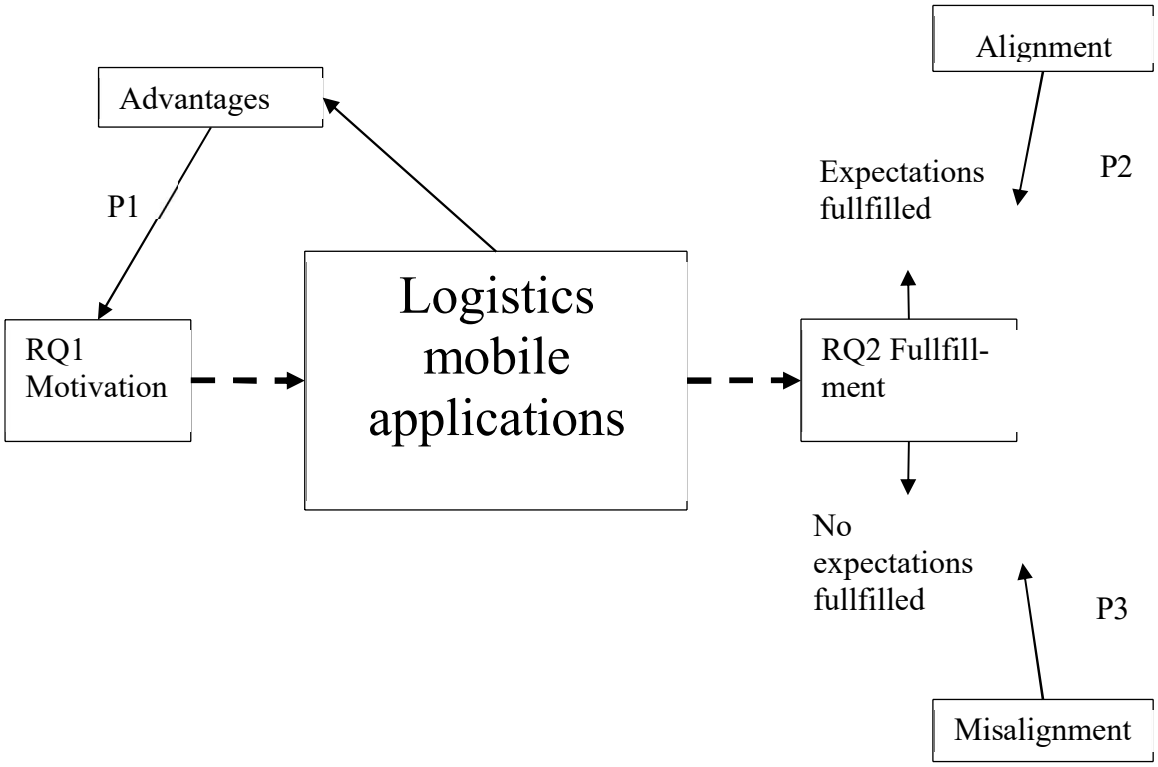

Figure 6 Theoretical frame of reference

The research questions set in this research are *RQ1: What are the motivators of the adoption of enterprise mobile applications in logistics? RQ2: How are the expectations regarding mobile applications fulfilled and why?* The first research question aims at testing and understanding the objectives and vision behind the decision to develop and or deploy logistics mobile applications. The second research question aims at testing and understanding whether the objectives and vision tested by RQ1 have been realised or not and what the reasons behind this are.

The three propositions have been developed to explain the usage of mobile applications in logistics. The research propositions are divided according to the research questions. The proposition based on the first research question (RQ1) is:

> *P1: A motivator for mobile applications usage in logistics is to gain the supposed advantages of logistics mobile applications: accessibility, real-time*

information, increased productivity, efficiency and effectiveness, cost reductions.

The propositions based on the second research question (RQ2) are:

P2: If there is alignment between logistics and IT, the expectations will be better fulfilled.

P3: If there is misalignment between logistics and IT, the benefits from mobile applications cannot be fully reached.

In order to test the propositions P3 and P4 we must measure, whether the research companies have alignment or misalignment between logistics and IT. A logistics IT alignment measurement tool has been developed for that purpose based on the previous research presented in chapter two. The alignment measurement tool tests the alignment by means of a short questionnaire. The answers are scored and these scores give an evaluation of a company's alignment. The questionnaire consists of 16 statements. The interviewees answer the following question by choosing the right value between 0 and 4: How well do the following statements describe your organisation? (0= does not describe at all, 4=describes very well). The statements are presented in Table 4 below. Next to each statement is the alignment type that the statement measures.

Table 4 The logistics IT alignment measurement tool questionnaire

Statement	Alignment type
1. Senior executives support new IT projects	Intellectual
2. IT is involved in strategy development	Intellectual
3. IT understands the logistics	Intellectual
4. Logistics and IT have good partnership	Intellectual
5. IT projects are well-prioritised	Operational
6. IT demonstrates leadership	Operational
7. Logistics and IT support each other	Intellectual
8. Logistics and IT infrastructures and processes are aligned	Operational
9. Logistics strategy and operation are aligned	Logistics
10. IT strategy and execution are aligned	IT
11. IT and logistics lack close relationships	Intellectual
12. IT does not prioritise well	IT
13. IT fails to meet its commitments	IT
14. IT does not understand logistics	Intellectual
15. Senior executives do not support IT	Intellectual
16. IT management lacks leadership	IT

The answers are scored accordingly: For questions 1-10, points are given according to the number selected. For questions 11-16, points are given according to the number selected multiplied by minus one. The points for all of the questions are added up and the total score is interpreted accordingly:

- Less than 12 points or less than 30 per cent.
  The company has misalignment.

- 12-20 points or less than 50 per cent.
  The company has no clear alignment or misalignment.
- More than 20 points or more than 50 per cent.
  The company has high alignment.

The maximum score is 40 points and the minimum score is minus 16 points.

5 RESEARCH DESIGN

This study is an empirical study. Empirical study is based on observing research objects and deriving conclusions based on these observations (Nummenmaa 2004, 19). In this study the qualitative research method is used. Companies utilising logistics mobile applications are interviewed. Data gathered from these interviews is analysed. The qualitative research method concentrates on describing, interpreting and understanding the subject of research (Eriksson & Kovalainen 2008, 5), in this research, the utilisation of mobile applications in logistics. The qualitative approach is sufficient for this research considering the objective of the research. The objective of this research is understanding the motivators of logistics mobile applications usage and their fulfilment. Qualitative research provides an in depth understanding of the research problems that require more interpreting than measuring (Eriksson and Kovalainen 2008, 5).

In this research the constructive approach is used. The research approach is visualised in Figure 7 Research approach (modified from Kasanen et al. 1993, 257).. The constructive approach aims at solving practical problems by using constructions. The constructions can be models, diagrams, plans etc. (Kasanen et al. 1993, 243.) The research process of this research follows the constructive research process phases. First, a practical problem with research potential is identified. The problem in this study is understanding the motivators of logistics mobile application usage and their fulfilment. General and comprehensive understanding of the theme has been obtained by exploring previous research in the literature review. An idea for a solution has been constructed and presented in chapter 4 as propositions (P1-3). Next, the idea of a solution is tested through empirical research. The connections between the solution and theory are shown as well as the research contributions. Finally, the scope of applicability of the solution is examined. (Kasanen et al. 1993, 243.)

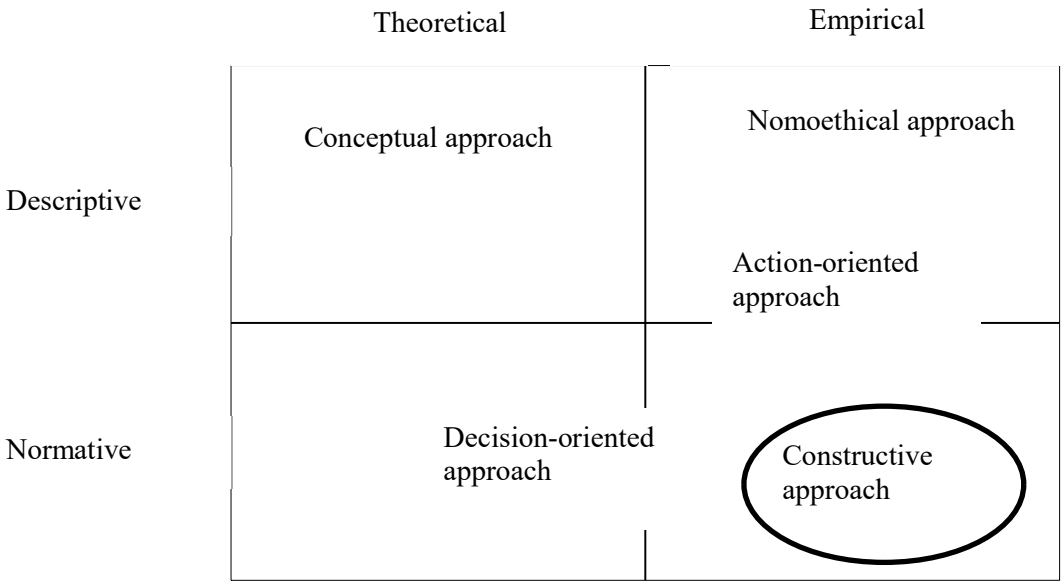

Figure 7 Research approach (modified from Kasanen et al. 1993, 257).

In a two dimensional comparison between the theoretical or empirical approach and the normative or descriptive approach, the constructive approach is located in the empirical and normative area. Other research approaches that draw close to constructive research are the decision-oriented approach and the action-oriented approach. The conceptual approach, opposite to the constructive approach, ins located in the theoretical and descriptive area. The fifth approach, the nomoethical approach, is also descriptive but belongs to the empirical research approach. (Kasanen et al. 1993, 257.)

The research process of this research follows the deductive research process. The five steps of a deductive research process are described in Figure 8 Deductive research process (modified from Spens and Kovács 2006, 376) below.

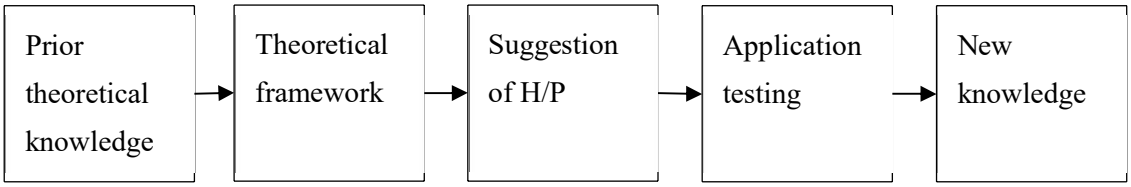

Figure 8 Deductive research process (modified from Spens and Kovács 2006, 376)

The deductive research process begins with gathering prior theoretical knowledge about the subject of research. Next, a theoretical framework is constructed based on the theoretical knowledge. Hypotheses or propositions are suggested and in the fourth step, they are tested. New knowledge is the result of the research. (Spens and Kovács 2006, 376.)

In this research, the theoretical framework and propositions were constructed based on the theoretical knowledge gathered from the literature review. Application testing was conducted by interviewing organisations that use logistics mobile applications and by analysing the data from the interviews. In addition, the interview questions were established based on the theoretical knowledge and the constructed theoretical framework and propositions. New knowledge is gained based on the analysis.

5.1 Data collection

The research data has been gathered from interviews with five different organisations that use logistics mobile applications. Some of the interviewed organisations are logistics companies and others are in another industry but have extensive in-house logistics functions. The interviewed organisations were selected based on the researcher's knowledge on organisations using logistics mobile applications. Interviews were limited to organisations that are currently using logistics mobile applications leaving out those that had used them previously but not currently and those that were only in the planning stage or had ongoing application projects but had not implemented them yet. Following this principle enabled the researcher to get more accurate and informative answers to the interview questions. Organisations A, D and E were the largest with turnovers of more than 100 million euros. Organisations B, C and E were in the logistics industry. In addition, organisation D was active in the public transportation, which belongs to the logistics sector. Organisation A was focused primarily on healthcare and social services.

Five interviews were conducted in the spring 2018. They were documented with a voice recorder. The answers to the questionnaire were also written down during the interviews. The interviewees were chosen by selecting people that had participated in mobile applications development and implementation projects in their organisations. Table 5 presents the interviewed companies and basic data about the applications and devices that they use.

Table 5 Companies interviewed

Org	Interviewed persons	Industry	Turnover M€	Personnel	Amount of end user's	Amount of applications, WM = warehouse management, TRANS = transportation	Device
A	Warehouse manager	Healthcare and social service	100-500	1000-5000	7 devices used by multiple users on different shifts	7 WM	Android based handheld device
B	Process owner	Logistics	50-100	100-500	5 users at time, together 15 users	1 TRANS	Independent from end device
C	IT manager	Logistics	50-100	100 + 500 agreement drivers	250 vehicles	1 TRANS	Independent from end device
D	Logistics specialist	Public transportation	100-500	1000-1500	7 users	5 WM	Zebra handheld device
E	Specialist at a IS project	Logistics	> 1 000	5000-10000	1 000 users	1 TRANS (10 functions)	Panasonic tablets

Interviews were divided into four sections. The first section was background information. The theme of the second section was the organisation's expectations towards the mobile application and development and implementation project. In the third section, the fulfilment of the expectations was discussed. Finally, the interviewees answered the questionnaire for the alignment measurement tool presented in chapter four. Not all the interviewees answered all the questions but they answered according to their personal knowledge. The interview questions are presented in Appendix 1.

5.2 Data analysis

The data gathered from the interviews was analysed. The analysis of qualitative data consists of, for example, the coding, labelling and grouping of data. Data analysis can be divided into five phases. The phases are; preparing the data for analysis, exploring the data, analysing the data, representing the data analysis and validating the data. (Creswell and Plano Clark 2007, 129.)

In this thesis, the data was prepared for analysis by listing all the advantages and disadvantages that the interviewees mentioned. The data analysing was conducted in this study by comparing the answers of the interviewees with each other and with previous literature. Similarities and differences between individual interviewees' answers were gathered together by question. The data analysis for this study is represented in this thesis.

5.3 Reliability and validity of the research

Reliability and validity are classic evaluation criteria for measuring the trustworthiness of research. Reliability measures the repeatability of research. It tells if the same results may be obtained when repeating the same research. Validity refers to the genuine description of the subject. Validity may be accomplished through analytical induction and reflexivity. (Eriksson and Kovalainen 2008, 292.) On the other hand, validity is also gained by choosing the right research method study for the specific subject (Hirsijärvi et al. 2007, 227). According to Yin (1994, 13) a case study is suitable especially in studies where the distinction between the contemporary phenomenon and its context is hard to make.

In this research, reliability was increased by constructing the structure of the interview beforehand and by following the same structure, themes and questions throughout all the separate interviews. The validity of the research was improved with a thorough familiarisation of the theoretical knowledge, based on which interview questions were formed.

Triangulation is another method for improving the trustworthiness of research. In triangulation, many different perspectives are utilised in order to explain and formulate research findings. The downside of triangulation is that the results of the research may be mixed and ambiguous. On the other hand, this may lead to new ideas or subjects of research. (Eriksson and Kovalainen 2008, 292.)

There are multiple different forms of triangulation that may be used together or separately. The different forms are the triangulation of methodologies, the triangulation of methods, the triangulation of data, the triangulation of theories and the triangulation of researchers. In this research, the triangulation of data and triangulation of theories were used. Data was gathered from multiple sources, that is to say, from multiple different organisations. The triangulation of theories was executed by using two different theoretical approaches to the subject, business IT alignment and enterprise mobile applications theory.

6 RESULTS

The outcome of the qualitative research is presented in this chapter. The findings based on the empirical data are analysed. This chapter is divided into two sections according to the research questions. In addition, the impact of logistics IT alignment to logistics mobile application usage is considered.

In the first section, the motivators and expectations behind the implementation of logistics mobile applications are analysed. The second section concentrates on the fulfilment of the expectations and the reasons behind fulfilment. The business IT alignment theory and the alignment measurement tool are utilised in this section.

6.1 Expectations

The first research question set in this research is *RQ1: What are the motivators of the adoption of enterprise mobile applications in logistics?* The questions examined what risks the organisations identify before starting their logistics mobile application project, what advantages they expect to gain with the logistics mobile application and why they decide to start using logistics mobile applications.

In some questions, the interviewees' answers were similar to one another. However, their answers varied greatly in other questions. The answers were mostly in line with the theory presented in previous chapters, but the interviewees did give answers that were outside the expectations based on theory as well.

6.1.1 Expected advantages of enterprise mobile applications

Ease of use was mentioned by almost all of the interviewees as an expected advantage. Especially the interviewee from organisation C emphasised this advantage. Unlike the other organisations, that used paper-based solutions before the implementation of their logistics mobile application, organisation C had already used a mobile-based solution before implementing their specific logistics mobile application discussed in the interview. This explains why they had a slightly different emphasis on their expectations. The interviewee from organization C emphasised the ease of deployment, which led to higher employee acceptance, and ease of maintenance and updating of the application.

The interviewee from organisation B also mentioned the demand for easy to use applications though in their organisation this was considered while identifying risks. The interviewee from organisation B emphasised that the user experience must be fast and simple to use. It must not have too small font or too many clicks. The importance of this

comes up especially during cold weather when drivers have to take their gloves off outside while using the mobile device.

For organisation E high information quality was of key importance. They expected the mobile application to be easy to use. Ease of use would help improve the information quality by preventing errors in end users tasks. The interviewee from organisation D mentioned ease of use as well. They wanted to improve the working environment and tools of the end users and thus make work easier.

Ease of use is mentioned in the literature as well. Car et al. (2014, 208-211) mentioned ease of use as an advantage of enterprise mobile applications. In addition to an advantage, it was also mentioned in the important features of successful enterprise mobile applications by Gurtner et al. (2014, 177). It was also mentioned by Legner et al. (2016, 821) under the term use and user satisfaction, by Nah et al. (2005, 87) as employee acceptance and by Natchetoi et al. (2008, 27) as ease of access to the system.

Consuming less paper was mentioned by multiple interviewees as an expected advantage. In literature, the decreased paper consumption was mentioned as a source of cost reductions (Car et al. 2014, 217; Pavin and Klein 2015, 227). The interviewee from organisation D described that sometimes they had even had to use post it notes. The interviewee from organisation A also mentioned that they used to have high paper demand, which caused costs, before switching to their logistics mobile application. However, the reduction of manual work was perceived as a higher advantage to decreased paper consumption due to reduced costs in multiple organisations. For example, the need for printing was minimised. In addition, the information that was previously manually copied from a printed excel sheet to the ERP system for invoicing was now transferred automatically from the mobile application to the background ERP system.

Effectiveness and efficiency was mentioned multiple times in the literature as an advantage of enterprise mobile applications (Gurtner et al. 2014, 177; Pavin and Klein 2015, 219; Tai et al. 2016, 141). Increased effectivity was also mentioned by the interviewee from organisation A. They connected increased effectivity with a logistics mobile application's ability to streamline work. Tasks would be done smoothly without problems. They also mentioned speeding up the process. According to the interviewee from organisation D the mobile application would increase effectivity by decreasing the need for end users to move from their warehouse and the workspace where the computer was. Organisation E thought that the mobile application improved effectivity by bringing the information system into the field.

Improved information quality was expected to be gained by organisation B since a printed excel spreadsheet can contain only a limited amount of information. The logistics mobile application may contain all the information that is deemed important enough to include. If information is updated in the ERP system, for example if the planned route of a driver is changed during a shift, the information in the mobile application is updated

simultaneously and the user gets more real-time and accurate information. Vice versa, the traceability of the shipments is also higher and information is more real time. According to the interviewee from organisation C, this is useful if customers have questions about shipments.

As mentioned above, organisation E was especially interested in improving their information accuracy. They had been utilising radio frequency identification technology to distinguish their equipment. They expected to decrease the possibility of human error and therefore improve information quality significantly.

Real-time information is also one of the most often mentioned advantages of enterprise mobile applications in literature (Car et al. 2014, 218; Chung et al. 2015, 93; Pavin and Klein 2015, 219; Tai et al. 2016, 142). Better information quality is mentioned by Legner et al. (2016, 821) as an important feature of successful enterprise mobile applications.

The different advantages of logistics mobile applications are visualised in Figure 9 Expected advantages of logistics mobile applicationsbelow. The size of a slice describes the significance of a feature, how often it was mentioned compared to the other features. For example, ease of use was mentioned 4 times from the 17 advantages identified by different interviewees.

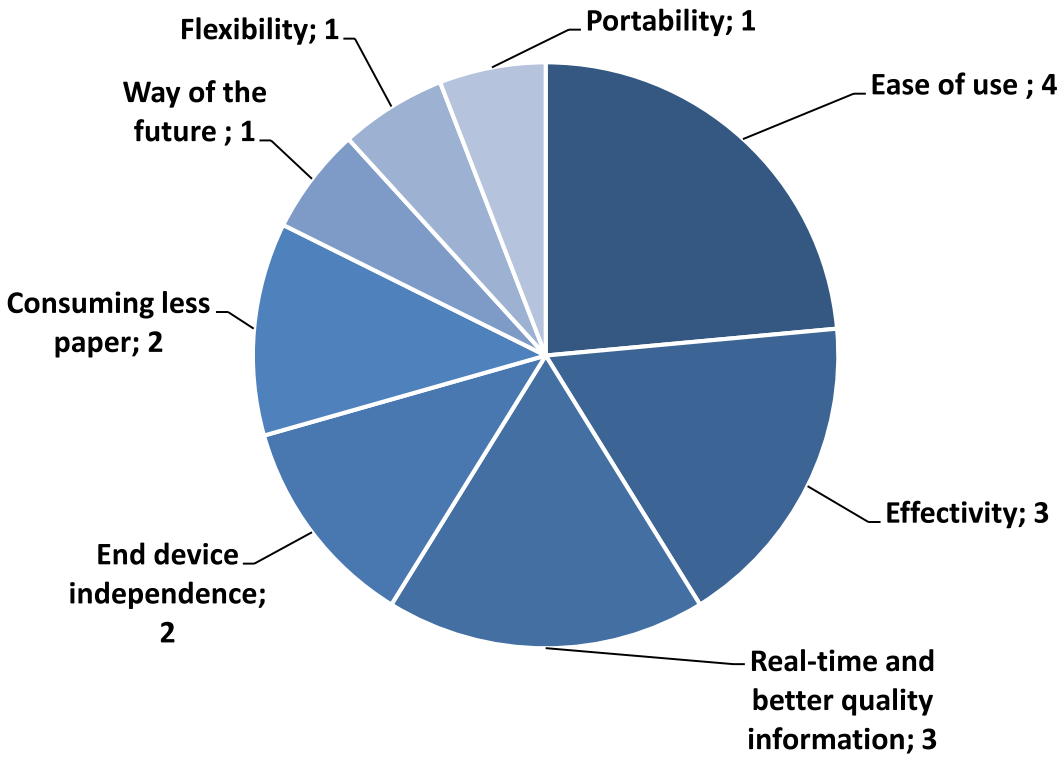

Figure 9 Expected advantages of logistics mobile applications according to interviewees

End device independence was an important expected advantage for the interviewee from organisation C. The contract drivers for organisation C can choose on which device

they want to use the logistics mobile application. They do not have to buy a certain device that might get outdated quickly. The interviewee from organisation B also mentioned that different subcontractors use organization B's logistics mobile application on different kinds of devices, though they were worried of the possibility that if the transportation companies use many different kinds of devices, the drivers have to cope with many different devices.

End device independence is not mentioned in the literature review in chapter three as such. However, Gurtner et al. (2014, 185) mention the advantages of multi-platform use. Whereas Al Bar et al. (2011, 61) suggest that choosing the device is a crucial decision in enterprise mobile application implementation. This challenge can be bypassed by developing an application that is end device independent like in the case of organisation C. Technology getting outdated quickly is identified as a risk by Legner et al. (2016, 817). Avoiding this risk by developing an end device independent application was organisation C's goal.

One motive, mentioned by interviewee from organization A, was seeing logistics mobile applications as the way of the future. This motive adds to the research framework presented in chapter three. This point arose when discussing the risks of logistics mobile applications.

Gurtner et al. (2014, 185) mentioned flexibility as one of the key advantages of enterprise mobile applications. This advantage was also identified by organisation D. The interviewee from organisation E said that being able to bring the information system into the field was one of their main reasons to start developing their mobile application. Portability was also mentioned in the literature by Gebauer and Shaw (2004, 22).

6.1.2 Considered risks of enterprise mobile applications

Distrusting the system was clearly the most often mentioned identified risk before the beginning of a logistics mobile application development and implementation project. It was mentioned by four organisations. The interviewee from organisation A thought that paper was more secure and trustworthy though less convenient than the information system. The interviewee from organisation B was worried about the information transfer between the mobile application and the background system not being reliable. A risk that organisation E had identified was that the application would not work as designed.

The interviewee from organisation C considered the mobile application's information security a risk that highlighted the need for trust in the system. Regarding information security, especially user management and interfaces to different databases rose up in the conversation. Al Bar et al. (2011, 64) also raise information security as an identified risk.

Nah et al. (2005, 87) emphasise the importance of information security in successful enterprise mobile applications.

Internet access problems were mentioned as identified risks in multiple organisations. Besides printing excel sheets, organisation A had previously been using handheld devices and they had had multiple problems with them. The former hand held devices wiped out all the information on the device if they dropped off the network. This former bad experience led to a preconceived attitude towards the new logistics mobile application among some members of the organisation.

Network capacity was identified as a risk by an interviewee from organisation B because the drivers would occasionally use the application in areas with unreliable internet connections. Dependence on internet connections was mentioned as a risk in the literature as well (Beji and Nelkadhi 2008, according to Al Bar et al. 2011, 64). Natchetoi et al. (2008, 27) suggest that transparency between connection modes is important for enterprise mobile applications.

The interviewee from organisation B brought up the risk caused by human error on the list of identified risks. They were worried if the end users would use the application as they were supposed to. The drivers were supposed to immediately register that they had performed the requested transportation task. The goal was to be able to see the exact time when the product had been left to the customer in case of the product getting lost, for example. The respondent feared that the drivers would register all the jobs at the end of the day. This would prevent the transportation managers from seeing the exact time. The risk caused by human error was also identified by organisation E. While organisation B was worried about the end users not understanding the importance of immediate registration, organisation E worried that their end users would not learn how to use the mobile application.

The risk of human error that the interviewees from organisations B and E identified adds to the research framework presented in chapter three. However, in the literature ease of usage was mentioned multiple times (Car et al. 2014, 208-211; Gurtner et al. 2014, 177). Easy to use applications may decrease the risk of human error.

Figure 10 Considered risks of logistics mobile applications according to the intervieweesbelow visualises the different risks that the interviewees identified concerning their logistics mobile applications. The size of a slice describes the significance of a risk, how often it was mentioned compared to the other risks.

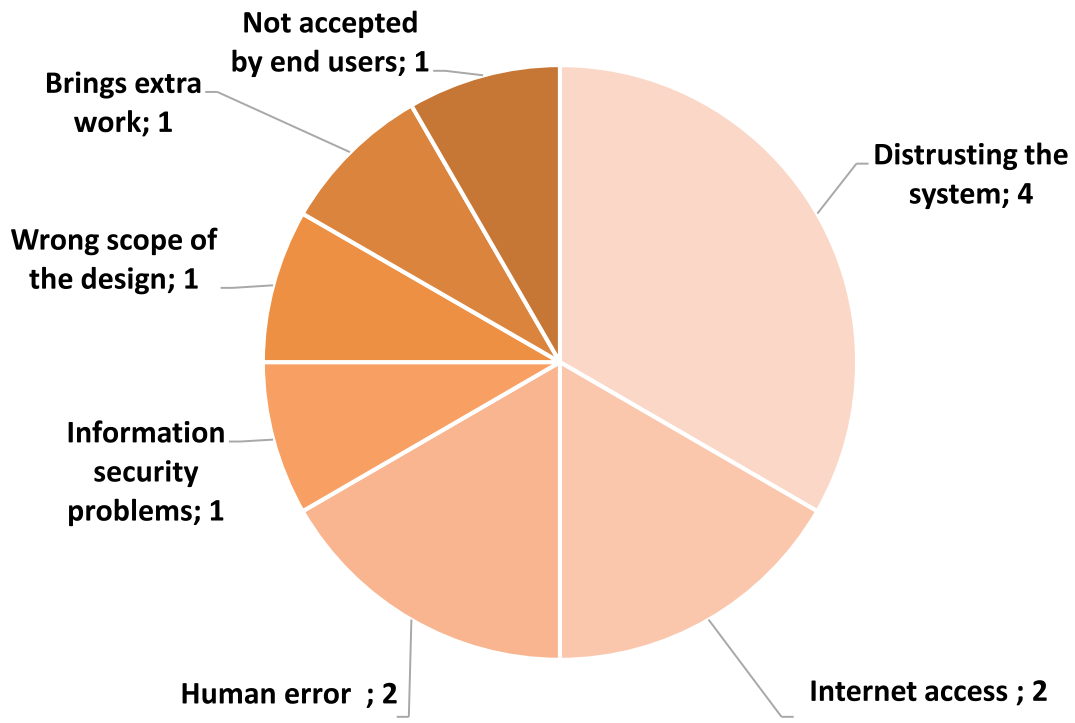

Figure 10 Considered risks of logistics mobile applications according to the interviewees

One risk identified by the interviewee in organisation B was the scope of the design. Has the design of the application been managed to be done on a level that the process is rational? This risk is not mentioned in the literature review in chapter three as such. However designing applications for wrong purposes was recognised as a risk in chapter three.

The interviewee from organisation D explained that extra work was identified as one risk that their logistics mobile application would cause. Another risk that was mentioned, was the mobile application not being accepted by the end users and that they would not actually start using it. The risk of applications not being accepted by end users was mentioned in the literature as well (Nah et al. 2005, 87; Legner et al. 2016, 817).

6.2 Realisation

The second research question set in this research is *RQ2: How are the expectations regarding mobile applications fulfilled and why?* The interviewees had similar experiences with logistics mobile applications implementation. The expected advantages were mostly realised and only one unexpected advantage was identified.

The organisations had faced some unexpected challenges during the implementation phase of their logistics mobile applications, but these challenges were overcome either

before or shortly after the actual implementation. Most of the realised advantages of the logistics mobile applications were in line with the theory. The challenges that the organisations faced, on the other hand, were not as directly connectable with the previous literature presented in chapter three.

6.2.1 The realised advantages

All of the expected advantages were realised according to the interviewee from organisation A. However, they did not notice any unexpected advantages from their logistics mobile application. The interviewee form organisation A presumed that the reason for the lack of unexpected advantages was that the application and its advantages were defined at the design phase so well beforehand.

The interviewee from organisation B was not able to answer the questions on the realisation of expectations for the logistics mobile application. The interviewee from organisation C on the other hand felt that the expected advantages were all realized. Organisation D had not identified any unexpected advantages after the implementation of their mobile application. The expected advantages had been realised for organisation E. They had also found an unexpected advantage.

The paper consumption decreased after the implementation of the application for organisation A. Organisation E had a similar experience. The decrease in paper consumption is mentioned in the literature as a source of cost reductions (Car et al. 2014, 217; Pavin and Klein 2015, 227).

The interviewee from organisation A explained that the application had increased their efficiency and effectivity. For organisation E the increased effectivity showed up as a decreased need for resources as there was no more need for manual entries. The end users read the RFID-tags automatically with their hand held devices and RFID readers. Efficiency is recognised as an advantage by multiple authors (Gurtner et al. 2014, 177; Pavin and Klein 2015, 219; Tai et al. 2016, 141).

For organisation C, one functional advantage was that information flow became faster and the organisation improved the geographic information provided by their logistics mobile application compared to the old application. For example, they could gather information about the different unloading locations. Organisation E was also able to improve their information quality with their application. Since the information tags from their equipment are read automatically, the information in their system is more accurate than before when they manually entered the information to their information system. Real-time information is also considered an advantage by multiple authors (Car et al. 2014, 218; Chung et al. 2015, 93; Pavin and Klein 2015, 219; Tai et al. 2016, 142). Legner et al. (2016, 821) also recognized better information quality as an advantage.

In Figure 11 Realised advantages of logistics mobile applications according to the interviewees below, the realised advantages of logistics mobile applications that the interviewees identified are visualised. The size of a slice describes the significance of an advantage.

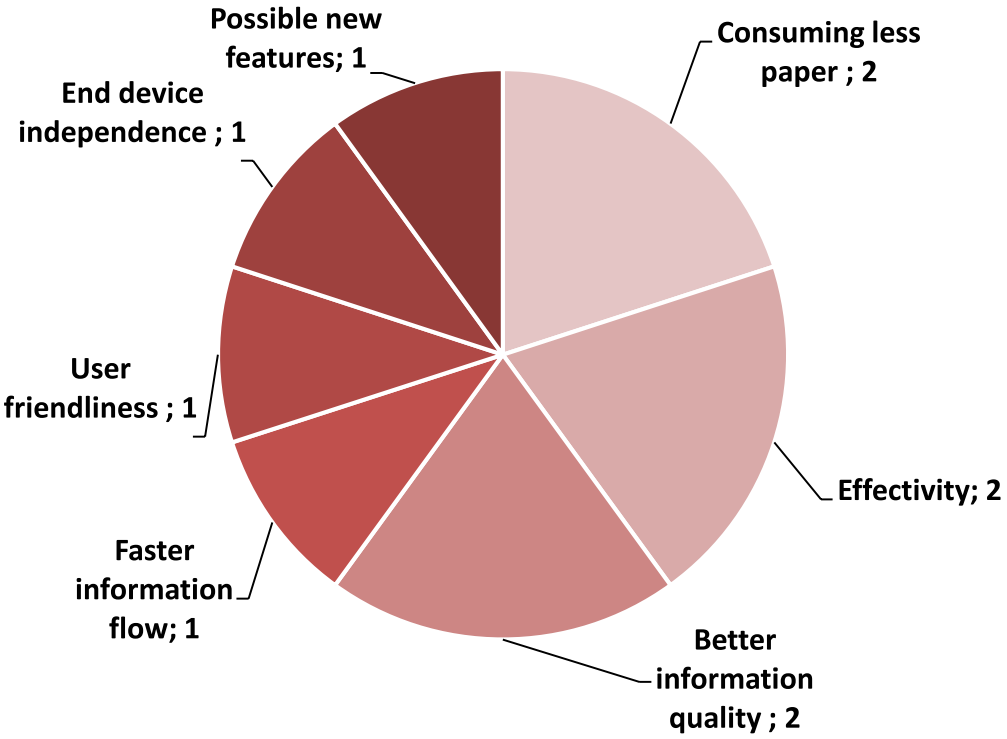

Figure 11 Realised advantages of logistics mobile applications according to the interviewees

Other advantages that realised for organisation C were user friendliness and end device independence. Contract drivers could choose and buy their own devices, which benefitted the organisation as it led to high user acceptance. Employee acceptance (Nah et al. 2005, 87) and user satisfaction (Legner et al. 2016, 821) are mentioned as important features of successful enterprise mobile applications. The perceived ease of use and perceived usefulness that are mentioned in the literature (Gurtner et al. 2014, 177) are part of user friendliness. Though end device independence is not mentioned in the literature review as such, multi-platform use is mentioned as an advantage of enterprise mobile applications (Gurtner et al. 2014, 185).

Organisation E was able to identify one unexpected advantage. When designing the first version of their application, they had expected to use the application only for the task that it was initially designed for. Later they had been able to add new features and interfaces to other systems to their application.

6.2.2 The realised disadvantages

In the beginning, both organisations D and E had had some problems with internet connections. If organisation D's devices were not used for a while, they would lose signal. They also had problems with connecting to their private network. The interviewee from organisation B believed that the reason for these difficulties was that the application was customised and not an existing product. With experience from users, the problems could be fixed. Organisation E's problem was that in the beginning the 2G network did not work in all the places that it was supposed to. Beji and Nelkadhi (2008, according to Al Bar et al. 2011, 64) mentioned dependence on internet connection as a disadvantage of an enterprise mobile application.

In Figure 12 Realised disadvantages of logistics mobile applications according to the intervieweesbelow, the realised advantages of logistics mobile applications are visualised. The size of a slice describes the significance of a disadvantage.

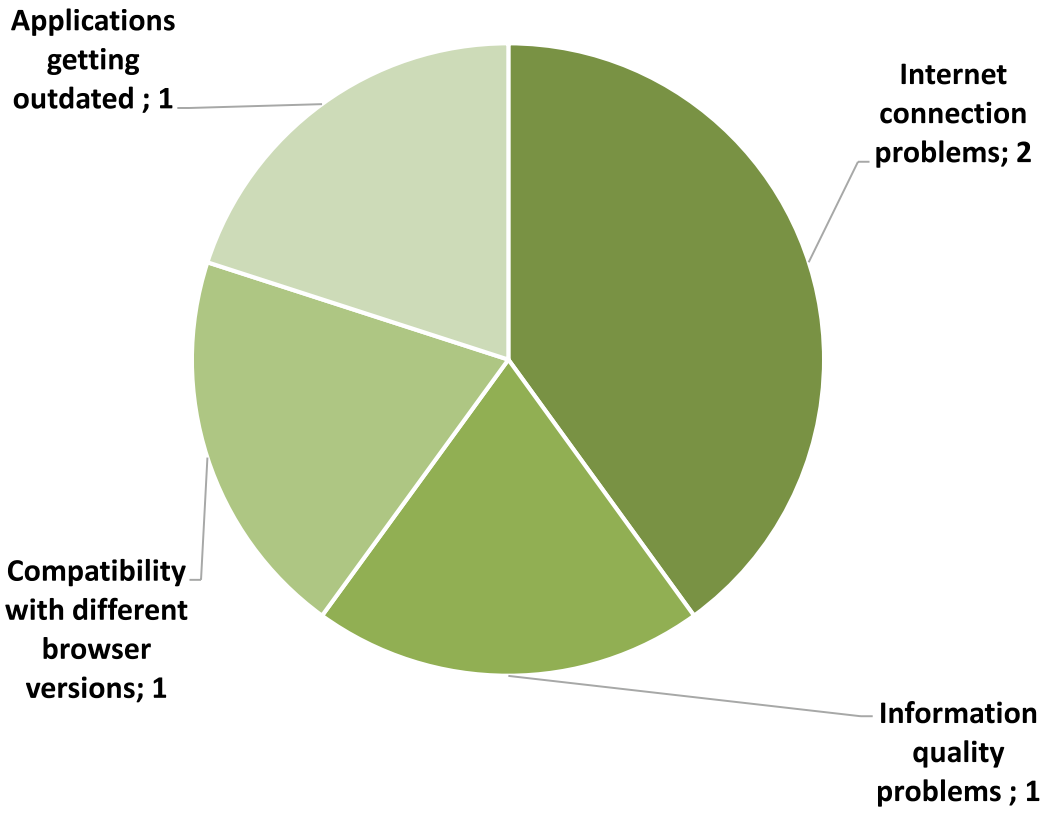

Figure 12 Realised disadvantages of logistics mobile applications according to the interviewees

According to the interviewee, organisation A faced some difficulties during the testing period. These difficulties or disadvantages have now been fixed. One problem was that

the invoices did not leave the ERP system if there were rows with zero values registered on the shipment. These invoices had to be printed manually. The problem was fixed with a modification to the application. The importance of information quality is mentioned in the literature as well (Legner et al. 2016, 821).

Organisation B had some challenges with compatibility with different browser versions. They had not expected this difficulty. This disadvantage adds to the research framework presented in chapter three.

Organisation C had identified some new risks for the future considering their logistics mobile application after its implementation. If a third party, for example Google, whose map the application utilises, releases updates to its software, the logistics mobile application must be updated as well. If organisation C decides to utilise a built in application from the device, for example the camera, this feature has to be separately developed for all the different operating systems on different devices. These are examples of applications getting outdated quickly, which is a risk, considered in the literature as well (Legner et al. 2016, 817.)

6.2.3 The results of the logistics IT alignment measurement tool questionnaire

The interviewees from all of the organisations answered the logistics IT alignment measurement tool questionnaire. However, some of the interviewees were not able to answer every question. Questions that were not answered are not included in the total amount of questions when calculating the percentage of points to maximum points for the specific organisation. The statements in the questionnaire, the answers of the interviewees and the alignment types that the statements measure are presented in Table 6 Organisations' answers to the logistics IT alignment measurement tool questionnairebelow.

Table 6 Organisations' answers to the logistics IT alignment measurement tool questionnaire

Statement	Organisation					Alignment
	A	B	C	D	E	
1. Senior executives support new IT projects	2	4	4	2	4	Intellectual
2. IT is involved in strategy development	3	3	4	3	3	Intellectual
3. IT understands the logistics	3	4	4	2	3	Intellectual
4. Logistics and IT have good partnership	3	4	4	4	3	Intellectual
5. IT projects are well-prioritised		3	3		2	Operational
6. IT demonstrates leadership		3	3	3	2	Operational
7. Logistics and IT support each other	3	4	4	3	3	Intellectual
8. Logistics and IT infrastructures and processes are aligned	4	2	2	3	3	Operational
9. Logistics strategy and operation are aligned	3	3	3	3	3	Logistics
10. IT strategy and execution are aligned			3			IT
11. IT and logistics lack close relationships	-1	-1	-1	-1	-1	Intellectual
12. IT does not prioritise well			-1			IT
13. IT fails to meet its commitments	-1		0	0		IT
14. IT does not understand logistics	0	0	0	-2	-1	Intellectual
15. Senior executives do not support IT	-1	0	0	-2	0	Intellectual
16. IT management lacks leadership			0	-1	0	IT
Total score (maximum for this organisation)	18 (28)	29 (36)	32 (40)	17 (32)	24 (36)	

Organisation A achieved a 64 per cent score in the logistics IT alignment measurement tool questionnaire. The interviewee from organisation A was not able to answer questions

5, 6, 10, 12 and 16. The highest score organisation A got from question 8 “Logistics and IT infrastructures and processes are aligned”. The lowest scores organisation A got from questions 11, 13 and 15.

Organisation B achieved an 81 per cent score in the logistics IT alignment measurement tool questionnaire. The interviewee from organisation B was not able to answer questions 10, 12, 13 and 16. Organisation B achieved its highest scores from questions 1, 3, 4 and 7. The lowest score organisation B got from question 11 “IT and logistics lack close relationships”.

Organisation C had an 80 per cent score in the logistics IT alignment measurement tool questionnaire. The interviewee from organisation C was able to answer all the questions in the questionnaire. Organisation C got the highest scores from questions 1, 2, 3, 4 and 7. All of these statements described organisation C very well according to the interviewee from organisation C. The lowest scores organisation C got from questions 11 and 12.

Organisation D got a 53 per cent score in the logistics IT alignment measurement tool questionnaire. The interviewee from organisation D was not able to answer questions 5, 10 and 12. Statement 4 “Logistics and IT have good partnership” described organisation D very well. The lowest scores organisation D got from questions 14 and 15.

Organisation E got a 67 per cent score in the logistics IT alignment measurement tool questionnaire. The interviewee from organisation E was not able to answer questions 10, 12 and 13. Organisation E got its highest score from question 1 “Senior executives support new IT projects”. This statement described organisation E very well. They got their lowest scores from questions 11 and 14.

All of the organisations achieved a score higher than 50 per cent. According to the alignment measurement tool, this means that the organisations are aligned. The scores of all the organisations are visualised in Figure 13 Results of the logistics IT alignment measurement toolbelow.

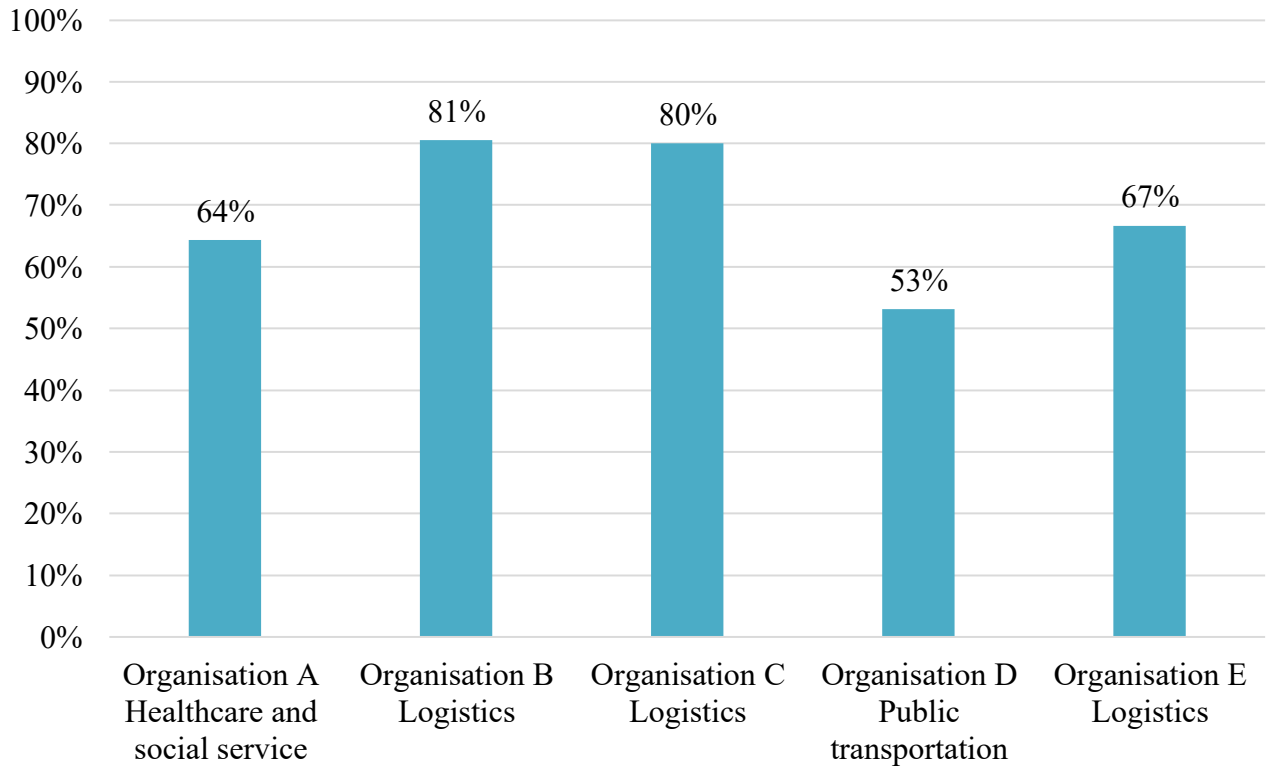

Figure 13 Results of the logistics IT alignment measurement tool

The columns in the chart in Figure 13 visualise the score an organisation received from the questionnaire compared to the highest score possible for the organisation considering which questions the interviewee was able to answer. Organisation B got the highest score with 81 per cent. The difference compared to organisation C was only one percentage point. Organisations A and E were left further behind with scores of 64 and 67 per cent. Organisation D got the lowest score of 53 per cent.

As presented in chapter two, the strategic alignment model contains both strategic fit and functional integration. Strategic fit is divided into intellectual alignment and operational alignment. Functional integration is divided into business alignment and IT alignment. (Henderson and Venkatraman 1993, 476.) The logistics IT alignment model presented in chapter two consists of similar alignment types including logistics alignment.

Questions 1, 2 3, 4, 7, 11, 14 and 15 are connected to intellectual alignment. They measure how logistics and IT support each other on a strategic level. They were the easiest ones for the interviewees to answer. All of the interviewees were able to answer these questions. Organisations B, C, D and E got their highest scores from these questions.

Operational alignment was measured with questions 5, 6 and 8. Operational alignment measures how logistics and IT infrastructures and processes are aligned. The interviewee from organisation A was able to answer only question 8, “Logistics and IT infrastructures

and processes are aligned", in this set. This statement described organisation A very well. The other interviewed organisations did not have that high of an operational alignment.

Logistics alignment was measured with question 9. According to the logistics IT alignment model presented in chapter two, logistics alignment is alignment between logistics strategy and operation. The statement was: "Logistics strategy and operation are aligned". All of the interviewees chose three, describes well, for this statement.

Questions 10, 12, 13 and 16 measured the organisations' IT alignment. An organisation has high IT alignment when IT strategy and execution are in sync. These questions were the overall hardest for the organisations to answer. The interviewee from organisation B was not able to answer any of the question in this set. The interviewee from organisation C was the only one that was able to answer questions 10 and 12. This led to it receiving a higher score compared to the others from this set of questions.

7 DISCUSSION AND CONCLUSIONS

The object of this research was to understand the usage of mobile applications in logistics. Especially the motivators or expected advantages behind developing and implementing a logistics mobile application and the realisation of these advantages was the focus of this research. The realisation of the motivators and advantages is compared to the organisations' logistics IT alignment.

The literature review in this thesis consists of two parts. The first part was the business IT alignment theory and the second part was the enterprise mobile applications literature. The business IT alignment consists of strategic fit and functional integration (Henderson and Venkatraman 1993, 476.) The four dominant alignment perspectives identified by the strategic alignment model are strategy execution, technology transformation, competitive potential and service level alignment perspective. (Henderson and Venkatraman 1993, 477.)

The enterprise mobile application theory presented in chapter three considers the advantages and disadvantages of enterprise mobile applications. The key advantages of enterprise mobile applications are efficiency/effectiveness, increased productivity, real-time information, cost reductions and accessibility. The recognised disadvantages of enterprise mobile applications are security problems, dependence on internet connections, telecommunications costs and applications getting outdated quickly.

A qualitative study was performed in order to research the topic further. Ease of use, effectivity and real-time and better quality information stood out as the most often mentioned expected advantages of logistics mobile applications. Other advantages that were mentioned by the interviewees were end device independence, consuming less paper (cost reductions), mobile applications being the way of the future, flexibility, and portability.

Distrusting the system, faulty internet connections and human error stood out as the most often mentioned considered risks of logistics mobile applications. Other risks that were considered were information security problems, wrong scope of design, applications bringing extra work and applications not being accepted by end users. The interviewees felt that the expected advantages were realised after the implementation. Some unexpected difficulties arose at the implementation phase, but the organisations managed to solve them.

Many of the features of logistics mobile applications that arose at the interviews were similar to those that are mentioned in the literature. A comparison between them is presented in Figure 14 Comparison of logistics mobile applications' features between literature and interviewsbelow.

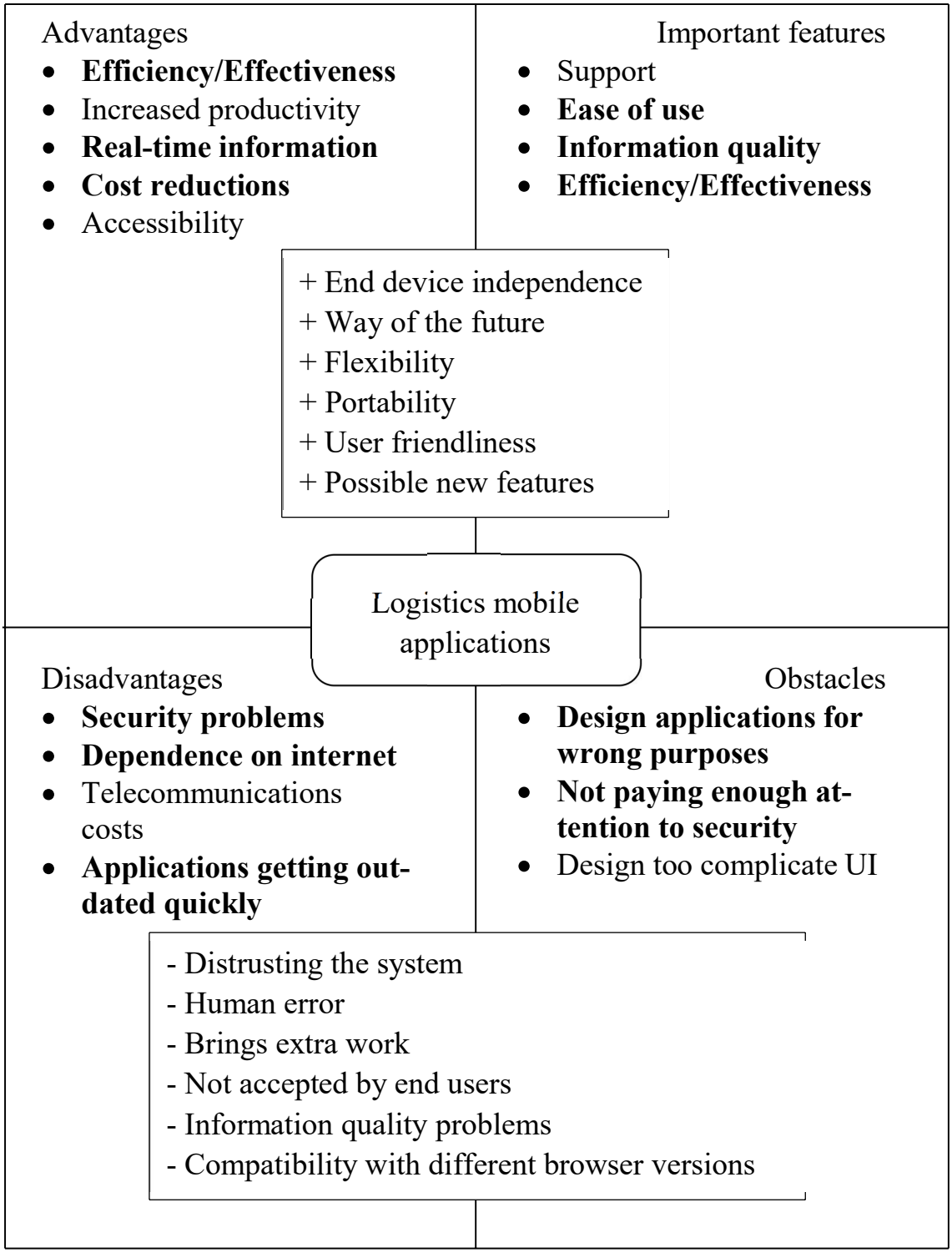

Figure 14 Comparison of logistics mobile applications' features between literature and interviews

The features in Figure 14 that have bullet points in front of them are the ones that are mentioned in the literature review of chapter three. The bolded features are mentioned

both in the literature and by the interviewees. Features that have plus or minus signs in front of them, instead of bullet points, are ones that were mentioned in the interviews but not in the literature review.

Majority of the features that were mentioned in the previous literature were supported by this study as well. Also new features were found. The previous literature has studied the features of enterprise mobile applications in general. This study has concentrated on this topic especially from logistics field's view. This may be one reason for new features arising. Though all of the case organisations operated in logistics field, they had many differences as described in chapter five. This study presents the different viewpoints to the logistics mobile applications such as the need for end device independence that some organisations value high and others do not need.

As part of this study, a logistics IT alignment measurement tool was developed. No such a tool existed before. The tool utilises the previous literature that has been written in the area of business IT alignment. This new tool adds to the previous studies by concentrating especially on logistics and making the determination of the level of alignment easier.

All of the organisations received a high score at the logistics IT alignment measurement tool questionnaire. This means that all of them were aligned. Organisation B got the highest score in the questionnaire and organisation D got the lowest score.

Three propositions were developed to explain the usage of mobile applications in logistics. Proposition one was: A motivator for mobile applications usage in logistics is to gain the supposed advantages of logistics mobile applications: accessibility, real-time information, increased productivity, efficiency and effectiveness and cost reductions. This proposition was mostly supported by the results of this study. As expected, the interviewees from different organisations told that the expected advantages were the most important motivators behind developing logistics mobile applications.

Three of the advantages listed in proposition one, real-time information, efficiency and effectiveness and cost reductions, were supported by the empirical study. All of them were mentioned by multiple interviewees as expected advantages. Two of the advantages that were listed, accessibility and increased productivity, were not supported by the empirical study. None of the interviewees mentioned these features. However this does not automatically mean that the case organisations did not have these features in their minds when designing their applications and making the decision to invest in them. The interviewees were not asked about these certain features but they were asked to mention their strongest motivators.

On top of the advantages listed in proposition one, some more arose from the empirical study. The newfound advantages were end device independence, user friendliness, possible new features and logistics mobile applications being the way of the future. The fact that applications being the way of the future was listed as one of the motivators

behind implementing logistics mobile applications tells how important information technology and keeping up with the development of IT is for logistics companies. The recognition of the importance of IT leads to higher logistics IT alignment. In addition, some advantages that the previous literature mentioned, but were not included in proposition one, were verified. These advantages were flexibility and portability.

End device independence does not necessarily apply to all of the logistics mobile applications. Instead of an advantage, it could be categorised as an important feature that future logistics mobile applications developers should consider. It is especially important at logistics companies that use multiple subcontractors. Different subcontractors may have different end devices.

Proposition two was: If there is alignment between logistics and IT, the expectations are better fulfilled. As all of the interviewed organisations did get their expectations fulfilled and all of them were aligned according to the logistics IT alignment measurement tool, this study supports the proposition that higher logistics IT alignment leads to expectations considering logistics mobile applications getting fulfilled.

The final proposition, proposition three, was: If there is misalignment between logistics and IT, the benefits from mobile applications cannot be fully reached. This proposition can be neither supported nor refuted. None of the interviewed organisations had misalignment between logistics and IT according to the logistics IT alignment measurement tool questionnaire. One reason for this might be that mostly organisations with high alignment are willing to invest in a mobile application. Enterprise mobile applications are still considered as new technology and aligned organisations are more prepared to implement new technologies. If this study had concentrated on some older technology, such as enterprise resource planning systems, the results could have been different and there would have been more variation between the organisations' alignment level. The results of the analysis compared to the propositions are visualised in Figure 15 below.

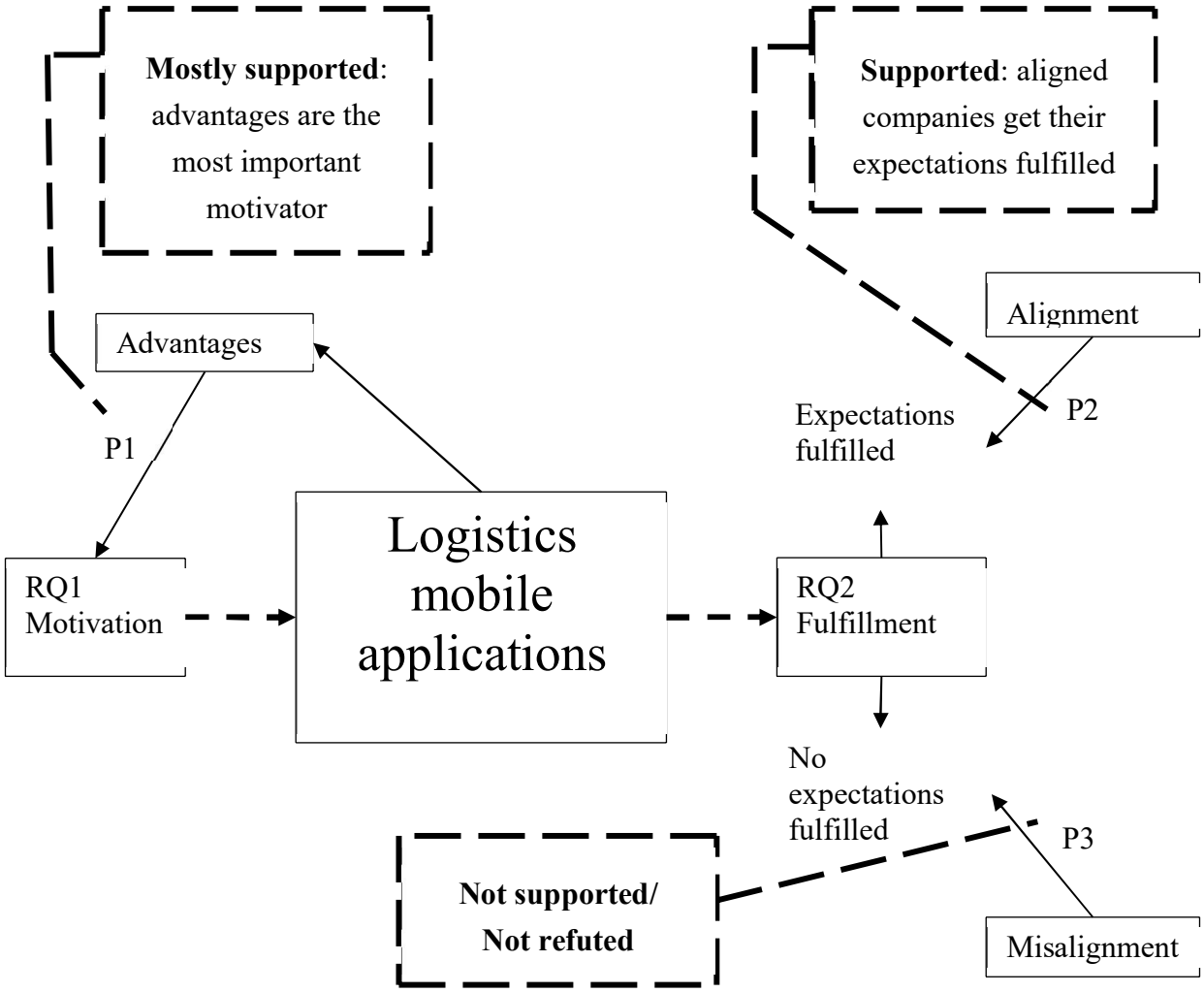

Figure 15 Result of the analysis compared to the propositions

There were two research questions set in this thesis. The first question concerned the motivators behind the adaptation of logistics mobile applications. This study finds that the motivators behind the adaptation of mobile applications in logistics are gaining advantages. These advantages are better information quality and real-time information, ease of use, end device independence, cost reductions by consuming less paper, effectivity, logistics mobile applications being the way of the future, flexibility and portability.

The second research question concerned the fulfilment of these expectations. Expectations for logistics mobile applications are satisfied. One reason behind this is that the companies that adopt logistics mobile applications often have high logistics IT alignments.

7.1 Research implications

There are multiple important features that companies should take into account when developing and implementing logistics mobile applications. Ease of use and user friendliness are the most important of them. In addition, information quality and efficiency and effectiveness should be considered. Many companies also benefit from end device independence.

Before implementing logistics mobile applications companies should examine their end users' needs. They should specify which advantages they expect to gain from their applications. For example, the list of advantages presented in this thesis could be reviewed. The possible obstacles and disadvantages should also be considered. With right partner, the advantages are easier to gain. Therefore, companies should pay attention to choosing their logistics mobile application supplier selection.

Companies can get many advantages from logistics mobile applications. These advantages are for example better information quality, real-time information and cost reductions by consuming less paper. High logistics IT alignment supports in gaining these advantages. In order to increase their logistics IT alignment, companies must be able to measure it. The new logistics IT alignment measurement tool that was developed for the purposes of this study offers a way to achieve this. It can be utilised in future studies as well. To increase their alignment level, companies should have their logistics strategy and operation and IT strategy and operation aligned. This can be achieved by close co-operation between logistics and IT personnel. In aligned companies, senior executives support new IT projects and IT demonstrates leadership.

7.2 Limitations of the study

Generalisability forms one of the main limitations of this study. The empirical data was constructed of five interviews. The generalisability of the conclusions has to be treated with caution. The study was, by accident, only limited to organisations that had high logistics IT alignment and had their expectations fulfilled. This limits the conclusions regarding proposition three.

One limitation in this study is that the organisations were interviewed only after the deployment of the mobile application. The interviewees did not remember the details of the mobile applications implementation projects clearly anymore. It might also have been more difficult to tell apart which features were considered before the deployment and which were recognised only after the deployment.

Only one person per case organisation was interviewed. The answers describe her or his personal experience. Other people in the same organisation might have given different

answers. Especially the answers to the logistics IT alignment measurement tool questionnaire may vary depending on the interviewees' position in the organisation.

All of the interviewees were not able to answer all of the questions in the questionnaire. This was mainly due to the fact that the questions considered both the logistics and IT departments. The interviewees were mainly working on logistics tasks. Only the interviewee from organisation C was able to answer all of the questions. He worked as an IT manager and was able to answer also all of the questions considering IT's role.

7.3 Suggestions for further research

The business IT alignment has been studied for many decades. It has been combined with supply chain management research before (e.g. Beukers et al. and Van de Wijngeart et al.). There has been research on enterprise mobile applications' advantages and disadvantages and important features, which can be applied to logistics mobile applications as well. In this thesis, the advantages that motivate companies to develop and implement logistics mobile applications were studied. The realisation of these expected advantages was studied with regards to the organisations' logistics IT alignment.

To further study this subject, a research on expectations on logistics mobile applications advantages and logistics IT alignment should be done as a large-scale survey. This quantitative study would improve the generalisability of the conclusions, since the sampling would be larger. Another option would be to conduct a longitudinal study on this subject, where there would be interviews before and after the deployment of the logistics mobile applications. The answers would be more accurate, since the interviewee would have the topics of the interviews fresh in their memory. The logistics IT alignment measurement tool could also be further developed and tested.

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APPENDICES

Appendix 1: Interview questions

0. Background information
    - Interviewee name
    - Position in the company
    - Company turnover and number of employees
    - For what function is the mobile application used?
    - When was your mobile application launched?
    - How many end users does the mobile application have?
    - Is the solution composed of multiple different applications/features, how many?
    - On what device is the application used by the end users?
    - How was this function done before mobile application was launched?
1. Expectations
    - What risks did you identify before the beginning of the logistics mobile application project?
    - What advantages did you expect to gain with your logistics mobile application?
    - Why did you decide to start using logistics mobile applications?
2. Fulfilment of expectations
    - Did the expected advantages get fulfilled?
    - Why or why not?
    - Did you notice any unexpected advantages or disadvantages?