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CRITICAL SUCCESS FACTORS FOR BUSINESS INTELLIGENCE SYSTEM IMPLEMENTATION

ABSTRACT

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Business intelligence (BI) helps organisations to make better and faster decisions. BI system can be seen as an integrated set of tools, technologies and software to support the decision-making. These systems are complex and their implementation has high risks and require a lot of time, money and effort, and therefore it is important to identify the factors that support the successful implementation.

This thesis focused on recognising the critical success factors (CSFs) for BI system implementation, and understanding why they are important. The CSFs were found and further analysed based on existing literature. The most important CSFs were categorised in organisational, process and technological dimensions. The CSFs from the organisational dimension were clear vision and well-established business case, committed management support and sponsorship, and understanding of organisational culture. From the process dimension the most crucial CSFs were appropriate team skills, user-oriented change management, and user training and support. And from the technological dimension business driven, scalable and flexible framework; sustainable data quality, accuracy and integrity; and understanding the firms needs, requirements and processes were identified as most vital. The most interesting observation of this study is that many of the CSFs have interrelations and are somehow dependent on each other.

Keywords: Business Intelligence, BI, Critical Success Factors, CSF, implementation

TIIVISTELMÄ

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Business intelligence (BI) eli liiketoimintatiedon hallinta auttaa organisaatioita tekemään parempia päätöksiä nopeammin. BI-järjestelmä voidaan nähdä sarjana työkaluja, teknologioita ja ohjelmistoja, jotka tukevat päätöksentekoa. Nämä järjestelmät ovat monimutkaisia ja niiden käyttöönotto sisältää suuria riskejä sekä vaatii paljon aikaa, rahaa ja vaivaa. Tämän vuoksi on tärkeää tunnistaa tekijät, jotka ovat tärkeitä käyttöönoton onnistumisen takaamiseksi.

Tämä tutkielma keskittyi tunnistamaan BI-järjestelmän käyttöönoton kriittiset menestystekijät ja ymmärtämään miksi juuri nämä tekijät ovat tärkeitä. Menestystekijät löydettiin ja niitä analysoitiin hyödyntämällä olemassaolevaa kirjallisuutta. Menestystekijät luokiteltiin organisatoriseen ulottuvuuteen, prosessiulottuvuuteen ja teknologiseen ulottuvuuteen. Organisatorisen ulottuvuuden tärkeimmät menestystekijät olivat selkeä visio ja hyvin luotu liiketoimintasuunnitelma, sitoutuneen johdon tuki, sekä organisaation kulttuurin ymmärtäminen. Prosessiulottuvuuden tärkeimmät menestystekijät olivat tiimin asianmukaiset taidot, käyttäjäorientoitunut muutosjohtaminen, sekä käyttäjän koulutus ja tuki. Teknologisesta ulottuvuudesta skaalautuva ja muuntautumiskykyinen teknologinen viitekehys, kestävä datan laatu, virheettömyys ja ehjyys, sekä yrityksen tarpeiden, vaatimusta ja prosessien ymmärtäminen nähtiin kaikkein tärkeimpinä. Tutkielman mielenkiintoisin havainto oli, että monilla menestystekijöillä oli keskinäisiä riippuvuuksia.

Asiasanat: Business Intelligence, BI, menestystekijät, käyttöönotto

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1 INTRODUCTION

During the latest decades big data, data analytics, and business intelligence (BI) have emerged as important areas of study in the information technology research field (Chen, Chiang and Storey, 2012). The term business intelligence is frequently used in literature, but many researchers still use slightly different definitions of BI. Therefore it is necessary here to clarify what is meant by the term BI in the context of this thesis.

Common definition in the literature for BI is that it is set of technologies and software that collect and analyse data in order to help knowledge workers to make better decisions (Chaudhuri, Dayal and Narasayya, 2011; Koronios and Yeoh, 2010; Ranjan, 2009). In many cases the data analysed by the BI system is generated by an Enterprise Resource Planning (ERP) system, and quite often the BI system is an extension for the ERP system (Hawking and Sellitto, 2010).

Implementation of a BI system has similar characteristics with the implementation of an ERP system. They are both infrastructural information systems, and implementing that kind of a complex system requires more than just purchasing the combination of software and hardware from the organisation. (Koronios and Yeoh, 2010). There have been a lot of studies on critical success factors (CSFs) on implementing ERP systems, but not that many in the context of BI systems specifically.

Although BI and ERP systems share similar characteristics, the success factors for implementing the systems may vary. This thesis will focus on finding BI system implementation specific CSFs from the existing literature. In addition to the CSFs this thesis will also cover different implementation models in the context of BI systems.

The study by Gartner (2009) revealed that BI has ranked top technology priority by CIOs for many years in a row. More than 1,500 chief information officers were interviewed in the survey and they believed that BI is transformational, and that it is important to focus on. According to Chen et al. (2012) BI has emerged as an important study area because data-related problems that need to be solved are increasing in contemporary business organisations. Businesses gather data from various sources and are using BI solutions to support business decisions. Almost

all successful companies are leveraging BI technology for their business nowadays. (Chaudhuri et al., 2011.)

1.1 Research problem and research questions

Successful implementation of information technology is both a theoretical and managerial challenge, and in BI system context it requires appropriate infrastructure and resources over a lengthy period of time (Popovič and Yeoh, 2016). It is important to not only list the CSFs but also to understand their significance in the big picture. This thesis will try to find answers to following two questions regarding the CSFs in BI system implementation:

- What are the critical success factors for business intelligence system implementation?

- Why are these success factors important in business intelligence system implementation?

1.2 Research method

This research was made in a form of literature review. The literature is acquired using Google Scholar and IEEE (Institute of Electrical and Electronics Engineers) Xplore digital library. Most of the articles are published between years 2008 and 2016. The articles were also ranked by the classification of the Finnish Publication Forum. The search of the articles was executed using combinations of the following keywords and phrases: business intelligence, business intelligence system, system implementation, critical success factors, implementation models.

1.3 Research structure

This thesis consists of five main chapters. The introduction chapter deals with the basic concept of BI, BI systems, CSFs, and implementing information systems. The chapter also includes the introduction of the research problem, research questions, used methods and the description of the structure of the thesis.

The second chapter, Business Intelligence, will focus on the details of BI systems. It will also give insights on why and how organisations can benefit from BI systems. Main purpose of this chapter is to make the reader familiar with the terms and concepts used throughout the thesis.

The third chapter, Critical Success Factors, is the main chapter of this thesis. It first explains the term critical success factor and why it is important to study them in the context of information system implementation. The first subchapter focuses on the CSFs found from the existing literature. Next subchapter presents why these CSFs are important in the context of this thesis.

The fourth and last chapter, Conclusion, sums up the topics discussed in this thesis. The main points and findings are explained and suggestions for future studies are presented.

2 BUSINESS INTELLIGENCE

The source of organisation's power has shifted from tangible to intangible resources, and nowadays organisations are more and more governed by information, knowledge, intelligence, intellectual capital, and wisdom. A critical component for an organisation's success is the ability to take advantage of the surrounding information. Business Intelligence (BI) seems to be the driver for business success for many organisations. (Olszak, 2016.)

The term BI is relatively new, but there have been computer-based intelligence systems for decades. BI has replaced decision support, executive information systems, and management information systems since then, and with every iteration capabilities have increased as enterprises' analytical needs have grown. (Negash, 2004). During the past decades the gathering of data from various sources has become easier and the growth in the number of products and services provided has been tremendous (Chaudhuri et al., 2011).

BI is the process of transforming raw data into useful information for more effective strategic and operational insights, and decision-making purposes so that it yields real business benefits (Duan and Xu, 2012). BI system can be seen as an integrated set of tools, technologies and software that are used to collect and analyse data in order to support knowledge workers' decision-making (Olszak and Ziemba, 2007). This chapter provides an overview of BI systems and technologies in order to help understanding of the complexity of the systems and their implementation. Further on this chapter also describes the most common benefits that organisations can obtain by using BI systems.

2.1 Business intelligence systems

The past two decades have seen enormous growth in the number of products and services offered, and in the adoption of BI technologies (Chaudhuri et al., 2011). BI technologies are widely accepted to mainly encompass data warehouse or data mart, On-Line Analytical Processing (OLAP), and data mining (Duan and Xu, 2012). Chen et al. (2012) state that in addition to previously mentioned technolo-

gies, tools for extraction, transformation and load (ETL), and reporting tools are essential for converting, integrating and presenting information. Likewise, Olszak and Ziemba (2007) argues compellingly in favour this definition.

An illustration of typical BI architecture by Chaudhuri et al. (2011) is seen in the figure 1. In this model the architecture consists of five parts; data sources, data movement and streaming engines, data warehouse servers, mid-tier servers, and front-end applications. Data from the sources is loaded back-end technologies often referred to as Extract-Transformation-Load (ETL) tools. Then the data is prepared, cleansed and standardised, and moved to the data warehouse servers. From the data warehouse the data flows forwards to the mid-tier servers where OLAP servers can perform common BI operations such as filtering, aggregation, drill-down, and pivoting. In addition to OLAP servers there can be data mining and text analytics engines, and other supporting technologies. After the operations made by the mid-tier servers, the data can be exposed to the user via front-end applications. These front-end applications can be such as spreadsheets or dashboards, and they can provide additional operations for the user to perform. (Chaudhuri et al., 2011.)
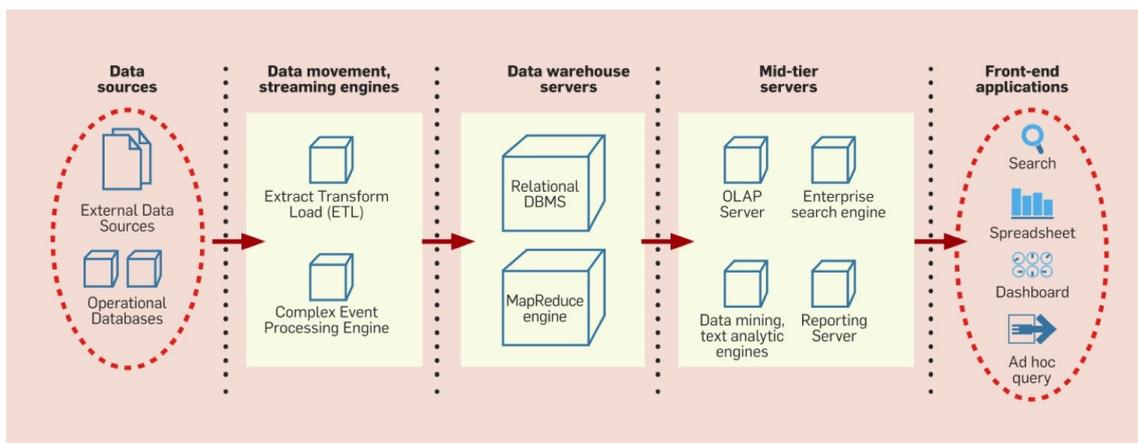
FIGURE 1   Typical business intelligence architecture (Chaudhuri et al., 2011)

According to Negash (2004) real-time data warehousing, data mining, automated anomaly and exception detection, proactive alerting with automatic recipient determination, seamless follow-through workflow, automatic learning and refinement, geographic information systems, and data visualisation are essential components of BI system. All of the described technologies are very advanced and complicated, and therefore their implementation requires a lot of planning and knowledge in order to succeed.

2.2 Benefits from business intelligence systems

In terms of value creation, BI is among the most promising technologies (Fink, Yogev and Even, 2017). BI systems help end users to answer questions like "What has happened?", "Why has this happened?", and even "What will happen?". These questions are answered by analysing the significance of historical data. (Watson and Wixom, 2007.) The technology enables knowledge workers such as executives, managers, and analysts to make better and faster decisions (Chaudhuri et al., 2011). Figure 2 shows the spectrum of BI benefits, and how difficult they are to measure and what kind of an impact they provide.

Easy to measure — Local impact

Cost savings from data mart consolidation

Time savings for data suppliers

Time savings for users

More and better information

Better decisions

Improvement of business processes

Support for the accomplishment of strategic business objectives

Difficult to measure — Global impact

FIGURE 2   BI benefits (Watson and Wixom, 2007)

Most of the BI benefits are intangible (Negash, 2004). BI saves time and costs in the data extraction processes, and for data suppliers (Watson and Wixom, 2007). Trieu (2016) states that BI systems can provide improvement in organisational performance, that is productivity and revenue. Trieu (2016) also identified the following outcomes of BI impact: improved operational efficiency of processes, new or improved products or services, and strengthened organisational intelligence and dynamic organisational structure.

On the other hand there are still quite many costs related to implementing a BI system. The four main categories of expenses are hardware, software, implementation, and personnel costs. The hardware costs are related to setting up data warehouses and possible installations of intranet or extranet for data transmission. Software costs consist of the actual BI software and possible costs from subscriptions to various data services. After the acquisition of hardware and software, a large one-time expense is the implementation and processes closely related to the implementation, such as user training. There are also costs for personnel assigned to perform BI actions, and for IT support. These personnel costs include salary,

overheads, space and computing equipment, and other infrastructure. Despite the costs, BI system can result to a return of investment up to 2000 %. (Negash, 2004.)

3 CRITICAL SUCCESS FACTORS

According to Popovič and Yeoh (2016) the successful implementation of IT innovations is a challenge, and the implementation projects have a high-risk profile. In order to ensure successful BI system implementation the company can use the critical success factor (CSF) approach. The term CSF refers to a set of factors influencing the implementation of BI systems (Gao, Koronios and Yeoh, 2008) and those few critical areas where the company has to succeed in order to achieve their goals (Hawking and Sellitto, 2010; Iahad and Sangar, 2013; Rockart, 1979). According to Olszak (2016) the use of CSFs is helping to align new systems with business objectives, and that they give a good basis for stating criterias to be followed during the implementation process. This thesis builds mainly upon the statement of Koronios and Yeoh (2010), that is the CSFs are necessary for successful implementation of a BI system, and their absence would lead to failure of the system.

This chapter discusses the CSFs found in the literature, how they could be categorised, and why these CSFs are important. The most important CSFs are then further observed and analysed.

3.1 Recognising the critical success factors

The literature has defined several frameworks for categorising and recognising CSFs. Hawking and Sellitto (2010) suggest that the CSFs vary due to solution, application and temporal perspectives. However, their definition is not directly applicable to the implementation of BI systems, but to measure BI success as whole. In comparison, the view of Iahad and Sangar (2013) seems more fit to the context BI system implementation. They divided the CSFs in managerial and technological dimensions, and they also categorised the success factors in pre-implementation, implementation, and post-implementation stages. This point of view has its problems since the managerial dimension is very broad.

Koronios and Yeoh (2010) have categorised CSFs in three dimensions and again in subcategories. Firstly, the organisational dimension is divided into vision

and business related factors, and management and championship related factors. Secondly, the process dimension is divided into team related factors, project management and methodology related factors, and change management related factors. And lastly, the technological dimension is divided into data related factors and infrastructure related factors.

Table 1 shows the summary of the CSFs found in the used literature. The CSFs are categorised using the framework of Koronios and Yeoh (2010). Interestingly, most of the CSFs for BI system implementation are not directly associated with the system itself nor the implementation process. The study of Gao et al. (2008) showed that organisational factors were perceived to be more important than the technological ones because they were considered to be out of the direct control of the BI teams.

TABLE 1: Success factors according to literature

Success factor	References
Organisational dimension	
BI and business strategy alignment	Greenwald, Rayman and Stackowiak (2007); Morien, Mungree and Rudra (2013); Olszak (2016); Watson and Wixom (2007)
Clear business goals and objectives	Gopalakrishna, Motwani and Subramanian (2005); Iahad and Sangar (2013); Ranjan (2009); Trieu (2016)
Clear vision and well-established business case	Elbashir, Collier, Sutton, Davern and Leech (2013); Gao et al. (2008); Gopalakrishna et al. (2005); Greenwald et al. (2007); Iahad and Sangar (2013); Koronios and Yeoh (2010); Morien et al. (2013); Olszak (2016); Popovič and Yeoh (2016)
Committed management support and sponsorship	Alaskar and Poulis (2015); Gao et al. (2008); Gopalakrishna et al. (2005); Greenwald et al. (2007); Hawking and Sellitto (2010); Koronios and Yeoh (2010); Morien et al. (2013); Olszak (2016); Popovič and Yeoh (2016); Watson and Wixom (2007)
Financial planning	Ranjan (2009)
Information and knowledge sharing values	Coelho, Hackney, Jaklič and Popovič (2014); Elbashir et al. (2013); Gopalakrishna et al. (2005); Olszak and Ziemba (2007)

Success factor	References
Involvement of business and technical side	Alaskar and Poulis (2015)
Understanding of BI system benefits	Chan, Chee, Chuah, Rahman, Tan, Wong and Yeoh (2009); Iahad and Sangar (2013); Watson and Wixom (2007)
Understanding of organisational culture	Alaskar and Poulis (2015); Gopalakrishna et al. (2005); Olszak and Ziemba (2007); Watson and Wixom (2007)

Process dimension

Appropriate team skills	Gopalakrishna et al. (2005); Hawking and Sellitto (2010); Morien et al. (2013); Olszak (2016); Wixom and Watson (2001)
Business-centric championship and balanced team composition	Gao et al. (2008); Koronios and Yeoh (2010); Popovič and Yeoh (2016)
Business-driven and iterative development approach	Alaskar and Poulis (2015); Koronios and Yeoh (2010); Popovič and Yeoh (2016)
Clear implementation strategy	Alaskar and Poulis (2015)
Effective project management	Gao et al. (2008); Gopalakrishna et al. (2005); Iahad and Sangar (2013); Olszak (2016)
Post-implementation audit and documentation	Gopalakrishna et al. (2005)
User involvement and participation	Hawking and Sellitto (2010); Olszak and Ziemba (2007)
User-oriented change management	Gao et al. (2008); Hawking and Sellitto (2010); Hsieh, Seah and Weng (2010); Koronios and Yeoh (2010); Popovič and Yeoh (2016)
User training and support	Hawking and Sellitto (2010); Iahad and Sangar (2013); Negash (2004); Olszak (2016); Watson and Wixom (2007)

Technological dimension

Business-driven, scalable and flexible technical framework	Gao et al. (2008); Koronios and Yeoh (2010); Morien et al. (2013); Popovič and Yeoh (2016)

Success factor	References
Effective data management	Kuo, Lin, Shiang, Tsai and Tsai (2009); Morien et al. (2013)
Suitability of technologies and infrastructure	Alaskar and Poulis (2015); Hsieh et al. (2010); Iahad and Sangar (2013); Olszak (2016); Watson and Wixom (2007)
Sustainable data quality, accuracy and integrity	Alaskar and Poulis (2015); Coelho et al. (2014); Gao et al. (2008); Gopalakrishna et al. (2005); Iahad and Sangar (2013); Jones, Ramakrishnan and Sidorova (2012); Koronios and Yeoh (2010); Kuo et al. (2009); Olszak (2016); Popovič and Yeoh (2016)
Understanding the firms needs, requirements and processes	Alaskar and Poulis (2015); Gopalakrishna et al. (2005); Greenwald et al. (2007); Hsieh et al. (2010); Morien et al. (2013); Olszak (2016)

As can be seen from the table above, committed management support and sponsorship was the most referenced factor in the used literature. Other often referenced factors were related to company's strategy alignment, vision and goals, as well as user-centric management and training, and data quality accuracy and integrity.

Interesting finding is that the organisational culture and its understanding was also mentioned as a CSF. For example Alaskar and Poulis (2015) stated that BI uses and challenges are different between organisations and therefore understanding of the organisational culture is vital. In addition to understanding of organisational culture, the understanding of BI system benefits stood out. As noted by Chan et al. (2009) to ensure a successful BI system implementation the stakeholders have to take account the substantial benefits the BI system could bring into the organisation.

3.2 Understanding the critical success factors

In the previous section the CSFs for BI system implementation were recognised and categorised into Table 1. Only listing the CSFs may not be beneficial enough for organisations to successfully implement BI systems. Therefore this section will cover and analyse the most referenced factors from each category.

3.2.1 Organisational dimension

The organisational dimension of the CSFs of BI system implementation consists of vision and business case related factors as well as management and championsip

related factors (Koronios and Yeoh, 2010). In addition to the definition of Koronios and Yeoh (2010) the organisational dimension also includes strategy and culture related factors. The most referenced CSFs from this category were clear vision and well-established business case, committed management support and sponsorship, and understanding of organisational culture.

Clear vision and well-established business case

BI initiative is driven by business, so a strategic business vision is needed to direct the implementation. A long-term vision is needed to establish a good business case, and the business case must be aligned to the strategic vision. (Gao et al., 2008; Koronios and Yeoh, 2010.) Iahad and Sangar (2013) state that an organisation must have a precise, strategic thinking and that it should evaluate readiness for the changes.

The alignment between BI and business strategies helps companies to create a clear vision of BI, and thus BI can become a powerful enabler of the strategy (Watson and Wixom, 2007). Morien et al. (2013) include the project alignment to the strategic vision inside the clear vision CSF. Although many articles discussed clear vision and the strategy alignment as two different CSFs, they are closely related. Aligning a business case in support of a BI system with the business' strategic vision enhances the likelihood of a successful BI system implementation (Popovič and Yeoh, 2016).

Committed management support and sponsorship

All levels of management from both technical and business side must be involved in BI implementation according to Alaskar and Poulis (2015). Likewise, many other authors (e.g. Greenwald et al. (2007); Hawking and Sellitto (2010); Koronios and Yeoh (2010); Morien et al. (2013)) have identified top level management support as an important CSF in BI system implementation. Popovič and Yeoh (2016) point out that the typical steering committee of a BI system implementation project included CIO, general managers, functional managers, IT/IS managers, and project managers. Together the committee and senior managers could determine a strategic BI governance direction and ensure ongoing BI-business alignment (Popovič and Yeoh, 2016).

Committed management support is also linked to the factor of understanding BI system benefits within an organisation. BI systems should be considered in business-driven mentality rather than technology driven in order to understand the benefits better (Alaskar and Poulis, 2015), and thus making it more interesting for top-level management. Watson and Wixom (2007) emphasise that BI should be driven from the top, and the senior management should provide the necessary resources and insist on the use of information-based decision-making.

Understanding of organisational culture

Understanding of organisational culture as CSF in BI system implementation was rather interesting finding. Olszak and Ziemba (2007) state in their study that building and implementing BI systems require that there is some culture of working with information within an organisation. Furthermore, Watson and Wixom (2007) point out that the use of information and analytics being part of the organisation's culture is a key to BI success. Even though their point was not in the context of successful BI system implementation but BI success in a broader scale, the understanding of organisation's culture in using information for decision-making purposes will drive towards successful implementation of BI systems.

Understanding organisational culture is related to learning, information-sharing and innovative behaviour in the organization (Gopalakrishna et al., 2005) and therefore help the implementation process of a BI system. Information and knowledge sharing values were also identified as CSF in the literature. Gopalakrishna et al. (2005) linked those with organisational culture and managing culture-change issues. The change management as a CSF is further discussed later in this chapter.

3.2.2 Process dimension

The process dimension of the CSFs in BI system implementation consists of factors related to the team, project management, and change management (Koronios and Yeoh, 2010). The most referenced and discussed CSFs from this category were appropriate team skills, user-oriented change management, and user training and support. Also project management related factors and post-implementation related processes belong to this category as well as business-driven development approach and implementation strategies.

Appropriate team skills

The composition of the project team is crucial (Gopalakrishna et al., 2005). Hawking and Sellitto (2010) suggest that system quality is affected by a skilled project team, management support, adequate resources, and user participation. Wixom and Watson (2001) studied the factors affecting data warehousing success and they found out that the skills of the project team have a major influence on the outcomes of the project. According to their definition, team skills include both technical and interpersonal abilities, and a team with strong skills is able to perform tasks and interact with users better. Although the study of Wixom and Watson (2001) focused on data warehousing and not BI directly, the importance of team skills were recognised by studies with focus on BI system implementation (e.g. Hawking and Sellitto (2010); Morien et al. (2013).

User-oriented change management

Frequently, employee resistance and change management related issues have been identified as main causes of system implementation failure (Hsieh et al., 2010). Koronios and Yeoh (2010) summarised that better user participation in the change process can lead to better communication of their needs, and thus helping to ensure successful introduction of the new system. User-oriented change management and interactive user participation during the whole implementation process can help with meeting critical information needs and format requirements (Popovič and Yeoh, 2016).

Interactive user participation was mentioned in the context of change management by Popovič and Yeoh (2016), but in some other studies (e.g. Hawking and Sellitto (2010); Olszak and Ziemba (2007) identified it as a CSF regardless of the change management context. That is to say, many of the CSFs are interlinked with each other.

User training and support

User education, training and support stood out from the literature as an important CSF. Lack of proper training for the users is a reason why many implementation projects fail (Iahad and Sangar, 2013). Proper training makes the users more comfortable with the system. Furthermore, training supports the perceived usefulness of the system and makes it easier for the users to accept the use of a new system. (Iahad and Sangar, 2013.) According to Negash (2004) training BI users would be a good research opportunity. Recognising training as an interesting research opportunity tells that it is important and significant.

3.2.3 Technological dimension

Technological dimension of the BI system implementation CSFs include data and infrastructure related factors (Koronios and Yeoh, 2010). The most referenced of these factors were sustainable data quality, accuracy and integrity; understanding the firms needs, requirements and processes; and business-driven, scalable and flexible technical framework. Other factors were closely related to the previously mentioned. Those factors were such as effective data management, and suitability of technologies and infrastructure.

Business-driven, scalable and flexible technical framework

Gao et al. (2008) recognised strategic and extensible technical framework as a CSF in BI system implementation. Furthermore, Koronios and Yeoh (2010) and Popovič and Yeoh (2016) extended the CSF as business-driven, scalable and flexible

technical framework. According to these articles stable back-end systems are crucial in implementing a BI system. Similarly Morien et al. (2013) emphasize stable and reliable back-end systems and extensible technical infrastructure. The study by Koronios and Yeoh (2010) claims that the technical framework of a BI system must be scalable and flexbile in order to meet the requirements of the dynamic business needs. The flexibility and scalability of the system makes expansions possible to align it with the changing information needs.

Sustainable data quality, accuracy and integrity

In the technological dimension the most referenced CSF was sustainable data quality, accuracy and integrity. Jones et al. (2012) state that data consistency and quality are a major cause of BI initiative's success or failure. Not only collecting clean, consistent, high quality, and integrated data could form a crucial foundation for BI success, but also realise high benefits through BI. Furthermore, Koronios and Yeoh (2010) point out that the primary use of a BI system is to make advanced data analysis for decision-making purposes, and therefore the data quality and accuracy is mandatory. Because BI systems' main purpose is to provide insights for decision-makers according to available data, it is extremely important that the data gathering and analysing processes are planned to the extent that the data is high quality and accurate.

Understanding the firms needs, requirements and processes

Many organisations struggle to align their technology approach to BI with exact goals and business objectives, which could result to a solution that fails to meet the business needs (Alaskar and Poulis, 2015). The technical framework of the system must meet the requirements of dynamic business needs Koronios and Yeoh (2010). Therefore it is crucial to understand those ever-changing requirements and needs. Gao et al. (2008) suggest that business stakeholders need to be involved interactively in order to meet their needs. This way the user-oriented change management, training, support, and user participation are again linked to other CSFs, especially to understand the firms needs and requirements. According to Morien et al. (2013) one of the major benefits of BI is more efficient processes, and thus it makes sense to understand the current processes before implementing a BI system.

4 CONCLUSION

Business intelligence (BI) is the process of transforming data into a more user-friendly state, and BI system is an integrated set of tools, technologies and software to perform this transformation and present the information to the end user. BI systems can be used to achieve potential business benefits on an organisational level which include for example better decision making, time and cost savings, and improvement of business processes. These systems are complex and expensive, and thus oragnisations must put a lot of effort into the implementation process.

Implementation of a BI system is a long and high-risk project. In order to successfully implement such system the organisation can use identified critical success factors (CSFs) to guide the process. This thesis stated that it is important not only to recognise and list these CSFs but also to understand why they are important and how they are related to each other.

Many CSFs were found from the literature and they were categorised in three categories: organisational dimension, process dimension, and technological dimension. Most of the CSFs were related to other CSFs on some level. The most important CSFs identified in this thesis from the organisational dimension were clear vision and well-established business case, committed management support and sponsorship, and understanding of organisational culture. From the process dimension the most crucial CSFs were appropriate team skills, user-oriented change management, and user training and support. And from the technological dimension business driven, scalable and flexible framework; sustainable data quality, accuracy and integrity; and understanding the firms needs, requirements and processes were identified as most vital.

Even though recognising and understanding these CSFs will help organisations to implement BI systems, they might not be enough to actually succeed in the implementation. Further studies could focus on how different implementation models and strategies could affect the success of BI system implementation. Also many articles argued that understanding organisational culture is crucial for successfully implementing a BI system, but there seemed not to be too much of empirical studies on it's effects.

This thesis aimed to identify critical success factors for business intelligence system implementation and to find out why these particular factors are important.

The literature review revealed total of nine important factors in organisational, process and technological dimension, and discussed their importance. These nine factors are indeed important but their interrelations could not be analysed properly without a larger study or empirical research.

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