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Critical Success Factors for Spend Analytics

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Rolf Tabak

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Department of Information and Service Economy
Aalto University
School of Business

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Author Rolf Tabak			
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Abstract

This is a research into the critical success factors for spend analytics. We examine which organizational and technical factors are influencing spend analytics success. Furthermore, we define spend analytics success and we are researching the factors that are behind the currently low success rate of spend analytics implementation. By means of semi structured interviews with representatives of companies involved with spend analytics, we discovered four organizational and five technical factors that influence spend analytics success, and we find data quality to be the factor that is mostly behind the low success rate of currently implemented spend analytics solutions. In addition, we develop a model for spend analytics success that can serve as a foundation for further research into spend analytics, and can provide a blueprint for companies involved with spend analytics (implementation).

Keywords Spend analytics, success factors

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1 Introduction

1.1 Topic and research questions

Procurement is an increasingly important area of economic importance (Westerski, Kanagasabai, Wong, & Chang, 2015). An average procurement department of an organization handles a little more than 60% of the total company spending (Bartolini, 2015). However, most companies do not exactly know how much they spend, on which products, and with which suppliers (Hennel, 2014; Pandit & Marmanis, 2008). This essential lack of information is a significant barrier for good strategic sourcing (Pandit & Marmanis, 2008). To overcome this barrier, an increasing amount of companies are implementing a spend analytics solution (Melvin Tan & Lee, 2015; Singh, Kalagnanam, Verma, Shah, & Chalasani, 2005; Westerski et al., 2015).

Spend analytics can be defined as a solution that provides enterprise wide view of spending, including a data cleansing and enrichment tool, equipped with analytics for identifying cost savings opportunities and out-of-compliance spending (Wilson, Bergfors, & Adams, 2015). Spend analytics provides 'holistic, detailed visibility into spend patterns, creating a foundation from which opportunities for savings can be identified and action on them can be taken' (Pandit & Marmanis, 2008, p. 15). Furthermore, it can result in benefits in several (business) areas: cost reduction opportunities can be identified; procurement projects can become more efficient; contract negotiations are supported by relevant information; and by monitoring the procurement process it can be ensured that 'negotiated results make it to the bottom line' (Pandit & Marmanis, 2008).

However, there is a relatively low success rate when it comes to the implementation of these analytical solutions. For example, a research conducted with sourcing and procurement managers from large companies based in the Nordic countries, shows that 93% of the managers are not content with the spend data they are provided with today, even though 33% has a (real time) spend analytics solution in place (Bjärkerud, 2015). This is in line with research by e.g. Gartner, stating that more than half of the business intelligence and analytic (BI&A) projects fail (Bitterer, Schlegel, & Laney, 2012), and Isis, Jones and Sidorova (2013), who note that 'despite all the interest and investments, not all business intelligence (BI) initiatives live up to management's expectations' (p.162).

Factors related to the success rate of BI&A have been identified, such as management support (Baars & Kemper, 2008; Yeoh & Koronios, 2010), data quality (Hawking & Sellitto, 2010; Wixom & Watson, 2001), a clear business objective (Trkman, McCormack, De Oliveira, Marcos Paulo Valadares, & Ladeira, 2010; Yeoh & Koronios, 2010) and BI capabilities (Işık et al., 2013; Watson & Wixom, 2007). However, the specific nature of spend analytics and the integration with the procurement process indicate some additional challenges, and clearly distinguishes spend analytics from general data warehousing and other business intelligence solutions (Pandit & Marmanis, 2008). Commodity classifications, specific data enrichment, and spend visibility within the organization (Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008; Singh et al., 2005) are among the specific challenges for achieving successful spend analytics.

In practice, the use of spend analytics is becoming an increasingly important topic. In general, an increasing amount of (large) companies use spend analytics (Bjärkerud, 2015; Melvin Tan & Lee, 2015). The global strategic sourcing application suite market, with spend analytics as one of the four most important pillars, was expected to achieve $1.1 billion in revenue in 2014; Gartner expects this market to achieve a compound annual growth rate of 8% to reach $1.5 billion by 2018 (Wilson et al., 2015). Major software providers, such as IBM (*Emptoris Spend Analysis*, n.d.) Oracle (*Oracle Procurement & Spend Analytics,* n.d.), and SAP (*Ariba Spend Analysis*, n.d.) already offer spend analytics solutions.

Although procurement/spend analytics is becoming an increasingly important topic in practice, the academic research on the topic is rather limited (Westerski et al., 2015). So far, some selective research has been conducted, focused on specific scenarios such as fraud detection (Jans, Lybaert, & Vanhoof, 2010; Ramamoorti & Curtis, 2003) and risk management (Nagali et al., 2008; Segerberg, Simchi-Levi, & Rothstein, 2014), or on specific analytical techniques (Westerski et al., 2015). Furthermore, a comprehensive overview of spend analytics has been provided (Pandit & Marmanis, 2008) and the business value of spend analysis was researched (Greenfield, 2005; Kamruddin, 2005). Additionally, research has been done on critical success factors regarding for example data warehousing (Wixom & Watson, 2001; Xu & Hwang, 2007) and general BI&A (Hawking & Sellitto, 2010; Işık et al., 2013; Yeoh & Koronios, 2010).

To date, however, to the best of our knowledge, no research has been conducted into the factors affecting spend analytics implementation success. Based on the increasing importance of spend analytics for both academics and practice, combined with the low success rate and low rate of user satisfaction (Bjärkerud, 2015), the question is what the actual problem is behind this low success rate and thus, what are the factors leading to a successful spend analytics implementation?

Therefore, a gap in the existing literature exists in the field of spend analytics. A clear need for further research into the factors leading to a successful implementation of spend analytics is visible due to the topic's rise in relevance and the limited amount of academic research conducted thus far on the topic. This thesis aims to fill that gap in literature by investigating the factors leading to spend analytics implementation success, resulting in the main research question:

RQ: What are the critical success factors for spend analytics?

In order to establish the factors leading to spend analytics implementation success, it is crucial we first define spend analytics success:

Sub question 1: *What defines spend analytics' success?*

Furthermore, when defining success factors, a distinction can be made between organizational (non-technical) factors and technical factors, as both tend to influence any information system success (Delone & McLean, 2003; Poon & Wagner, 2001):

Sub question 2: *From the organizational perspective, what are the critical success factors for spend analytics?*

Sub question 3: *From the technical perspective, what are the critical success factors for spend analytics solutions?*

Additionally, we can identify which of the factors are causing the current low success rate (Bjärkerud, 2015):

Sub question 4: *Which factors are causing the low success rate for currently implemented spend analytics solutions?*

1.2   Research methodology

The academic research on the topic of spend analytics is rather limited (Melvin Tan & Lee, 2015). Despite some selective research being conducted, focused on specific scenarios (Lanclos & Phillips, 2014; Phillips & Lanclos, 2014; Presutti, 2003; Ramamoorti & Curtis, 2003), the topic of spend analytics is far from mature (Melvin Tan & Lee, 2015; Westerski et al., 2015) and to the best of our knowledge, no prior research has been conducted on spend analytics success. Therefore, a qualitative research approach is used (Strauss & Corbin, 1990). Thus this research aims at finding out 'what is happening; to seek new insights; to ask questions and to assess phenomena in a new light' (Robson, 2002, p.59), indicating an exploratory nature of research (Saunders, Lewis, & Thornhill, 2009). Semi-structured interviews will be conducted to collect data on this topic (Saunders et al., 2009).

This research builds on the available academic work on spend analytics and success factors. Literature about these topics has been reviewed in order to research the problems under question and facilitate the structure of the qualitative research, by deducting a conceptual framework for spend analytics success from the literature.

Figure 1 provides an overview of the study's research approach.
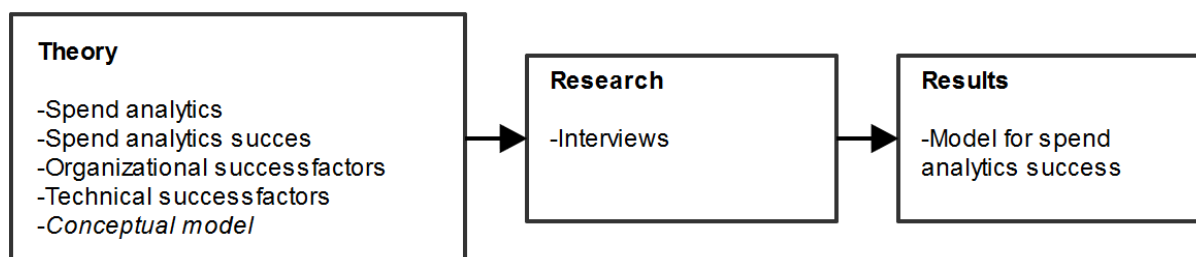
Figure 1. Overview of research approach

1.3   Structure of the thesis

Four chapters are following this introductory part of the thesis. In the second chapter, the literature review is presented. Based on the main topics of the research questions (*spend analytics* and *success factors*), that part will consists of two main parts. The first part will consist of a comprehensive overview of spend analytics, including the definition of spend analytics success, different components of spend analytics, and different aspects of spend

analytics. The second part consists of an overview of success factors, derived from the literature on e.g. information systems, BI&A, and data warehousing. At the end of this chapter, a conceptual model based on the research questions and reviewed literature is presented.

The third chapter of this thesis describes the method used to collect data. It consists of six parts; the *research approach, research method, research context, data collection, interview design* and *data analysis*. In the fourth chapter, the findings of the qualitative research are presented. Finally, in the last chapter, the discussion and conclusion are presented.

2   Theoretical Framework

In this part, we first present an overview of the literature on spend analytics (Chapter 2.1); the main topic of the research. The second part consists of an overview of the literature on success factors (Chapter 2.2), as we intend to research what the success factors are of spend analytics. Following the main research question ('*what are the success factors for spend analytics*'), this chapter will be concluded by a conceptual framework for spend analytics success (Chapter 2.3)

2.1   Spend analytics

We will start the review with defining spend analytics, and provide a brief overview of the literature so far on spend analytics. Thereafter, we will reflect on the different components/capabilities of spend analytics. Finally, we delve into spend analytics success.

2.1.1   What is spend analytics?

In this part we will review the literature on spend analytics, as it is the main topic of this research. We will start with defining spend analytics, and discuss the literature thus far on the topic.

Wilson et al. (2015) define spend analytics as a solution that provides an enterprise wide view of spending, including a data cleansing and enhancement tool, equipped with analytics for identifying cost savings opportunities and out-of-compliance spending. Furthermore, spend analytics 'provides holistic, detailed visibility into spend patterns, creating a foundation from which opportunities for savings can be identified and action on them can be taken' (Pandit & Marmanis, 2008, p.15). Westerski et al. (2015) define spend analytics as applying analytics to the 'set of activities and processes related to acquisition of goods and services through purchase orders placed by organization employees, from external contractors' (Westerski et al., 2015, p.1357).

Academic literature on the topic is rather limited (Melvin Tan & Lee, 2015). Some selective research has been conducted, focused on specific scenarios such as fraud detection (Jans et al., 2010; Ramamoorti & Curtis, 2003) and risk management (Nagali et al., 2008; Segerberg et al., 2014). For example, Jans et al. (2010) researched how spend analytics can be utilized to detect procurement fraud, and Nageli et al. (2008) undertook a case study at Hewlett-Packard to investigate the value of spend analytics in procurement risk reduction.

Also, specific analytical techniques used for spend analytics have been researched by e.g. Westerski et al. (2015). They studied the use of Markov models for the prediction of enterprise purchases. Furthermore, different authors have deliberated on business value of spend analysis. For example, Kamruddin (2005) argued for the importance of spend analytics for companies involved in undertaking mergers and acquisitions. On a more general level, Chae and Olson (2013) researched the value of analytics in Supply Chain Management. They argue that there is a growth in (predictive) analytics being used for intelligent material planning, inventory management, and supplier relationship management. Furthermore, they describe promising (analytical) techniques used in sourcing.

Finally, the most comprehensive overview of spend analytics has been provided by Pandit and Marmanis (2008). Among other aspects, they provide an overview of the different components of spend analytics, its business value, organizational aspects, and implementation considerations.

2.1.2   Spend analytics components

To provide an in-depth understanding of spend analytics, and being in line with the fourth sub question of the thesis, this part will consist of an overview of the different capabilities/components of spend analytics.

Spend analytics solutions are in some instances offered as part of a bigger strategic sourcing application suite, or in other cases, specific spend analytics components can be part of another software solution (Wilson et al., 2015). However, for this research we define spend analytics as a solution offering the following basic components/capabilities: data extraction, data enriching, and data analytics (Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008; Wilson et al., 2015). Not only are these the main components of a spend analytics solution according to Pandit and Marmanis (2008), but the spend analytics solutions in practice also consist mostly of these capabilities (Emptoris spend analysis.; Oracle procurement & spend analytics.; Ariba spend analysis.; Wilson et al., 2015).

The data extraction component, also called the 'data definition and loading capability' refers to the capability to extract (transactional) data from different (heterogeneous) sources (Pandit & Marmanis, 2008). Usually, these data have different schemas and different semantics. Thus data from different sources, e.g. transactional data, needs to be extracted and

inserted into a common commodity scheme. An important aspect of this component is the capability to cleanse the data: identify and eliminate errors from the data to improve the data quality (Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008). There could be errors due to misspelling, inconsistent attribute values, or missing information.

Extracting and cleansing the data, prepares it for data enrichment. The primary goal of data enrichment is to create a complete, accurate, precise, consistent and coherent representation of the transactional and dimensional data (Pandit & Marmanis, 2008). *Complete* refers to the requirement that all spend should be covered by the data as otherwise there will not be a full picture of the corporate spend, while *inaccurate* data will also result in inaccurate results. Furthermore, e.g. assigning the transaction of purchasing an Apple MacBook to the commodity 'computers' is *accurate*, while the commodity 'laptop computers' would be more *precise*. The *consistency* refers to schema and attribute level. Finally, *coherent* refers to the internal structure of the data that is sufficient to contain all of the information available without excess or duplications.

Thus, the data enrichment component should interpolate the values of the recorded spend as accurate as possible with the information that is available. Enrichment can be transactional enrichment or dimensional enrichment (Pandit & Marmanis, 2008). Transactional enrichment refers to enriching the transactional data in the system, while dimensional enrichment refers to enriching the structure or content of dimensions, e.g. changing taxonomies. Furthermore, data can be enriched in different ways, from manual editing, to fully-automated through e.g. machine learning, and in-between options such as semi-automatic (such as a machine learning process with manual review processes).

The enrichment happens based on the knowledgebase, and is described by Pandit and Marmanis (2008) in more detail. Acquisition and management of actionable data is the main purpose of the knowledge base (Pandit & Marmanis, 2008). It often contains information about suppliers and commodities, and other relevant, structured, knowledge related to the procurement process in the company. Users should be able to browse and navigate through the structure of the database, and to make changes. In case of a common database, knowledge of different users and companies may be assimilated.

The module that end-users will mostly interact with, is the actual analytics component, and the real business value should be visible through it. This component should provide

business intelligence capabilities, such as reporting, (predictive) analytics, score carding, dashboards, etc. (Pandit & Marmanis, 2008). To provide insight into the current state of the analytical capabilities of the spend analytics solutions currently offered, the following list shows some of the analytical capabilities offered by different providers, as extracted from the websites of ten spend analytics suppliers [1]: providing total spend visibility/transparency; insights into spend leakage visibility, supplier compliance, price trends, organizational linkage between suppliers, potential supplier risks, supplier performance, employee expenses, benchmarking, customizable dashboards, industry specific KPI's, and proactive insights.

2.1.3   Spend analytics success

Related to the main research question and the first sub question, in this part we will address the spend analytics success.

In the case of general business intelligence (BI), organizations may implement solutions for different reasons, depending on the BI goal and business context, and thus BI success is defined differently by different organizations (Miller, 2007). Spend analytics, however, is a more specific solution, aimed at the procurement process, and thus more specific aspects of its success can be identified (Pandit & Marmanis, 2008). Although the literature on spend analytics is limited (Melvin Tan & Lee, 2015), some aspects of spend analytics success can be deducted from the literature: achieve total spend visibility, identify cost savings opportunities, and improve procurement process efficiency. (Chowdhary et al., 2011; Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008; Westerski et al., 2015).

The main goal of implementing spend analytics is, on the most general level, to gain total spend visibility (Chowdhary et al., 2011; Melvin Tan & Lee, 2015). This means gaining insight into the total spend of the enterprise: how much the spend is on what and on which provider, intelligently classified. More detailed; e.g. how much is spend on each family of suppliers, where prices vary, where purchasing overlaps, which employees spend what, what kind of spending (purchase order (PO) backed, non-PO backed, expenses, etc.).

In line with gaining total spend visibility, implementing a successful spend analytics solution, should result, over time, in cost saving opportunities (Chowdhary et al., 2011; Melvin

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[1] Ariba, Oracle, SAP, Sievo, RapID, Zyclus, Spend HQ, SciQuest

Tan & Lee, 2015). First of all, this shows on a general aggregated spend level: opportunities as a consequence of vendor fragmentation, demand aggregation, maverick spend reduction, changing supplier, etc. Furthermore, next to the spend level, saving opportunities can be identified on transactional level as well: reduced contract compliance violations, item unit price variance, payment terms, invoice processing, and quality of general ledger assignments. A successful implementation of a spend analytics solution should also result in a more efficient procurement process, e.g. by identifying bottlenecks in the process, more automation, less adjusting, etc. (Pandit & Marmanis, 2008; Trkman et al., 2010).

2.2 Success factors

As the main research question aims at identifying the success factors for spend analytics, we will review the literature on success factors, and provide an overview of the most common success factors for technology that is related to spend analytics, such as business intelligence and analytics (BI&A) and data warehousing (Chapter 2.2.1). In line with sub questions 2 and 3, we will make a distinction between the organizational- (Chapter 2.2.2) and technical- (Chapter 2.2.3) factors.

2.2.1 Success factor literature

Over the past decades, a vast amount of academic research has been done on factors affecting the success of different categories of information systems, and researchers have developed a variety of success models to define and explain the phenomena of information system success. Some areas of research into IS success are: general IS system success (Delone & McLean, 2003; Poon & Wagner, 2001; Rockart, 1982), ERP systems implementation success (Akkermans & van Helden, 2002; Holland & Light, 1999; Hong & Kim, 2002), and data warehousing success (Shin, 2003; Wixom & Watson, 2001; Xu & Hwang, 2007). However, closest related to spend analytics success, is business intelligence and analytics (BI&A) and data warehousing success, as spend analytics can be seen as a business intelligence application (Kamruddin, 2005; Ramamoorti & Curtis, 2003; Singh et al., 2005). Thus we will draw mostly on the research of BI&A and data warehousing success factors.

Table 1 provides first an overview of the academic work on BI&A success. It contains the most common success factors for BI&A, as derived from the relevant literature: *management support, user participation, clear vision/ objectives, change management, data quality, technical capabilities,* and *scalability/flexibility*. Even though also other factors were found in individual articles, there was little support for them in other articles and are thus excluded from the table. Examples of these are: business champion (Hawking & Sellitto, 2010; Yeoh & Koronios, 2010), resources (Mungree, Rudra, & Morien, 2013), governance (Hawking & Sellitto, 2010), risk management support (Işık et al., 2013), methodology (Hawking & Sellitto, 2010), organizational culture (Popovič, Hackney, Coelho, & Jaklič, 2012), service quality (Schieder & Gluchowski, 2011), and rewards and recognition (Yew Wong, 2005).

Table 1: Overview of success factors in BI&A related literature

	Organizational factors				Technical factors		
	Management support	User participation	Clear vision/ objectives	Change management	Data quality	Technical capabilities	Scalability/Flexibility
(Yeoh & Koronios, 2010)	X		X	X	X	X	X
(Wixom & Watson, 2001)	X	X			X	X	
(Hawking & Sellitto, 2010)	X	X	X	X	X	X	
(Işık et al., 2013)		X			X	X	X
(Finney & Corbett, 2007)	X	X	X	X		X	
(Mungree et al., 2013)	X		X	X		X	X
(Popovič et al., 2012)					X		
(Schieder & Gluchowski, 2011)	X				X		
(Yew Wong, 2005)	X	X		X			
(Olszak & Ziemba, 2012)		X	X	X	X	X	X

We will now discuss the success factors presented in Table 1 in more detail.

2.2.2   Organizational success factors

The success factors from an organizational perspective are *management support, a clear vision/objective, change management,* and *user participation*.

Management support

Several researchers have found management support as a critical success factor from the organizational perspective (Hawking & Sellitto, 2010; Mungree et al., 2013; Schieder & Gluchowski, 2011; Wixom & Watson, 2001; Yeoh & Koronios, 2010; Yew Wong, 2005). According to Mungree et al. (2013), business intelligence needs to be based on business goals, and implemented with the widespread support of (top) management. Top management needs to be involved, to help overcoming resistance and provide resources. In order to succeed, there needs to be enough funding, e.g. for IT systems and human resources. Furthermore, according to Finney and Corbett (2007), this concept refers to the need to have strong leadership from the top, the need for management to help overcome setbacks, and the need for management support in terms of organizational factors (strategy, business), but they also need to be technically knowledgeable enough.

Yeoh and Koronios (2010) argue that the business intelligence project, especially when implemented company wide, requires ongoing funding and other resources that need to be appointed by top management. They refer e.g. to the challenges that may come up during the implementation if more than one department is involved, as those implementations often encounter issues with business processes, data ownership, data quality, and company structure. Thus the support and monitoring done by management is crucial, particularly in changing the 'states of mind' within the organisation (Yeoh & Koronios, 2010). In his research, Yew Wong (2005), argues that the management should set example by projecting behaviour they want to see achieved, related to the possible new processes related to the IS implementation. He states that it is imperative that the top management shows deeds based on desired behaviour, not just words. By doing so, the author argues, management can further influence other employees to follow their leadership and adjust to changed working processes. Other leadership competencies that are important, include managing the change, communicating the importance of the new system to users, and shaping an environment that promotes the correct use of the system. In general, top management needs to provide the conditions for successful BI (Yew Wong, 2005).

Clear vision and objective

The second factor that emerged from the relevant literature is a *clear vision/objective.* For a BI implementation to be successful, there needs to be a clear (business) vision and

objective/goal (Finney & Corbett, 2007; Hawking & Sellitto, 2010; Mungree et al., 2013; Olszak & Ziemba, 2012; Yeoh & Koronios, 2010). Mungree et al. (2013) state that the project should be in line with business, and should have clearly defined requirements for the system. Furthermore, they stress that it needs to be clearly defined what the scope of the project is, and what are the possibilities and (financial) consequences of enlarging scope. Finney and Corbett (2007) argue that a clear vision/objective requires setting clear goals and objectives for the system, and that the IS strategy should be in line with the business strategy. Furthermore, they state that goals should also be measurable, that risk management is addressed beforehand, as well as quality management, and the implementation (planning) should involve benchmarking, both internal and external, and best practices related to the solution one is wanting to implement.

Yeoh and Koronis (2010) also argue for the importance of a clear vision and objective. They emphasise that since business intelligence should be driven by business, a strong business vision is needed to direct the goals, measures, etc., of the BI project. A clear picture of the (strategic) future path to be taken is imperative for a proper business case. They state that when the business vision and business requirement are not understood or taken into consideration, the system will not be used to a satisfactory level, and implementation will likely not succeed. Their study showed that the main reasons business intelligence projects fail is not due to technical challenges, as those problems can often be solved by other technical solutions. On the contrary, the reason for failure they found was that the business intelligence system did not meet the business (vision) and its desired goals and strategies. This leads to a system that does not satisfy the business, and therefore also not its users. Among the aspects that need to be taken into consideration when considering the implementation, in this context, are: the proposed business benefits, the required resources, the risks of the implementation, the budget it requires, and the time needed for implementation (Yeoh & Koronios, 2010).

Change management

Change management is another important success factor from the organizational perspective (Finney & Corbett, 2007; Hawking & Sellitto, 2010; Mungree et al., 2013; Olszak & Ziemba, 2012; Yeoh & Koronios, 2010; Yew Wong, 2005). According to Finney and Corbett (2007), one of the most widely acknowledged critical success factors is change management: 'the need to formally prepare a change management program and be conscious of the need to consider

the implications of the implementation of the system'. Mungree et al. (2013) state that the solution should be developed in close contact with the end users, based on many feedback sessions. Finney and Corbett (2007) further elaborate on the concept, and identify different aspects of change management. These include promoting the solution to ensure a positive attitude throughout the organization. This can be done via education about the benefits and emphasising the needs for a new system so that there is a more 'natural need'. To accomplish this, it is important to ensure that you have the support of so-called change agents and influential employees in the organization. And when needed, finding people in the organization who could potentially bridge between different parties (Finney & Corbett, 2007).

Additionally, change management can also refer to changing the specific working process related to the implemented system. For instance, Yew Wong (2005) elaborates on the change of the knowledge sharing process related to the implementation of a new knowledge management system. In his study into the implementation of knowledge management systems, he argues that changing the knowledge sharing processes within the organization, is essential for a successful knowledge management system. Thus, he notes, it is important that the processes of knowledge sharing changes in favour of collecting data and installing the system: Control mechanisms and awards, incentives, and even punishments, should be in place so that knowledge sharing processes are being organized following a systematic and structured approach.

Finally, managing cultural change can be seen as a subcategory of change management. Davison (2002) suggests that there can be cultural differences and organizationally biased perspectives, and new information system implementation often entails changes to the working culture (Fui-Hoon Nah, Lee-Shang Lau, & Kuang, 2001). Therefore, the organizational characteristics need to be understood in the context of culture, and one should try to facilitate a culture that is open to change (Fui-Hoon Nah et al., 2001).

User participation

The fourth and last organizational success factor identified, is user participation (Finney & Corbett, 2007; Hawking & Sellitto, 2010; Işık et al., 2013; Olszak & Ziemba, 2012; Wixom & Watson, 2001; Yew Wong, 2005). As Yeoh and Koronis (2010) already note, even if an excellent system was established, it does not guarantee people want to use it. Wixom and Watson (2001) state that the user participation is more satisfying in the case of a clear

assignment of roles and task, leading also to a more structured way of communication the needs and feedback, which in turn leads to a successful implementation. The authors argue that this is especially important for decision support systems, since the requirements for those systems might be unclear in the beginning. Additionally, user participation facilitates the means to manage expectations and fulfilling user requirements. When using the system, people tend to have a better understanding of what the possibilities and impossibilities are of a system, increasing the likelihood that they accept the system (Schieder & Gluchowski, 2011).

Another aspect of user participation, as described by Işık et al. (2013), is the user access to the system, and the decision of which users have access to which part of the system. In practice, there are both companies who decide to open up the user interface (UI) to many users, form different departments, while there are also companies who are limiting the access and user freedom within the system. According to Isik et al. (2013), companies need to find the balance, so they can allow access to the users who can benefit from using the system, while also putting too much time and effort in preparing the system for users who only gain very little value from the system should be avoided for the sake of simplicity, time, and budget considerations.

2.2.3   Technical success factors

The success factors from the technical perspective, as presented in Table 1, are *data quality, technical capabilities,* and *scalability/flexibility.*

Data quality

The first technical success factor addressed is data quality (Hawking & Sellitto, 2010; Işık et al., 2013; Olszak & Ziemba, 2012; Popovič et al., 2012; Schieder & Gluchowski, 2011; Wixom & Watson, 2001; Yeoh & Koronios, 2010). Data quality refers to the consistency and comprehensiveness of the data (Işık et al., 2013), and according to Schieder and Gluchowski (2011), a big part of the success of the implementation process, and in the end the success of the whole system, relies on the accuracy of the data used by the BI system. Furthermore, Isik et al. (2013) state that around half of the business intelligence projects fail, due to data quality related problems. Data quality issues can include problems in the data handling process or in data maintenance governance, while problems might also occur due to the migration process

from one system to another, resulting in e.g. a low level of data reliability. When the data which is being analysed is not correct or reliable, neither will be the outcome.

Another important aspect of the data quality concept are the issues related to the data source (Wixom & Watson, 2001). Internal data sources can be combined through a data warehouse architecture, data mart or OLAP cube, and it can be sometimes problematic to achieve the same level of data accuracy and consistency throughout different systems. Furthermore, external data can also be part of the BI process, such as data residing at the suppliers' databases, and these data are usually not stored in the company's own data warehouses, and even data from websites, spreadsheets, audio files, etc. can be included, further increasing data quality issues (Işık et al., 2013). Finney and Corbett (2007) also elaborate on the topic and note the challenges with data to occur when the data is initially in different, heterogeneous systems. They argue that each of those systems often require specific knowledge in order to extract the data from them. Also, data stored in different source systems might have different formats or schemas. Thus, also the lack of a common data standard across different systems makes it problematic to extract and analyse data from different source systems (Wixom & Watson, 2001).

Technical capabilities

The third success factor from the technical perspective is the technical capabilities of the system (Finney & Corbett, 2007; Hawking & Sellitto, 2010; Işık et al., 2013; Mungree et al., 2013; Olszak & Ziemba, 2012; Wixom & Watson, 2001; Yeoh & Koronios, 2010). According to Wixom and Watson (2001), the technical capabilities include the hardware, software and methods used. More specifically, according to Işık et al. (2013), technological (BI) capabilities are 'sharable technical platforms and databases that preferably include a common technology architecture and data standards' (p. 16).

As Wong (2015) states in his research on implementing knowledge management systems, one of the main success factors is the capabilities the IT provides. According to the researcher, those capabilities can provide search mechanisms and database access, and actually deduct the information. Furthermore, Olszak and Ziemba (2012) and Yeoh and Koronios (2010) stress the importance of the IT infrastructure, while Işık et al. (2013) more specifically notes that the BI capabilities are arguably the most important characteristic of successful BI. Işık et al. (2013) argue that the quickly changing business models and environments ask more

agility from companies, and they think that the different business intelligence tools provide a part of this agility. Furthermore, the level of agility that can be achieved through business intelligence is determined by the (technical) capabilities of the system. Finally, also the ability to use also unstructured data from different sources depends on the BI capabilities (Chen, Chiang, & Storey, 2012).

Another important aspect of the technical BI capabilities is the integration with other systems, so that more value can be extracted than is possible in the case of separate usage of systems. This is seen as critical for the BI success (White, 2005). Thus, the integration and communication between the different systems is essential for success (Işık et al., 2013). This requires for example, technologies such as in-database analytics (Chae & Olson, 2013), and such techniques often require more processing capabilities, especially for companies that make use of real-time analytics (Işık et al., 2013).

Also the increase in the variety of data types and sources is raising the difficulty level of the integration of a BI system with other systems. Additionally, businesses must find ways to successfully manage the integration between different systems, but also on different levels, as integrating just on e.g. the data level might not be sufficient. Integration must also happen on the business or process level in some cases to succeed (Chen et al., 2012).

Finally, as stressed by different authors, there needs to be an organizational fit with the BI hardware and software (Mungree et al., 2013; Olszak & Ziemba, 2012; Yeoh & Koronios, 2010). Thus, the capabilities should match the business objectives, e.g. the analytical capabilities should be in line with the organizational goals, KPI's should reflect the business needs, and the interface should be understood by the business oriented end user (Olszak & Ziemba, 2012).

Scalability/flexibility

The fourth and last success factor, from the technical perspective, is the scalability and flexibility of the system (Işık et al., 2013; Mungree et al., 2013; Olszak & Ziemba, 2012; Yeoh & Koronios, 2010). According to Mungree et al. (2013), scalability and flexibility refers to the ability of the system to have the possibility to change based on the vastly changing business requirements. Gebauer and Schober (2006) define flexibility as the capability of a business intelligence system to provide decision making information in business environments that are changing. Scalability refers to the ability to scale the technological capabilities up or down,

depending on the needs, e.g. regarding processing power, data storage, or analytical capabilities (Negash, 2004).

Among others, the study by Yeoh and Koronios (2010) into the success factors for BI systems elaborates on the topic of scalability and flexibility. They note that BI solution technology needs to enable scalability and flexibility, in line with the changing business needs and environments. Thus, the system should consist of flexible and scalable components, allowing for expansion of the score of the project, based on the business needs. Furthermore, the system needs to allow adding components/sources/etc. to the system, while it is seen as a requirement as well, that e.g. external data from suppliers, government institutions, or benchmarking data can be included. In this way, the solution is valuable on the long term, and it is able to support business objectives to a fuller extent (Yeoh & Koronios, 2010).

Additionally, also Isik et al. (2013) elaborate on the topic, and state that the system should be able to interact and connect with existing systems, data sources and applications, so that the costs do not increase too much, and neither does complexity. Furthermore, the ability to handle (existing) business process rules directly affects the flexibility of the system (Işık et al., 2013).

2.3 Framework for spend analytics success

In this part, we will combine the literature on spend analytics and success factors, in order to provide a conceptual model for spend analytics success, in line with the main research question. Firstly, the construct spend analytics success will be defined (sub question 1), followed by the organizational success factors (sub question 2), and technical success factors (sub question 3). This part will be concluded with the visualization of the conceptual model.

2.3.1 Spend analytics success

The different studies into the critical success factors for BI, BA, data warehousing, etc. define success either not at all (Chaudhary, 2004; Hawking & Sellitto, 2010), or in different ways (Işık et al., 2013; Yeoh & Koronios, 2010). However, studies that address the success agree that a successful implementation of the system must in the end lead to (tangible) business benefits (Işık et al., 2013; Wixom & Watson, 2001; Yeoh & Koronios, 2010).

Spend analytics, contrary to general BI solutions, is a more specific solution, aimed at the procurement process, and thus more specific aspects of business benefits can be identified (Pandit & Marmanis, 2008). Although the literature on spend analytics is limited, some aspects of spend analytics success and business benefits can be deducted from the literature: achieving total spend visibility, identifying cost savings opportunities, and improving procurement process efficiency (Chowdhary et al., 2011; Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008; Westerski et al., 2015). Thus we expect a successful spend analytics implementation to lead to procurement-related business benefits such as gaining spend visibility, identifying cost savings opportunities, and increasing procurement process efficiency.

2.3.2 Spend analytics success factors from the organizational perspective

Following the second sub question, in this part we will address the success factors for spend analytics from the organizational perspective. As derived from the literature on business intelligence and data warehousing, the most common organizational success factors are, *a clear business objective/vision, management support, change management,* and *user participation*.

Clear business objective/vision. In the context of spend analytics, this could include aiming for a lower rate of maverick spend, consolidating suppliers for indirect spending, or reducing spend by x% across the top five commodities (Melvin Tan & Lee, 2015). Also supporting goals, such as reorganizing cost centres appropriately or increasing organizational

visibility to spend, are vital to a successful implementation of spend analytics (Pandit & Marmanis, 2008). Additionally, making spend analytics goals is important, exemplified by Sievo's mathematical model to calculate and visualize procurement savings (Saporito, Sammalkorpi, Sillanpää, & Teppala, 2011).

Furthermore, Pandit and Marmanis (2008) state that the correct scoping of a company's requirements regarding spend analytics is an important and often underestimated task when it comes to the implementation. They argue, for instance, for simplifying the scope of the first release, to realize a better initial roll-out of the system and to create a better (companywide) understanding. Also, opportunities (e.g. first picking the low hanging fruits) and data could be prioritized (e.g. selecting the divisions that account for 80% of the spend, and within that group, picking the source systems that account for 80% of the spend) (Pandit & Marmanis, 2008). *Thus we expect a clear objective/vision to be an organizational success factor for spend analytics.*

Management support. Management support is also expected to be a success factor for spend analytics. Pandit and Marmanis (2008) argue for the importance of securing executive support as it is critical to the success of the spend analytics solution. They state that this is especially true when also other groups, next to the procurement department, are involved, such as the IT and business. Moreover, the management should support the spend analytics implementation from the top by enforcing the policy and organizational changes that are related to the procurement processes within the company (Pandit & Marmanis, 2008).

Furthermore, by assigning responsibility for the creation of management reporting to track the results and calculate the impact of spend analytics on shareholder value, management is believed to have an important role (Pandit & Marmanis, 2008). *Thus, we expect that management support is among the organizational success factors for spend analytics.*

Change management. Pandit and Marmanis (2008) state that for spend analytics implementation to succeed, scepticism in the organization needs to be overcome by communicating the success on a continuous basis. Furthermore, people need to be trained in using the spend analytics system, mostly focusing on a key set of functions that are most important to the users, such as reporting, opportunity identification and feedback generating and processing (Pandit & Marmanis, 2008).

Next to education and training about the system, the commodity scheme might need to be changed to implement a successful spend analytics solution (Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008). Pandit and Marmanis (2008) note that, rather than going through a difficult process of consolidating the disparate schemas into one complicated schema, one should consider using an industry standard schema. Change management is required, as it might be difficult to change the mind-set of hundreds of material planners and buyers to change from a commodity scheme that they are used to (Kamruddin, 2005). *Thus, we expect change management to be among the organizational success factors for spend analytics.*

User participation. As Yeoh and Koronis (2010) already note, even if an excellent system was established, it does not guarantee people want to use it. Pandit and Marmanis (2008) note about spend analytics that getting the commodity managers to submit corrections on spend mapping is critical to ensuring that the accuracy improves over time. Additionally, the user participation related to the (renewed) procurement process can be a factor that influences success. Possibly a large group of people needs to (start) classify spending, using a new commodity schemes, adapt to the new procurement processes, and report spend analytics results (Pandit & Marmanis, 2008). *Therefore, we expect that user participation is yet another organizational success factor for spend analytics.*

2.3.3 Spend analytics success factors from the technical perspective

From the relevant literature, the following technical success factors were identified: *data quality, technical capabilities,* and *scalability/flexibility.* However, based on the nature of spend analytics, and the importance of its main components, we propose a different classification of success factors from the technical perspective. Given the importance of, and distinction between, *data extraction, data enriching* and *data analysis* (Kamruddin, 2005; Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008) we see these three technical capabilities as three different success factors. Thus, we split up the general 'technical capabilities' factor.

Data quality. Pundit and Marmanis (2008) refer to three types of data for which the quality is crucial to spend analytics success. First, they refer to the quality of vendor data, where for example, the same vendor might be entered differently in different transactions. Secondly, the quality of transactional data is important. The transactional data are frequently poorly formatted and often incomplete, duplicate records are common, commodity code assignments might be missing, be incorrect, or not be detailed enough, and the item descriptions might be

blank or of poor quality (Pandit & Marmanis, 2008). Unless these problems are addressed and data are cleansed, assigning proper commodity codes to these transactions becomes difficult, and spend analytics might not be successful. Finally, the authors refer to quality of category schema. They argue that a good commodity schema is the basis for a good spend analytics solution, as commodity managers, involved with the schemas and opportunity identifying, have years of experience in procuring items in their commodities.

Another aspect of the data quality, is the quality of the source systems. As data for spend analytics often needs to be extracted from different systems, we expect this to be crucial for the success as well. Pandit and Marmanis (2008) already noted that spend data often resides in different IT systems that could be spread out across different divisions that are located in different countries and be in different languages. Furthermore, systems could be managed by different groups that might not report to a centralized IT department, thus they are seldom integrated (Pandit & Marmanis, 2008). *Therefore, we expect data quality to be among the technical success factors for spend analytics.*

Data extraction, data enrichment and data analytics. Given the importance of, and the distinction between the different components/capabilities of a spend analytics solution (Hennel, 2014; Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008), we split the *technical capabilities* factor into *data extraction capability, data enrichment capability*, and *data analytics capability*, and classify them all as (different) technical success factors for spend analytics.

Firstly, data that is being used as an input for spend analytics, such as invoice data, general ledger data, and/or accounts payable data, needs to be extracted from the different systems to be able to use it for spend analysis. The capability to extract (transactional) data from different (heterogeneous) sources is therefore critical. Additionally, the data enrichment component needs to ensure the completeness, accuracy, preciseness, consistency and coherency of the data. Finally, the component where end-users will interact with, the data analytics component, should provide the real business value through a user interface (UI) that offers the possibilities for reporting, analytics, score carding, dashboards, etc. (Pandit & Marmanis, 2008). *Thus, we expect that the data extraction capability, data enrichment capability, and data analytics capability are part of the technical success factors for spend analytics.*

Scalability / Flexibility. We expect this factor to also be relevant when it comes to a successful spend analytics implementation. For instance, the size of transactional data could change over time, either through natural growth or by the company performing mergers and acquisitions (Pandit & Marmanis, 2008). Thus, the system needs to be able to scale up and down accordingly. Furthermore, it needs to be flexible to adjust to changing business needs: given the fact that there might be different user groups having access to the system (e.g. procurement, business, and management), the system must be adjustable to the needs of different users, including changing needs over time. For example, for the first year the procurement department may want to see only the percentage of maverick spend given the initial scope of the project, whereas the next year it could be wanting a more detailed overview of the supplier performance as well. *Thus we expect the scalability/flexibility to be among the technical success factors for spend analytics.*

2.3.4   Conceptual model for spend analytics success

The following model (Figure 2) visualizes the different success factors and their relationships, as described in this chapter. Additionally, we see spend analytics implementation as a dynamic process (Pandit & Marmanis, 2008), in line with e.g. Yeoh and Koronios' (2010) view on business analytics. This dynamic nature of the model implies a reciprocal relationship between the success factors and spend analytics success (Yeoh & Koronios, 2010), hence the feedback loops (Pandit & Marmanis, 2008). Finally, we expect an interaction between organizational and technical perspectives (Işık et al., 2013; Popovič et al., 2012; Wixom & Watson, 2001).

Organizational perspective

- Clear business objective / vision
- Management support
- Change management
- User participation

Technical perspective

- Data quality
- Data extraction
- Data enrichment
- Data analytics
- Scalability / Flexibility

Implementation success

Business benefits

Feedback loop

Feedback loop
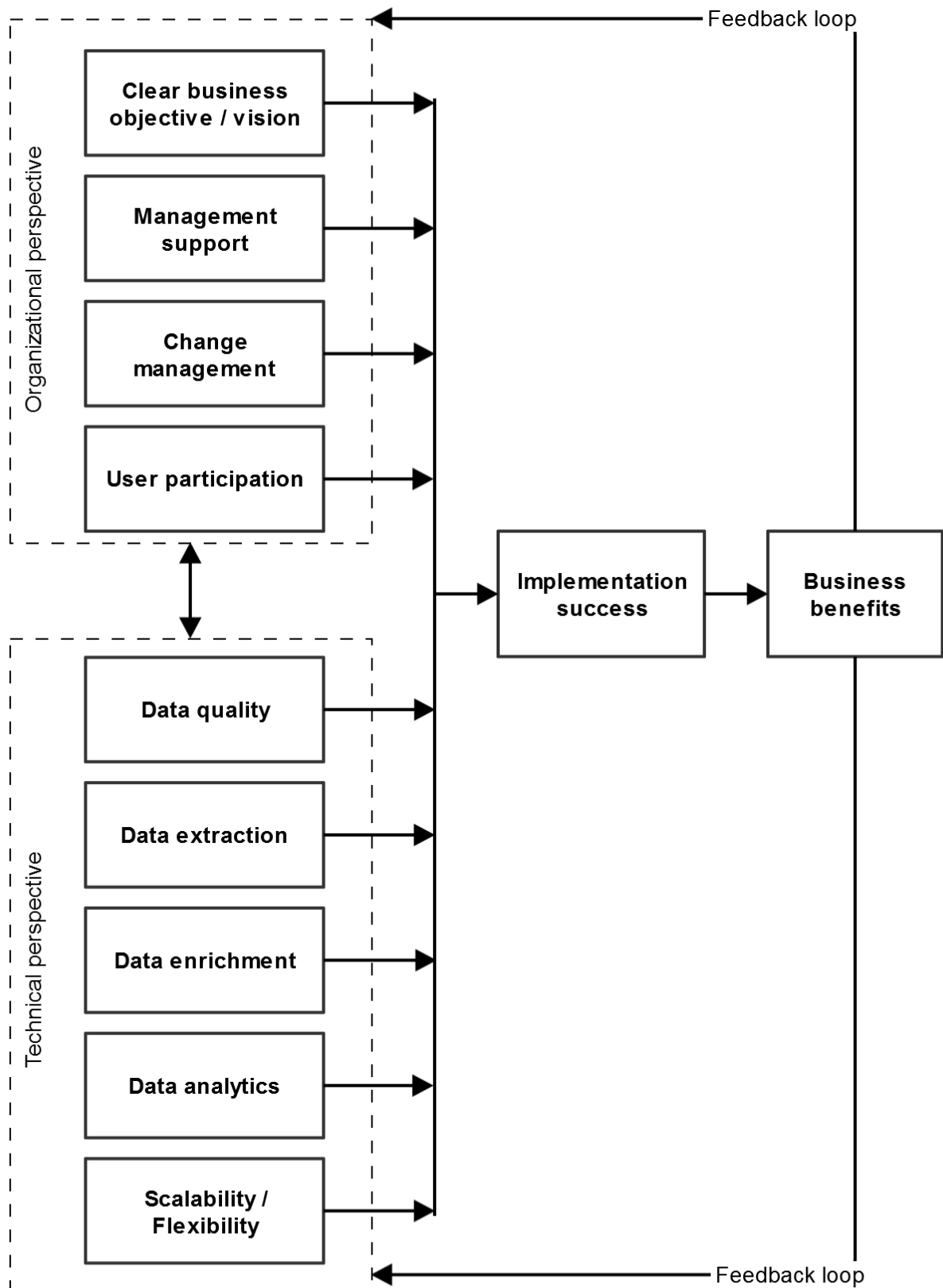
Figure 2. Conceptual model spend analytics success

3   Methodology

This chapter aims to explain and clarify the chosen research method and data analysis techniques that were used for this research. Six parts are included in this chapter. This chapter starts with the *research approach* and *research method,* where the approach of the research and chosen method will be discussed. This is followed by the *research context*, in which the setting of the research will be addressed. The *data collection* follows fourth, including an overview of the steps and choices that were relevant to the data collection. The fourth part, *interview design,* will describe how the interview was designed and how the different factors and relationships are conceptualized in the interview. *Data analysis*, the final part, will consist of an explanation on how the data was analysed.

3.1   Research approach

The main purpose of this research is to gain insights into spend analytics success: determine what factors lead to a successful spend analytics implementation. This also includes deliberating on spend analytics success and on the factors cause the current low success rate of spend analytics.

The topic of spend analytics is far from mature within the academic literature, and the success factors for spend analytics are therefore a relatively unknown phenomenon (Melvin Tan & Lee, 2015). Consequently, this research aims at finding out 'what is happening; to seek new insights; to ask questions and to assess phenomena in a new light' (Robson, 2002, p.59), indicating an exploratory nature of research (Saunders et al., 2009). Given the notion that there is little prior research and theory on the topic, this research adopts an inductive approach: proceeding from data to theory (Saunders et al., 2009).

3.2   Research method

Semi-structured qualitative interviews were conducted to collect the data. This method helps to understand phenomena about which is little known (Strauss & Corbin, 1990), such as spend analytics (success) in this case, and thus it fits the exploratory nature of the research best (Saunders et al., 2009). Furthermore, conducting qualitative resaerch is the preferred method when conducting inductive research (Saunders et al., 2009).

According to Saunders et al. (2009) interviews can be highly formalised and structured, or they can be more informal and unstructured. In between are intermediate positions, including the semi-structured interview method. Contrary to structured interviews, semi-structured interviews are not standardized and are often referred to as 'qualitative research interviews' (Saunders et al., 2009, p.351). When using these semi-structured interviews, particular questions may be left out during some interviews, depending on the organizational context in relation to the research question (Saunders et al., 2009). The order of questions can also be changed, depending on the flow of the conversation. On the other hand, additional questions can be asked to explore the research question in more detail given the organizational context (Saunders et al., 2009).

The semi-structured interview method also enables to understand the statements provided by the respondents in context (Bernard & Bernard, 2012), which is important for this research: it seems that spend analytics solutions are offered with different capabilities or are part of other solutions, and different companies tend to have different procurement processes, as well as different ways of using spend analytics solutions (Wilson et al., 2015). Consequently, it is important to understand the interviewees' perceptions and understanding of both their spend analytics solution, as well as relevant information about their procurement process, in their own words. Thus, this method enabled the comprehension of the respondents' thoughts, ideas, and understanding about spend analytics and its success factors.

Furthermore, given the novelty of the spend analytics construct used, this qualitative approach enabled interaction between the interviewer and the respondents to clarify, explore, and raise new issues, which could not be derived from academic literature yet (Bryman, 2006). Finally, this direct interaction enabled both parties to clarify each other's statements immediately (Saunders et al., 2009). This is relevant especially for the identification of success factors, as different procurement practices can lead to different success factors, and thus the possibility to clarify statements can prove to be valuable.

Finally, as a part of the semi-structured interviews, for some questions, the respondents were asked to indicate the relevance/importance/satisfaction of certain factors or concepts on a scale from 1 to 5. This combination of semi-structured questions with a quantitative scoring approach offers the advantage of reliable and comparable qualitative data, yet giving

opportunity to gain new insights on this topic as the research is still limited (Saunders et al., 2009).

3.3 Research context

The research was conducted in cooperation with a financial service provider in Finland. Based on the context of the research, (business-to-business) customers who were believed to hold the relevant knowledge on their respective procurement process and spend analytics, were selected from the company's customer database. Potential respondents were informed about the research and asked to participate. Furthermore, other companies who were believed to use spend analytics based on their respective size and online information, were contacted through email to ask to participate in the research.

Due to time restrictions from both the researcher and potential respondents, it was not always possible to schedule an interview, and some of the possible respondents did not want to participate or did not reply to the request to participate. Eventually, this resulted in a sample of 10 people, from 8 different companies, who were willing and able to participate in this research. The companies were situated throughout Finland/Sweden and were using or implementing a spend analytics solution. The representatives held relevant knowledge about the use of spend analytics and procurement within their own company, as well as sometimes held relevant knowledge on the topic gathered from their previous jobs. Interviews were conducted in English, either face-to-face, or through a video call (Skype).

3.4 Data collection

The interviews were conducted at a convenient place for the interviewees, either at their office or through a video call, and they lasted on average one hour each. During the data collection, interviews were constantly compared to look for differences and similarities. In order to overcome the reliability treat of lack of standardization (Saunders et al., 2009), the context of the research and main concepts were explained by using the same wording in every interview, as well as all the questions, following the interview guide (Appendix A). This helps to overcome interviewer bias and increases the reliability of the research (Saunders et al., 2009). Follow-up questions were asked when answers were not clear or perceived detailed enough by the interviewer. This enabled the interviewer to explore the topic and to gain deeper insights

(Saunders et al., 2009). Interviews were audio-recorded and fully transcribed in order to analyse the data.

3.5 Interview design

Based on the research questions and the reviewed literature, an interview guide was developed (Appendix A). The interview covered all the factors as presented in the conceptual model. Firstly, the research goals and context were explained to the interviewee and it was stated what was expected from both parties. Furthermore, confidentiality and anonymity was ensured. Thereafter some background questions were asked about the interviewee and the company to clarify the context.

The first topic covered during the interviews was spend analytics in general. The respondents were asked what kind of spend analytics was being used within their company, and to clarify their experience with spend analytics in order to understand the context, as this is an important aspect of qualitative research (Janesick, 1994). Hereafter, the interviewees were asked to state on a scale from 1 to 5 how satisfied they were with the spend analytics in place, to verify the claim by Bjärklund (2015) that there is a low level of satisfaction when it comes to currently implemented spend analytics solutions and to also verify the relevance of the fourth sub question (*Which factors are causing the low success rate for currently implemented spend analytics solutions?).*

The second topic covered was spend analytics success (sub question 1). Firstly, the respondents were asked to describe what spend analytics success means for them. Furthermore, they were asked whether they had measures in place to actually measure the success.

The next topic covered was the success factors from an organizational perspective (sub question 2). The respondents were asked what they see as organizational factors leading to a successful spend analytics implementation. This was initially done by an open question in order to overcome the threat of a biased answer (Saunders et al., 2009), so that non-identified factors could be recognized. Later on, however, the interviewee was presented the conceptual model, including some examples of each factor, to clarify their understanding of the research, questions asked and different factors. This resulted in better understanding of the question and more elaborate and detailed answers.

Furthermore, the respondents were asked to score the importance of each factor on a scale from 1 to 5, relative to its influence on the implementation success, in order to identify which advantages are most significant. Additionally, the respondents were asked to explain their choice. Hereafter, respondents were again asked if there were any factors missing from the organizational perspective, as they might come to the respondents' mind after discussing the different factors. Finally, the respondents were asked to pick one or two factors that were most satisfying at the moment within their company, and one or two that are least satisfying and thus needing most improvement. This was done to identify the factors that are currently causing the alleged low success rate of spend analytics implementation (sub question 4).

The next part covered the same questions, but for the success factors from the technical perspective (sub question 3). Also here respondents were asked for factors leading to a successful spend analytics implementation, followed by the questions to score each factor according to importance, identify missing factors, and to pick factors that were most and least satisfying in their current situation.

The final part of the interview addressed the dynamics of the model and possible additions to the model. Here, the respondents were first asked about the interaction between the technical side and organizational side within their company, followed by some questions about the feedback loop(s). Furthermore, the respondents were asked whether some factors were missing from the model and if they have some additional remarks to the topic.

3.6 Data analysis

After fully transcribing the interviews, the interview data was coded by using ATLAS.ti software to test for similarities and differences and identify patterns in the data (Saunders et al., 2009). Initially a deductive approach was used; the conceptual model was used as a means to devise an initial coding scheme to direct the data analysis (Malterud, 2001). This coding scheme included the main concepts and relationships between variables as stated in the conceptual model, such as *data quality, a clear business vision/objective* and *implementation success*. During the process of analysing the initial coding scheme evolved and. subcategories were added as they emerged inductively (Malterud, 2001), such as *scope* and *goal setting* under *clear business objective/vision,* while also three new categories emerged: *business context*, *time*

and *costs*. An iterative process resulted in the final coding scheme, which contains 13 main concepts and their 30 sub concepts.

Furthermore, the quantitative scores that the respondents scored in selected questions were analysed, allowing for a more structured and formalized way of data analysis (Saunders, 2011), thus increasing its validity (Saunders, 2011).

An overview of the research approach, data collection, and analysis is given in Figure 3.
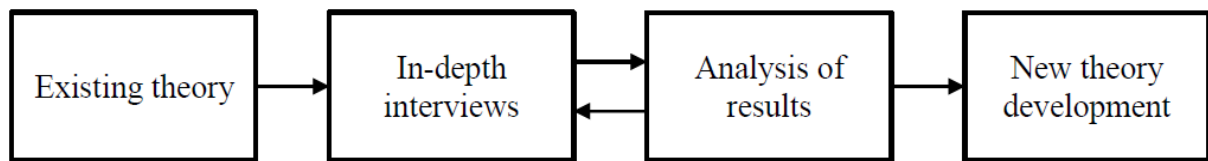
Figure 3. Overview of the research approach, data collection and data analysis

4 Results

Where the previous chapter discussed the methodology of the research, this section will analyse the interview results. Each element of the conceptual model described in Chapter 2.3.4 will be discussed. The sub-questions of the research are used to structure this chapter; each section will focus on one sub-question and/or part of the conceptual model and elaborate on the answers from the interviewees' perspective. In the final chapter, Discussion and Conclusion, this perspective will be combined with the existing theory in order to, eventually, develop new theory.

To gain more insights about the background of the interviewees and their organizations, some general results will be presented first. Secondly, another general part will address the use of spend analytics within the organizations, to gain insight into the actual use of spend analytics and set-ups. The third part, will elaborate on spend analytics success (sub question 1), the fourth part addresses the organizational success factors (sub question 2), the fifth part focusses on the different technical success factors (sub question 3), and in the sixth part, the dynamics of the model will be discussed based on the conceptual model (e.g. the feedback loop and interaction between business and IT side). Finally, in Chapter 4.7, the factors causing the current low satisfaction rate will be discussed (sub question 4).

4.1 Background of the Interviewees

Table 2 provides an overview of the interviewees and their respective position and company. Interviewees 7 and 8 were from the same company and they were interviewed at the same time (the same applies to interviewees 9 and 10). Consequently, the respondents represent altogether 8 different companies. The companies operated in various industries in the private sector, ranging from construction and production to finance and telecommunication. All companies can be considered as relatively large, as they all employ at least 2000 people. The reason for this is arguably that smaller companies usually do not use spend analytics, as they already tend to have a fairly good overview of their spending, given their smaller scale.

The respondents could be considered knowledgeable on the topic of spend analytics: all interviewees were involved in their company's spend analytics utilization, and held relevant knowledge about this. Of the eight companies involved, seven were already using spend analytics, while one was in the implementation phase at the time of the interviews.

Furthermore, some of the interviewees also held relevant knowledge about the use of spend analytics at their previous job(s).

Table 2: Overview of the respondents

Interviewee	Role	Experience in current role	Industry	Company size (employees)
1	Project engineer	2 years	Construction	>5000
2	Sourcing and Procurement head/consultant	3 years	Logistics/Finance	>2000
3	Project manager	20 years	Production	>15000
4	Business controller/project manager	1 year	Construction	>15000
5	Procurement developer	4 years	Transportation	>5000
6	Head of procurement	14 years	Telecommunication	>4000
7	Sourcing team member	2 years	Logistics	>20000
8	Head of category management	3 years	,,	,,
9	Head of procurement	10 years	Construction	>4000
10	Procurement team member	<1 year	,,	,,

4.2   Spend analytics usage

Out of the eight companies involved in the research, six of the companies were using a fully in-house system, and two were using a partly in-house, partly cloud-solution. The companies who were using a fully in-house solution, handled all of the three components of spend analytics by themselves (data extracting, enriching, and analysing). The two companies that used a partial cloud-solution, collected and organized the spend data in their own database, before using a spend analytics tool provided by a spend analytics provider for further classification and analysis of the data.

Table 3: Use of spend aanlytics

	In-house	**In-house/cloud**	**Cloud**
Number of companies	6	2	0

Most of the companies were using their enterprise resource planning (ERP) system as the primary data source for spend data (5), while also the accounts payable (2) and purchase invoicing system (1) were deployed.

The respondents were not really satisfied with the spend analytics in place at the moment. The average score awarded for the satisfaction with current system, on a scale from 1 to 5, was relatively low (mean 2,3; SD 0,9). None of the respondents was fully satisfied (5) with the system, while only one respondent awarded 4 to this question.

Table 4: Interviewees' satisfaction of currently implemented spend analytics

Measure	**Question**	**Mean**	**SD**
Satisfaction with spend analytics **(on a 5 point scale)**	*''Could you indicate how satisfied you are with the spend analytics solution in place? (On a scale from 1 to 5, where 1 indicates least satisfied, and 5 most satisfied.)''*	2,3	0,9

There were a variety of reasons behind the dissatisfaction with the spend analytics. Table 5 provides an overview of these. The respondents complained especially about the lack of data quality and reliability; for instance, the spend data that was used for spend analytics was not complete enough, it did not provide enough possibilities to check data correctness, the data was not detailed enough, etc. Also the lack of integration with, for example, different ERP systems or purchasing systems and the spend analytics solution was one cause for dissatisfaction.

Furthermore, the (lack of) capabilities of the analytics was causing the low satisfaction: the output the system produced was often just numbers, without context or suggestion of action to be taken, relevant (pre-defined) business reports were missing or the system was not easy to use. Finally, also the lack of automation during some steps of the process was one factor behind low satisfaction.

Table 5: Interviewees' reasons for satisfaction with currently implemented spend analytics

Element	Times mentioned by interviewees
Data quality/reliability	6
Lack of integration to other systems	4
No ready-made reports/analytics	3
Not pro-active	3
Too labour intensive	2
Not easy to use	2

4.3   Spend analytics success

To get answers to the first sub question (*what defines spend analytics success?)*, the respondents were asked how they would define spend analytics success. Furthermore, during the rest of the interview, in addition to their answer to the explicit question, some additional elements of spend analytics success came up. Table 6 shows the different aspects of spend analytics' success, as revealed by the different interviewees.

Table 6: Elements of spend analytics success mentioned by interviewees.

Element	Times mentioned by interviewees
Increase spend visibility	9
Generate savings	6
Increase supplier compliance	6
Pro-activeness	5
Increase contract compliance	5
Information supporting business and decision making	4
Reducing the number of suppliers	4
People using spend analytics	2
Measuring supplier performance	2
Consolidating suppliers	1
Increasing automation	1
Detection of faulty processes	1

Almost all of the interviewees mentioned the goal to increase overall spend visibility: to know how much you are spending, on which category, on which supplier, who are you suppliers, etc. Exemplified by the following statement:

> *You just need to know how much you spend. That's how it starts. You need to know how much you spend on each category, to which suppliers, to which supplier families. How much spend is based on contracts, on preferred suppliers, etc.?(Interviewee 6)*

Furthermore, the second most mentioned element was generating savings. Respondents noted that this is one of the ultimate goals of implementing spend analytics. Without savings there is no value. E.g. interviewee 1 stated:

> *Simply to say, if we can get savings in a way or another. Utilizing information so that we can get savings in procurement. So that is for me spend analytics success in a simple way.*

Also increasing supplier compliance was seen as one of the crucial aspects of spend analytics success. By utilizing spend analytics (information), companies need to establish a decrease of maverick spend. This maverick spend was seen as a serious problem in many organizations, and a successful spend analytics implementation should result in identifying and then correcting this maverick spend, and thus leading to less purchasing done at non-preferred suppliers. E.g. interviewee 3 stated that there are often existing agreements or contracts in place with some suppliers, but ordering is still done at other suppliers, and thus, part of spend analytics success is for him to identify and improve this. Next to reducing maverick spend or increasing supplier compliance, another aspect that came up frequently was increasing contract compliance, as indicated by interviewee 3:

> *Then there is the contract compliance: Okay we are having a contract, but why are we not ordering anything from the contract. So it comes down to the daily activities, how we are really purchasing.*

Furthermore, the pro-activeness was often mentioned as a part of the success. This involves a system providing information that is providing actionable insights, as demonstrated by the following two quotes:

Because one of the key elements is to find the opportunities out of the results. So you should be able to identify things out of the data, so seeing that there is something that I should look more into detail in. Or seeing that one part is going fluently no need to do something in that area. (Interviewee 2)

And also that the figures are presented in a way that it is informative. So it should not be only numbers, people may not exactly know what those numbers mean. So it should be presented in a way that instantly provides you the information. Really what you need for the decision-making. And not just having the numbers. (Interviewee 7)

Next, in line with the previous element, it was emphasized that in case of success, the information provided really supports business and (top level) decision making. It was felt that information provided by the spend analytics, should be in line with business and business objectives, not just information for procurement only:

The ultimate purpose is that spent analytics should be something that is supporting companies' decision-making process. That is number one. (Interviewee 2)

It is key part of the decision making. You need to be able to make business decisions based on the data. It is irrelevant if it is not supporting business. You need to be able to tell business how they are doing, also compared to others, inside and outside the company. Make relevant analytics. How well you are doing against the competition. What stuff should cost, and compare your prices with that. (Interviewee 9)

Finally, reducing the number of suppliers was also mentioned by four interviewees, as they felt this was essential to their goal of spend analytics implementation, as mentioned by interviewee 4:

Yeah reducing the volume of smaller suppliers which we don't have any contracts with. In utopia I would say we have around 20 suppliers. That would be success. That is the main thing for us.

Finally, other elements of success, mentioned by the interviewees were *people using spend analytics, measuring supplier performance, consolidating suppliers, increasing procurement automation,* and *detection of faulty processes*.

4.4 Organizational success factors

To assess the different organizational success factors as portrayed in the conceptual model for spend analytics success, we asked the respondents to score each factor, based on their importance, on a scale from 1 to 5. The results are shown in Table 7. It shows that all factors were perceived as really important; all factors scored at least 4 out of 5 on average, with a standard deviation of less than 0,9. Furthermore, 7 out of 10 the respondents felt that no factors were missing from the organizational perspective. Only the *business context* and *suppliers* were mentioned, by respectively 2 and 1 interviewees, as possible additions to this part of the model. Others factors mentioned by the respondents could be grouped under existing factors.

Table 7: Importance of organizational success factors as graded by interviewees.

	Importance mean score (scale 1-5)	Standard deviation
Clear business objective / vision	4,7	0,64
Management support	4,3	0,87
Change management	4,0	0,83
User participation	4,2	0,87

4.4.1 Clear business objective / vision

A clear business objective and vision was perceived as the most important organizational success factor for spend analytics (mean 4,7; SD 0,64). The respondents named this as the basis for a successful spend analytics implementation. They felt that if there was no clear vision and business objective, there is little chance of succeeding. This can be exemplified by the following quotes:

> *Clear business vision, that has to be there in the beginning, there needs to be a vision why we are actually taking the spend analytics into use. Otherwise it will fail somehow. (Interviewee 3)*

> *Everything starts from a clear vision. (Interviewee 9)*

Different aspects related to a clear business objective/vision were mentioned during the interviews. Table 8 provides an overview.

Table 8: Aspects of a clear business objective / vision mentioned by interviewees.

Aspect	Times mentioned by interviewees
Clear vision for spend analytics	7
Establish KPI's	6
Define scope	5
Based on business and business objectives	5
Take end-users into consideration	1

First of all, respondents felt it is important to really define why to implement spend analytics, how it should work, what purpose it has, etc., thus a clear vision for spend analytics. Furthermore, as a part of the clear business objective / vision, it should be defined what actually will be measured by the spend analytics, and based on that establishing KPI's. This is exemplified by interviewee 1:

> *First of all, it is important to establish some KPI metric, those are used in management meetings. Otherwise the spend analytics has no real goal.*

Also, defining the scope was seen as an essential part of a clear business objective / vision to spend analytics success. This refers to both the horizontal scope (which departments/companies/countries do we need to include into our spend analytics?), as well as vertical scope (how detailed does the data need to be?). Both impact greatly the difficulty of implementation, expectations of implementation, and therefore success of implementation. This can be exemplified by the following quotes of interviewees:

(..) But the question is, do we need that much detail here in this business? No I don't think so. We can never implement too detailed systems. We need to know the best level we want to achieve, and then we need to stop there. Because otherwise we just create more work and not that much value. The bar needs to be high, but on a right level. Otherwise it will be counterproductive. (Interviewee 9)

Another thing we haven't done yet, is to connect the invoice systems to spend analytics. But for now, that is not most important, our focus is to get more countries in, based on the current system as we will benefit more from that. (Interviewee 1)

Additionally, the spend implementation goals must be in line with the business, and the business objective according to the interviewees. Otherwise there will not be enough support from the business side and the implementation will likely fail. Thus, the goals should not only be relevant to procurement, but also to business:

I'm also waiting for the day that the business guys are saying to sourcing that there is now need for such spent data. Then it will really be flying. (Interviewee 7)

That's the kind of topic when I say being in line with business. If you don't understand business, if you don't know how to communicate with them, it is a lost case. (Interviewee 9)

I think we really have to be in line with the business. Business targets. So that the KPIs can be modified to meet those targets. Not only to financial targets, but also the customer experience related KPI's. (Interviewee 5)

Finally, also one respondent noted it is crucial to take the end user into consideration, already from the beginning, to ensure the solution will fit the end user upon completion.

4.4.2 Management support

Management support was seen as another important factor by the interviewees. This could be derived from the score of the factor, based on its importance towards implementation success (mean 4,3; SD 0,87). E.g. interviewee 7 stated the following:

Management support is important, especially in practice, in real life. If you have support from management then this is a key priority, and then all the other things will get better as well, such as data input etc. And it will start to fly.

Table 9: Aspects of management support mentioned by the interviewees.

Aspect	Times mentioned by interviewees
Paying for the system	5
Supporting organizational / technical changes	5
Making decision to buy	4
Monitoring implementation	3

Table 9 provides an overview of elements of management support, mentioned by the interviewees. The most mentioned aspect of management support was the fact that management needs to pay for the implementation. E.g. respondent 3 stated:

Management support is always needed, especially in case of financial support and funding.

Another aspect is the support for organizational and technical changes needed for, or based on, spend analytics. In the eyes of the interviewees, the top management should support the changes needed to implement a successful spend analytics system, such as enforcing people to enter more detailed data in the system during the purchasing process to gain more results out of the spend analytics. Also, the management should enforce action based on the spend analytics results in order to succeed:

For example, if the KPI is not matching the target level, the actual actions should be supported by top management. There should be visible support. (Interviewee 5)

Finally, it was noted that (top) management is always making the decision in the end to buy the system, while also the importance of monitoring the implementation, by top management, was emphasized:

And they are definitely monitoring the progress when we are implementing the system. We have for example a steering group with three or four executives. Monitoring the implementation. This is really important. (Interviewee 4)

4.4.3   Change management

The third organizational success factor, change management, was also perceived to be critical for a successful implementation of spend analytics (mean 4,0; SD 0,83). The aspects of change management, mentioned by the interviewees, are provided in Table 10.

Table 10: Aspects of change management mentioned by interviewees.

Aspect	Times mentioned by interviewees
Changes to the input data related processes	7
Changes to the procurement process	6
Promote/educate spend analytics within company	4
Changes to suppliers' way of using invoices	1

When it comes to change management, the most mentioned item was the fact that the way of working needs to be changed, in order to provide useful data for spend analytics. For example, purchasing that does not happen through the appointed and official system, resulting in a lack of high quality spend data, or the process of assigning categories to the invoices when handling them. Interviewee 9 summarizes this:

It includes people using the invoices in right way, us defining the process, us defining how we use the data, us maintaining, keeping it up to date, and giving the feedback to all the people who can post invoices in the company. That is the change management part.

Interviewee 3 continues, regarding the on the invoice handling:

If you don't change the way of doing in the operating level, the spend tool doesn't help you. For example, if you are receiving a lot of invoices without purchasing order, it is really challenging.

Next, the interviewees noted that changes need to occur based on the outcome of spend analytics in order to succeed, and keep on succeeding, mostly related to the procurement process. This can refer to both technical changes to the system, and to organizational changes. For example, to convince people they should start ordering from other suppliers, as spend analytics outcomes indicated this would be cheaper/better, etc.:

> *For change management, I would say that at the moment we have the problem that people are going to the wholesalers, instead of ordering online. To fix this you would need strong management and guidance from your local manager. To explain to them which benefits could be withdrawn from purchasing online, for example. (Interviewee 4)*

Or more generally, as interviewee 1 stated:

> *And then when we get results, we need to react upon them.*

Additionally, also people need to be educated, and the benefits need to be promoted clearly according to the respondents, as interviewee 2 noted:

> *So I think that if the change management, or kind of bring the benefits more clearly to people to understand, would have been beneficial for them to use it more and to kind of deep dive better into the analytics to find the opportunities. The tool was more given as it is, like, here it is use it or not. (Interviewee 2)*

4.4.4   User participation

The final organizational success factor, user participation, was also perceived as being really important; the mean score awarded for its importance towards implementation success, on a scale from 1 to 5, was 4,2 (SD 0,87). For example interviewee 6 stated:

> *User participation needs most improvement, because we have so many individuals who need to do work for that. So not only procurement. Everybody should follow the processes we have defined. Documenting as agreed, using the system as defined, processes as defined. And for the sourcing side, it means that using the procurement spend analytics when you understand that there might be some possibilities to improve, even if business say everything is fine. So it's not only blaming the process and business people, but everybody needs to participate in the correct way. People tend to be lazy. (Interviewee 6)*

Table 11 provides an overview of aspects of user participation as mentioned by the interviewees.

Table 11: Aspects of user participation mentioned by interviewees.

Aspect	Times mentioned by interviewees
Using the analytics	6
Using the right systems/processes to order	5
Rewards/incentives based on KPI's	3
Including more (business) people in the process	1

Firstly, the most mentioned item was the actual use of the analytics. The value of a good spend analytics tool could only be fully unleashed if people are actually using the tool (in the right way). That was most important here, according to the interviewees. E.g. interviewee 2 stated:

> *I think people were to some extent using the analytics, but I think it was not fully utilized. So they were using it, but they were not making the most out of it. That's how it was. So my personal feeling is that there could have been done much more and achieved more, when properly used.*

Or sometimes it is not even used enough, as interviewee 6 stated:

> *Some use, some don't. It's more of a supporting tool for some, and I have the feeling they can get so much more out of the tool.*

Additionally, the systems and processes people use in the purchasing process, was considered as another important aspect of user participation. Interviewee 1 stated the problem for him:

> *Why not everybody participates and orders through right systems? Convenience, and a cultural thing. So many people making orders, and systems are a bit old and not so convenient to use. For example, at a construction site, the system needs time to update, it takes time and it frustrates. And there is also a difference between different users, in the geographical way, who, or who are not, using the systems in procurement, because we have no centralized procurement. For*

example, full-time procurement people use the system when they order stuff, but people who are project people, working for construction site, who also still order, they don't properly use the system.

Interviewee 6 encounters the same:

The buyer's don't use the system the way how we thought they would.

Another aspect mentioned, was the rewards and incentives, based on use and KPI's. E.g. interviewee 7 stated:

And we have also these reward based on KPIs in place. We have scorecards, there are bonuses connected, it's good for human beings have incentives. To boost activities.

4.4.5   Additional factors

The interviewees were also asked if they felt there were some factors missing from the organizational perspective. Seven out of ten respondents felt no factors were missing, and the only additional factors that came up, which could not be grouped under other factors, were *business context* (mentioned by 2 interviewees) and *suppliers* (mentioned by 1 interviewee). Regarding business context, they believed that the industry the company operated in also influenced spend analytics implementation success. The nature of the business determines the feasibility of successful spend analytics. It was argued that it easier for, let's say, a company that only purchases (mainly the same) goods every year to get correct spend data, compared to a company that makes use of sub-contracting or orders other services. *Suppliers* was also a factor for one interviewee, that potentially influences spend analytics implementation success, as the respondent felt that e.g. the willingness to use e-invoices is something that can affect success.

4.5   Technical success factors

To validate the different technical success factors, as displayed in the conceptual model for spend analytics success, we asked the respondents to score each factor, based on their importance, on a scale from 1 to 5. The results are shown in Table 12. It shows that data quality, data extraction, data enrichment, and data analytics were perceived as really important; all

those factors scored at least 4,1 out of 5 on average, with a standard deviation of less than 0,62. Additionally, eight out of ten the respondents felt that no factors were missing from the technical perspective. Only the *costs* were mentioned, by two interviewees, as a possible addition to this part of the model. Others items mentioned by the respondents could be grouped under existing factors.

Table 12: Importance of technical success factors as graded by interviewees.

	Importance mean score (scale 1-5)	Standard deviation
Data quality	4,9	0,30
Data extraction	4,2	0,62
Data enrichment	4,2	0,60
Data analytics	4,1	0,53
Scalability / Flexibility	3,5	0,67

4.5.1   Data quality

Almost all respondents awarded the highest score, regarding importance towards implementation success, for data quality. It is seen as the most important factor of a successful spend analytics implementation. Three different interviewees exemplified this by the following quote: *''garbage in, garbage out''*. Without quality data as input for the spend analytics, the implementation will definitely fail, was the feeling of the respondents. Table 13 shows the different aspects of data quality as mentioned by the interviewees.

Table 13: Aspects of data quality mentioned by interviewees.

Aspect	Times mentioned by interviewees
Data validation	8
Data completeness	7
Data accuracy	5
Governing model	4

Data validation was the most important aspect regarding data quality, as mentioned by the interviewees. It refers to validating the data quality. Given the vast amounts of transactional (master) data, this is seen as difficult or impossible according to the interviewees.

> *That is always hard. When you do big data extraction, when you want to look in a micro level, it is hard to make sure the quality of the data is good. We know little about that actually. It's hard to tell. (Interviewee 4)*

> *Because when we take new systems, and usually it is so that neither procurement people nor businesspeople can validate the data. So that is sometimes a little with challenging part. (Interviewee 1)*

Also, the completeness of the data is important, and often a problem according interviewees. This refers to the 'richness' of the data, the number of fields that hold different information, on a level that is useful enough to use, etc:

> *But still the problem with this data is, we don't actually identify the parent side company structure. There are not enough elements in the data, to really make the identification. So there are a lot of vendor masters, but we don't actually know if they are part of the corporate or not. And that is challenging of course. And therefore the spend tool gives us no opportunity to actually match those vendors together. So most of the problem is the master data itself, the spend tool itself cannot fix these master data. That is for sure that we noticed so many times. (Interviewee 2)*

The master data management in source systems. That's poor at the moment. Could be much better. For example vendor master data, it's lacking information on fields that should be mandatory, especially for the historically opened suppliers. Not enough elements in the data to make identification for the classification. (Interviewee 5)

Also, the accuracy of the data was regarded as important, but often perceived as problematic. E.g. interviewee 9 stated the following about data accuracy in his situation:

Data is not 100% accurate. When you look at supplier angle. You actually don't easily define the category. We do use some of these internal project numbers or order numbers for the invoices to categorize in such a way that it should go to right category. We try to do that, but that is mostly dependent on the people who are working in the company.

Finally, the governing model was mentioned to be important when it comes to data quality. To define who is responsible for data quality, who owns the data, etc. This can be exemplified by the following quote:

So the governance model, who is actually owning the tool in the company. Somebody has to look after the data quality. And since there are so many categories, nobody's expert on all the areas. So it means that there needs to be a governance model, on monthly basis somebody needs really be responsible to check that the data is on a good level. So checks that the classification works fine, and if they notice something, they have to reclassify something. So somebody really should have the data responsibility at least from the business. For example, we have now decided, there is a business analytics team, who are responsible, and have to check the data after it's being in place. That will help us so that we can really say that the credibility and reliability will be in good shape because we really validated the data. (Interviewee 3)

4.5.2   Data extraction

The second factor, is the capability to extract data. This was also seen as an important factor. On a scale from 1 to 5, the interviewees assigned on average 4,2 (SD 0,62). The most important aspects of this factor are shown in Table 14.

Table 14: Aspects of data extraction mentioned by interviewees.

Aspect	Times mentioned by interviewees
Different source systems	6
Different formats	5
Connect right systems	5

Firstly, the respondents felt this capability was really important, as there are often different source systems for spend analytics. Therefore, it is important to be able to extract the data in the correct way from the different systems:

> *Data extraction I see as an important part since companies quite often have different data sources; some ERP here some different system there, they are being in different countries, and then to get transparent data from all the different sources… It is important to get the extraction automated from there. In one data warehouse, from where the spent analytics can be done. (Interviewee 2)*

> *Another challenge is that we have different ERP systems used to order services and subcontracting. (Interviewee 1)*

Secondly, not only are there different systems, but also different formats of the data. This makes the classification and analytics more difficult according to the interviewees. For instance, interviewee 1 noted:

> *We have now some challenges, with our Russian part, bookkeeping there has difference formats than here, so that's a challenge.*

Finally, the respondents indicated that it is import to actually connect the correct (source) systems to the spend analytics to get a better and deeper insight into their spending. Thus, sometimes connect more/other systems:

Somehow I would like to see that it is connected to the purchasing systems. Actually the one which we make the purchase orders with, that one should be done collecting the data. The previous company where I worked, we basically followed the spend, through the system that we were generating the orders with. And here we are following the invoices. And for me, as a sourcing guy, I do not see all the companies who are sending the invoices as a supplier. But here we are considering all the companies were sending invoices as suppliers. (Interviewee 8)

4.5.3   Data enrichment

Data enrichment was the third technical success factor addressed. This one was also considered to be important. On a scale from 1 to 5, the interviewees assigned on average a 4,2 (SD 0,60). The most important aspects of this factor are shown in table 15.

Table 15: Aspects of data enrichment mentioned by interviewees.

Aspect	Times mentioned by interviewees
Classification	6
External data sources	5
Unaware of possibilities	3

For example, for interviewee 2, data enrichment is an important factor:

Data enrichment is something I would highlight. My understanding is, that this is the area which is mostly missing in organizations. Is there a way that it can be automated? Or is there a specific role assigned to look into the enriching? Which are the data sources, both internal and external, that can be used to enrich the spend data. So if this part could be improved, in a kind of second-level way, then the business benefits will increase even more. In a proactive way.

The most apparent aspect here is the classification of the spend data. Respondents agreed this was an important aspect, but there are some differences on how to achieve this classification, also depending on the data quality that is avaible, as described in the data quality part. E.g. interviewee 3 stated that classification engines offered by spend analytics providers are often not sufficient:

Most likely the classification itself is part of the service. But when they are doing the classification, are they really experts? Okay they are doing it for 20 other companies, but still, it might be beneficial to do the classification by yourself. Because the category persons who are actually negotiating the contracts and using the spend analytics, they are really familiar with the things. So they know the supplier, what we are actually purchasing from them. So they can really make the classification easy. Without any mistakes. So I would say it would be one success factor to really have resources within the company to make the classification by themselves. (Interviewee 3)

Sometimes it happens partly manually, like interviewee 4 stated:

Enriching happens partly manually, for example, our people from the procurement department, sit down with the consultants, and say, this or this or this supplier belongs to this family. (Interviewee 4)

While other times it happens automatically:

Yes, and the data enriching part, we have a table that is used in the business intelligence tool. And we don't actually enrich row by row, but the tool does it according to the classification rules presented in the table. (Interviewee 6)

Also mentioned was the use of external data sources to enrich the data to gain more value out of the spend analytics:

External data is coming to use in excel. Data about price trends regarding fuel prices, electricity prices, etc. So we can enrich our own data, or take our own data and look at comparison data and look together. (Interviewee 9)

However, also it became apparent that some do not know exactly how much is possible with data enrichment:

Data enrichment, we are not doing too much, so it's difficult to grasp what it actually can do. But I think it depends also a lot on demand, what do we want with the spend analytics? (Interviewee 7)

4.5.4 Data analytics

Data analytics was considered as another really important factor, towards implementation success. On a scale from 1 to 5, the interviewees assigned on average a 4,1 (SD 0,53).

The most important aspects of this factor are shown in Table 16. This table shows that there are many different aspects that interviewees felt that were important when it comes to the actual data analytics.

Table 16: Aspects of data analytic smentioned by interviewees.

Aspect	Mentioned by interviewees
Red flagging (proactive)	5
Pre-defined reports/analytics/KPI's	5
User access for different user groups (also outside sourcing)	4
Ease of use	4
Business context of numbers	4
Individually defining own KPI's	3
Drill down manually	3
Best practices	3
Spend context (trends, price levels, etc.)	2
Contract information	2
Supplier score cards	2
Companywide reporting platform	1
Budgets availability	1

Red flagging, or being proactive, was one of the most important aspect of good analytics. The analytics should provide actionable insights, red flagging automatically, based on e.g. KPI's :

> *But the reason why I don't give a five, is that it was not really proactive in a way that the solution was not red flagging any kind of deviations from the trend for example. So for example, if you*

have a category or subcategory where the spend is 1 million per month, and then in one month it will be 1.5 million all of a sudden, the solution didn't red flag that itself. (Interviewee 2)

Pre-defined reports/analytics/KPI's, was another important aspect. If it is a system where every user should start by selecting all the different elements manually, and manually drill down, it is not a good solution according to the interviewees. It should have pre-defined reports, KPI's, etc.:

Next to a system where you can let say, play with data cubes, etc., we would like to have a more spend analytics which provides the information more or less. Not that much huge databases, but one that provides operational information, ready- made reports. (Interviewee 7)

Additionally, the fact that more users should have access than just procurement was mentioned:

And also you need to be thinking about who really uses the system that is one of the questions. Here you have roughly 200 end-users. Most of those are sourcing persons working with the sourcing. But there also persons from the middle management who want to follow up the invoices. What do we have actually purchased? Use to save money. So I would say it's not only sourcing too. So more and more persons within the organization need to have access to it. (Interviewee 3)

Ease of use was also considered to be important. Respondents felt that the systems need to be easy to use for everybody, otherwise it might happen that it is not used properly, or not at all:

Well, in reality it's really important the system is easy to use. When the user basically gets to report without doing anything, it motivates more, and it is easier to sell to his or her colleagues. (Interviewee 1)

(Business) context of numbers was also a frequently mentioned aspect, as just numbers are not being perceived informative enough:

And also that the figures are presented in a way that it is informative. So it should not be only numbers, people may not exactly know what those numbers mean. So it should be presented in a

way that instantly provides you the information. Really what you need for the decision-making. And not just having numbers. (Interviewee 8)

4.5.5 Scalability / Flexibility

Scalability and flexibility, was not awarded as high score for importance by the interviewees, compared to the other factors. On a 1 to 5 scale, the mean score was 3,5 (SD 0,67). E.g. interviewee 3 stated:

When it comes to the flexibility and scalability, I don't think it's too important. The only thing that needs to be changed sometimes, are the business hierarchies. But that doesn't happen too often. Only if the company changes.

However, interviewee 4 stated that it could be beneficial to scale up the system when needed:

Scalability flexibility; of course you want a system that can be used in the whole group. We want to have all the countries to have access to the benefits we have drawn from the system. For example, that also other countries could draw benefits from the categorization we made. And don't have to reinvent the wheel again.

Furthermore, two respondents pointed out that making changes to the system, e.g. to the analytics module or classification engine, should be relatively easy.

4.5.6 Additional factors

Interviewees was also asked if they felt there were some factors missing from the technical perspective. Eight out of ten respondents felt no factors were missing, and the only additional factors that came up, which could not be grouped under other factors, were *costs* (mentioned by 2 interviewees) and *time.*

E.g. interviewee 9 stated:

The cost of the system. That is something important. The kind of business case is missing. It is very relevant. If you make any of this without a business case you don't understand what are the benefits for business, but also costs for the business. Typically, you will then fail in implementation. If too costly, or surprise cost, that's going to be uphill battle. So important before you start implementation.

Related to that was also the *time* that should be taken into consideration according to one interviewee: If the implementation takes too long, the support from business, management, and users may disappear over time.

4.6   Feedback loops

Additionally, based on the conceptual model, we asked respondents about the feedback loops, both to the organizational and technical perspective, but also between them.

Most important for the feedback to the organizational perspective, as felt by the interviewees, was that action in the organization that will be taken, based on the results of spend analytics. Procurement, business, and/or others may need to change their behaviour (e.g. changing supplier, use different way of purchasing, etc.), as also discussed in the change management part. Respondent 2 stated:

> *Because one of the key elements is to find the opportunities out of the results. So you should be able to identify things out of the data, so seeing that there is something that I should look more into detail in. Or seeing that part is going fluently and that there is no need in that area. So it is imperative that action is taken based on the results. (Interviewee 2)*

Furthermore, we asked how often the 'feedback' loop towards the organizational perspective is happening (e.g. how often the results of spend analytics are reported?). Out of the 8 companies, one had monthly feedback loops, two did it on quarterly basis, one around each half a year, and one on yearly basis, and three more or less on ad-hoc basis. However, it was felt that a systematic approach was preferred by two of the respondents who indicated that they were having an ad-hoc based feedback loop.

Regarding the feedback loop towards the technical factors, it was mostly about validating data quality, as already discussed in the data quality section. Furthermore, two respondents noted that also the IT department is asked frequently to make changes to the tool, as interviewee 2 stated.

Especially when it comes to easiness of the use. So that is also one area where a lot of feedback actually was given. To state, that why something cannot be done easier than before? Or why do I get a different result now compared to yesterday?

Finally, also the interaction between the two perspectives was questioned. It was highlighted by five interviewees that the interaction between technical and organizational side is crucial, and that there might be problems in some cases. E.g. interviewee 2 stated:

Must be there of course. Absolutely. They are anyway quite closely linked I would say. But the difference is, that there are probably different user groups participating in both of the boxes. The technical part is basically where the technical people in the company, who are kind of key users of the solution, or even the IT department owning the BI solution. And then the organizational perspective comes more in the business use. And then comes off course the organizational barriers, in a way that the IT and technical people might not realize all the key needs of the business, and vice versa.

Another important aspect, mentioned by four interviewees, is that there needs to be somebody in between the business and the IT side, who is responsible for the solution. As exemplified by the following quotes:

We had a role called solution manager, so he was the person who was owning the concept of the solution and interacting actively with the business and end-users. So we had a specific role for that. That is crucial. (Interviewee 2)

There needs to be a governance model. So there really needs to be the owner of the tool in the company. Who can actually take care of this loop in total. That needs to be somebody who is in between the technical and the organizational perspective. He must know everything, and handle all the feedback. (Interviewee 3)

4.7   Factors causing low success rate

To gain more insight in the current low success rate of the spend analytics implementations, the respondents were asked what the success factors are that they perceive as most and least satisfactory at the moment, for their current spend analytics in use. They could pick, if possible,

1 or 2 factors for most satisfactory, and 1 or 2 for least satisfactory, from both the organizational and the technical perspectives. Figure 4 provides an overview of the most satisfying success factors, as mentioned by the interviewees, while Figure 5 provides an overview of the least satisfying factors.

Figure 4. Most satisfactory success factors, as mentioned by interviewees.
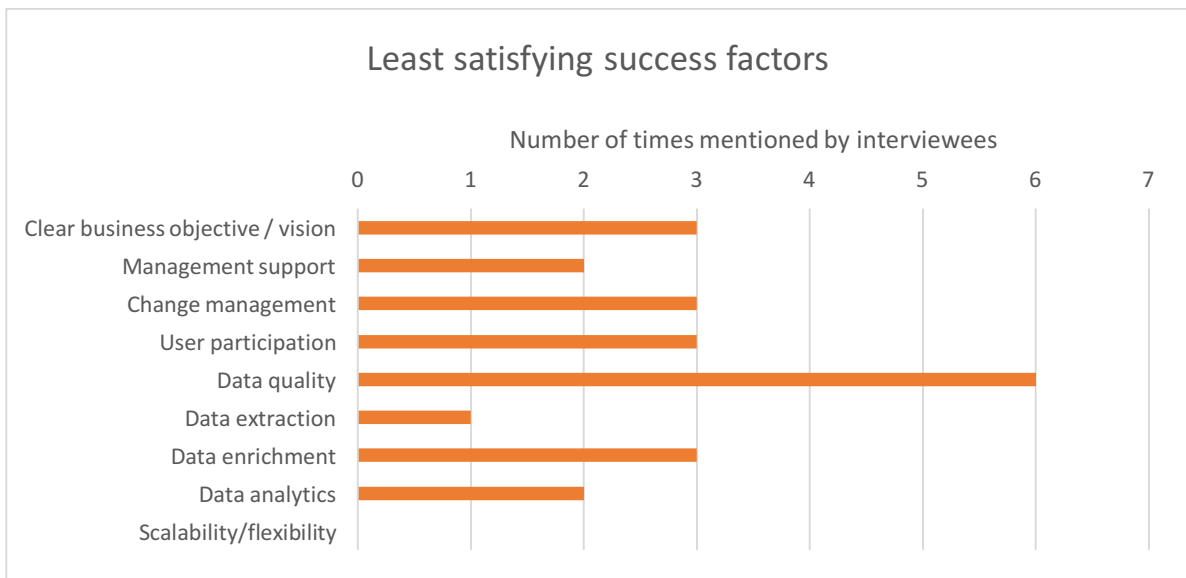
Figure 5. Least satisfactory success factors, as mentioned by interviewees.

4.7.1 Organizational perspective

From an organizational perspective, the business objective and vision and management support were four times mentioned as most satisfying. For those interviewees it was mostly clear what the objective and vision was for implementing spend analytics. For instance, interviewee 9 stated:

> *We have very clear business objective and vision what we want to do. We know what we want to do.*

The four respondents who indicated that management support was most satisfying for them, highlighted most that top management was supporting the implementation, and that they are interested in the outcomes. E.g. interviewee 3 stated:

> *So we are really having full support from the management, so they really can see that this tool is needed, also in the future.*

However, considering the factors that were least satisfying, also the business objective/vision was mentioned by three interviewees. E.g. the problem stated by interviewee 7 was that it is not clear enough for everybody what the actual goals and possibilities of spend data analytics are. Interviewee 3 mentioned the need for a clearer future vision on the use of spend analytics, given the advances in technologies and offerings of spend analytics solutions:

> *The reason is, the suppliers are offering many different things, modules, etc. so the vision needs to be clear, we really need to know what we need now, and in the future.*

Furthermore, the change management and user participation were indicated by three interviewees each to be the least satisfying at the moment. For change management, it was highlighted that more needs to be done to make people use the invoices the right way, use purchasing systems (the right way), etc. Also enforcing people to change their work/purchasing habits, based on the results of spend analytics, was mentioned. Finally, interviewee 2 stated on change management:

> *Definitely, that was change management. At the end of the day what happened was, was up to the end user or the people by themselves how well they were utilizing the spend analytics in their*

daily work, planning, annual planning, and strategy work. So I think that if the change management, or kind of bring the benefits more clearly to people to understand, would have been beneficial for them to use it more and to kind of deep dive better into the analytics to find the opportunities. It was more given as it is, like, here it is use it or not. The kind of the background, selling phase was not done as good as it could be. So there was some resistance.

On user participation, the following quote exemplifies the major issue:

User participation needs most improvement, because we have so many individuals who need to do work for that. So not only procurement. Everybody should follow the processes we have defined. Documenting as agreed, using the system if defined, processes as defined. (Interviewee 6)

Change management, was not mentioned by any interviewee as most satisfying factor.

4.7.2 Technical perspective

From the technical perspective, scalability/flexibility, data analytics and data extraction were mentioned two times each as the most satisfying technical factor at the moment. For example, about data extraction and data analytics, interviewee 2 noted:

I think the one what was working quite well was the data extraction. So the environment was built quite well, also we had a visibility for the different source systems, and they were put together into one reporting platform. And the second one I would put data analytics. So we were kind of opening up the spend analytics for the users, so everyone who was supposed to get access to it, were able to get access and were able to do basic analytics around that environment. I think it was quite nicely put together.

The scalability and flexibility was considered less important, and (therefore) often satisfactory enough by two interviewees. Respondents did not often feel the need to scale up and down. Regarding the factors that need most improvement, data quality was mentioned by most interviewees. Eight interviewees saw this as the (or one of the two) technical success factor(s) that would need most improvement in their situation. Especially the data completeness and validation were mentioned. This can be exemplified by interviewee's 3 & 5 statements:

And the quality itself. I mean, the tool functionality is usually fine, all tools are more or less the same. The biggest issue is with the data itself. There are not enough elements to make identification for the classification. And that is the major problem. I am not trusting these out to make classification rules. Somebody has to validate them. I don't believe the supplier of spend analytics can do that. I think we need to make the rules by yourself and put effort to that. (Interviewee 3)

The master data management in source systems. That's poor at the moment. Could be enhanced. For example, vendor master data, it's lacking information on fields that should be mandatory, especially for the historically opened suppliers. Then we have the source system which hasn't got fields for required information. This information has to be enriched afterwards. Such as vendor grouping. We don't have a field in our master data that we could use for grouping different vendor numbers for the same VAT registration code. That is done only afterwards in our data enrichment phase. (Interviewee 5)

Also, the data validation was mentioned. For instance, interviewee 1 stated:

Because when we take new systems, and usually it is so that procurement people neither businesspeople can validate the data. So that is sometimes a little bit challenging part.

Data enrichment was mentioned by three interviewees as the least satisfying factor from a technical perspective. For example, interviewee 6 mentioned:

Data enrichment needs most improvement. So we should get more information out of the data we have.

In this context, the use of external data sources came up as well, e.g. interviewee 2 stated:

One thing that came to my mind was linking external data sources. So not only looking at the internal data sources, but linking to external as well. For example, financial ratings for the company, or for example those cost indexes that are calculated in the industry. So linking that kind of external data sources to enrich would give a better perspective.

Finally, the interviewees who named data analytics as the least satisfying were mostly complaining about the lack of pro-activeness and ease of use, while the interviewees who perceived data extraction as the most problematic, mostly found it difficult to extract the data from the different source systems in a proper way.

Data quality and data enrichment were not mentioned by any interviewee as most satisfying factor, while scalability / flexibility was not mentioned as least satisfying by the respondents.

5 Discussion and Conclusion

While the previous section analysed the interview results in detail, this chapter will scrutinize the results with the theoretical framework. The practical viewpoint, deducted from the interviews, and the theoretical perspective, derived from literature, will be discussed to develop new theory, answer the sub-questions, and eventually the main research question. Furthermore, practical implications as well as theoretical implications are provided, and possible directions for future research are addressed. This chapter will end with a conclusion.

5.1 Discussion

In this part, we will reflect on the findings, based on the theory, and answer the (sub) research question(s). This part will be concluded by a discussion on the reliability and validity of the results.

5.1.1 Sub question 1: *What defines spend analytics' success?*

Based on the literature on success factors for BI, BA, and data warehousing, the success for spend analytics was not that easy to define. Those studies define success either not at all (Chaudhary, 2004; Hawking & Sellitto, 2010), or in different ways (Işık et al., 2013; Yeoh & Koronios, 2010). According to Isik et al. (2013) this has to do with the fact that business intelligence success can be different for different companies in different industries, depending on the goal set for the analytics system. However, studies that address the success have in common that a successful implementation of the system must in the end lead to (tangible) business benefits (Işık et al., 2013; Wixom & Watson, 2001; Yeoh & Koronios, 2010). Additionally, from the literature on spend analytics, some possible aspects of spend analytics success and business benefits could be deducted: achieving total spend visibility, identifying cost savings opportunities, and enhancing procurement process efficiency. (Chowdhary et al., 2011; Melvin Tan & Lee, 2015; Pandit & Marmanis, 2008; Westerski et al., 2015).

During the interviews, different aspects of spend analytics success came up. Those factors that were mentioned by at least two different interviewees were*: Increase spend visibility, generate savings, increase supplier compliance, pro-activeness, increase contract compliance, provide information supporting business and decision making, reduce the number of suppliers, get people to use spend analytics,* and *measure supplier performance*. Some of

these could be considered as (tangible) business benefits, like increase spend visibility, generate savings, and increase supplier compliance. Others are more general implementation success factors, like get people to use the system and provide information in a business context. Following Yeoh & Koronios, (2010), we expect that the general implementation success factors lead to tangible business benefits. Furthermore, the factors *costs* and *time,* which emerged as additional factors during the interviews, could be classified as factors related to general implementation success (Wixom & Watson, 2001). Figure 6 provides a visual representation of the spend analytics success' definition.


```
┌─────────────────────────────────┐                    ┌─────────────────────────────────────────┐
│  Implementation succes          │                    │  Perceived business benefits            │
│                                 │  ───────────────▶  │                                         │
│  - pro-active information       │                    │  - increased spend visibility           │
│  - information in (business)    │                    │  - savings generated                    │
│    context                      │                    │  - increased supplier- and contract     │
│  - system usage                 │                    │    compliance                           │
│  - time and budget utilized     │                    │  - reduced number of suppliers          │
│                                 │                    │  - measured supplier performance        │
└─────────────────────────────────┘                    └─────────────────────────────────────────┘
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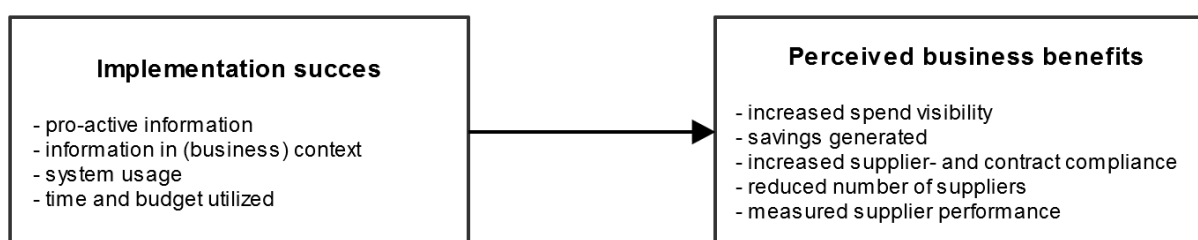
Figure 6. Spend analytics success defined

5.1.2   Sub question 2: *From the organizational perspective, what are the critical success factors for spend analytics?*

Following a literature research on the success factors related to BI, BA and data warehousing (Hawking & Sellitto, 2010; Mungree et al., 2013; Schieder & Gluchowski, 2011; Wixom & Watson, 2001; Yeoh & Koronios, 2010; Yew Wong, 2005), combined with the (limited) amount of avaible work on spend analytics (Kamruddin, 2005; Pandit & Marmanis, 2008; Singh et al., 2005), we expected the following success factors, from an organizational perspective: *a clear business objective/vision, management support, change management* and *user participation*.

Interviews confirmed that these are the success factors from the organizational perspective. All factors were perceived as really important, and no additional factor(s) need to be added to this perspective. The only additional factor, mentioned two interviewees, was *business context*. However, this can be seen more as a moderating variable between the different success factors and the implementation success (Işık et al., 2013; Yeoh & Koronios, 2010).

For business objective and vision, the following aspects were mentioned by at least two different interviewees: *Clear vision for spend analytics, establishing KPI's, setting the scope* and *goals based on business and business objectives*. These aspects, as mentioned by the interviewees, are in line with some of the academic works on success factors. For example, Mungree et al. (2013) stressed the importance of a clear vision, and the clearly defined scope, while Corbett (2007) argued for the importance of goals in line with business, and the defining of clear KPI's beforehand.

Regarding management support, the following aspects were mentioned by at least two different interviewees: *Paying for the system, supporting organizational / technical changes, making the decision to buy,* and *monitoring implementation.* These aspects find support in the literature. For instance, Yeoh and Koronios (2010) state the importance of paying for the system, and monitoring the implementation, in their research into success factors. Yew Wong (2005) referred to the supporting role the management has in changes to be made in the organization. Finally, the fact that top management is in charge of decision making, is highlighted by e.g. Finney and Corbett (2007).

Change management was also perceived as an important factor, and the following elements were mentioned by at least two different interviewees: *changing input data related processes, changing the procurement process,* and *promoting/educating spend analytics.* These aspects find support in the academic literature as well. For example, Finney and Corbett (2007) elaborate on the need for education and promotion of the system, while e.g. Yew Wong (2005) discusses the need to change the way of working to provide successful input for the system.

The aspects of user participation, as mentioned by at least two interviewees, were: *using the analytics tool, using right systems/processes for procurement,* and *rewarding/incentivizing based on KPI's.* These aspects, as mentioned by the interviewees, are in line with some of the academic works on success factors. Using the system (Watson, 2001), the procurement process (Pandit & Marmanis, 2008), and rewards and incentives (Malhotra & Galleta, 2003), are discussed.

Figure 7 provides an overview of the different organizational success factors and their elements.

Clear business objective/vision	User participation
- developing a clear vision for spend analytics - establishing spend analytics KPI's - setting the spend analytics scope - goals in line with business (objectives)	- using the spend analytics tool - using the right systems/processes for procurement - rewarding and incentivizing based on KPI's
Change management	Management support
- changing data input related processes - changing the procurement process - promoting / educating spend analytics	- providing funding/resources for implementation - supporting organizational and technical changes - making the decision to buy - monitoring the implementation

Figure 7. Organizational success factors for spend analytics

5.1.3 Sub question 3: *From the technical perspective, what are the critical success factors for spend analytics?*

Likewise the organizational success factors, we expected the following success factors from the technical perspective: d*ata quality, data extraction, data enrichment, data analytics,* and *scalability/flexibility.*

Interviews confirmed that these are the success factors from the technical perspective. The first four factors were perceived as really important, while the scalability/flexibility proved to be somewhat less important. No additional factor(s) need to be added to this perspective. The only additional factors, mentioned by at least two interviewees, were *time* and *costs*. However, as explained before, we see them as part of the implementation success variable.

For data quality, the following aspects were mentioned by at least two interviewees: *data validation, data completeness, data accuracy,* and *data governance model.* These aspects find support in the literature as well. For example, Pandit and Marmanis (2008) already discuss data validation, data completeness and data accuracy in their work on spend analytics, and Wende (2007) argues for a data governance model to ensure data quality.

Data extraction was also perceived as an important factor, and the following aspects were mentioned by at least two different interviewees: *extracting from different source systems, handling different formats,* and *connecting to the right systems.* For data enrichment, *classifying spend data, including external data sources* and *being aware of possibilities* were

the aspects mentioned by at least two interviewees. These two factors were not described in great detail in the limited academic literature on spend analytics. However, Pandit and Marmanis (2008) do refer to these aspects briefly.

Data analytics was the factor for which the respondents named the most different aspects. The ones mentioned by at least two interviewees were: *Red flagging (proactive), pre-defined reports/analytics/KPI's, user access for different user groups (also outside sourcing), user interface (ease of use), (business) context of numbers, individually defining KPI's, manually drilling down, best practices, spend context, contract information,* and *supplier score cards.* These are mostly requirement stated for the analytics, and can be seen being in line with the work of e.g. Isik et al. (2013), who also delve into the topic of user requirement for the analytics.

The ability to scale up or expand the system and the flexibility to make changes to the system, e.g. to the classification schema or to the analytics component, were the two elements of scalability/flexibility that were mentioned. Even though the scalability and flexibility was considered to be less important compared to the other factors, we do not think the factor should be omitted, given its relative importance in literature on success factors (Işık et al., 2013; Mungree et al., 2013; Olszak & Ziemba, 2012; Yeoh & Koronios, 2010) and score awarded by participants based on perceived importance (3,5 on a scale from 1 to 5).

An overview of the success factors from spend analytics from the technical perspective and its aspects is provided in figure 8.

Data quality

- data validation
- data completeness
- data accuracy
- data quality governance model

Data extraction

- capablity to extract data from different source systems
- handling different data formats
- connecting the right systems

Data analytics

- provide 'pro-active' information
- provide pre-defined KPI's
- provide user access for different user groups
- provide easy to use UI
- provide numbers in context
- provide 'drill-down' possibility
- provide best practices
- provide spend context
- provide contract information
- provide supplier score cards

Data enrichment

- classifying spend data
- including external data sources
- being aware of possibilities

Scalability / flexibility

- ability to expand system scope
- flexibility to make changes to system

Figure 8. Technical success factors for spend analytics

5.1.4 Sub question 4: *Which factors are causing the low success rate for currently implemented spend analytics solutions?*

It became apparent from the interviews that data quality was the factor that was mostly behind the low success rate from currently implemented systems. This is in line with Wixom and Watson (2001) who place great emphasis on the data quality, and with others who name data quality as one of the main reasons why other IS implementations fail, such as Xue et al. (2005) who investigated ERP system implementation failure. Figure 9 provided an overview of the different factors and their perceived impact on failure.

Furthermore, it became apparent from the interviews that also the (lack of) a clear business objective / vision, change management, user participation, and data enrichment were factors often mentioned as least satisfactory and thus could be lowering the implementation success rate.

5.1.5 Main research question: *What are the critical success factors for spend analytics*?

Based on the sub research questions, Figure 9 provides a model for spend analytics success.

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Clear business objective/vision

- developing a clear vision for spend analytics
- establishing spend analytics KPI's
- setting spend analytics scope
- goals in line with business (objectives)

Management support

- providing funding/resources for implementation
- supporting organizational / technical changes
- making the decision to buy
- monitoring the implementation

Change management

- changing input data related processes
- changing the procurement process
- promoting/educating spend analytics

User participation

- using the spend analytics tool
- using correct systms/processes for procurement
- rewarding and incentivizing based on KPI's

Organizational perspective

Solution manager

Data quality

- data validation
- data completeness
- data accuracy
- data quality governance model

Data extraction

- capablity to extract from different source systems
- handling different data formats
- connecting the right systems

Data enrichment

- classifying the spend data
- including external data sources
- being awarene of possibilities

Scalability / flexibility

- ability to expand the system scope
- flexibility to make changes to system

Data analytics

- provide 'pro active' information
- provide pre-defined KPI's
- provide user access for different user groups
- provide easy to use UI
- provide numbers in context
- provide 'drill-down' possibility
- provide best practices
- provide spend context
- proivde contract information
- proivde supplier score cards

Technical perspective

Business context

Implementation succes

-pro-active information
-information in (business) context
-system usage
-time and budget utllilized

Perceived business benefits

-increased spend visibility
-savings generated
-increased supplier- and contract compliance
-reduced number of suppliers
-measured supplier performance

Feedback:
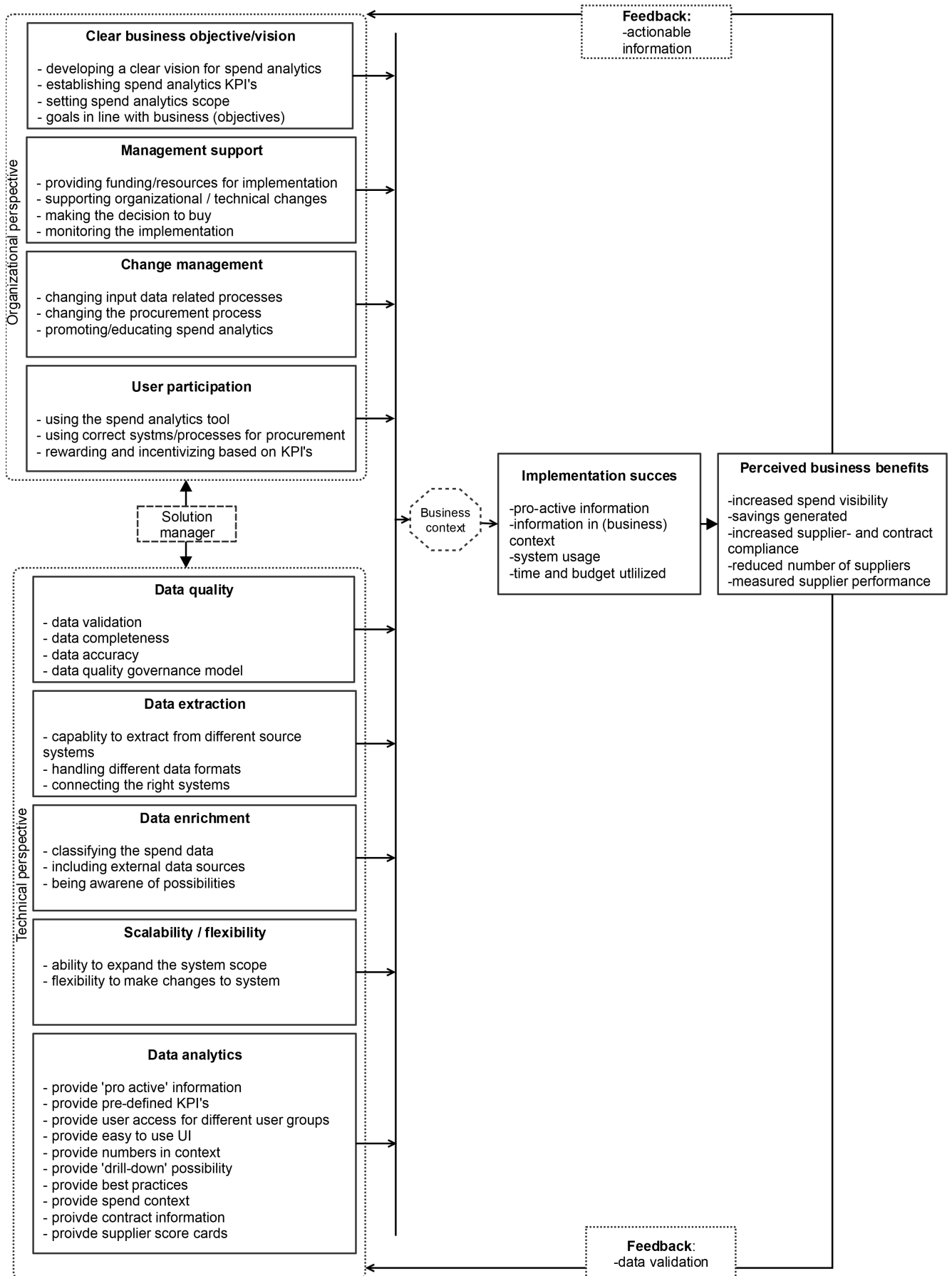-actionable information

Feedback:
-data validation

Figure 9. Model for spend analytics success

The model for spend analytics success is based on the conceptual model, crafted in section 2.3.4. However, there are some changes that are mostly based on the answers of the sub questions 1-3: implementation success, the technical perspective, and the organizational perspective are adjusted and expanded, based on the answers to the sub questions 1 -3, (see sections 5.1.1, 5.1.2, and 5.1.3). For example, different aspects of each factor are added, as they make the model more specific for spend analytics.

Furthermore, the additional factor *business context*, is added as a moderating factor between the success factors and the implementation success: The nature of the business determines to some extent which level of implementation success can be achieved, as became apparent from the interviews. For example, in an industry where a lot of (irregular) purchasing consists of sub-contracting and service contracts, it will be more difficult to reach a high level of spend visibility, compared to an industry where purchasing consists of (mostly similar) materials, on a regular basis.

Additionally, it is crucial to have a 'solution manager' between the technical and organizational perspective to facilitate communication and cooperation between the two sides. Finally, based on the interview results, the most important aspects of the feedback loops are added. The main goal of the feedback loop to the organizational perspective is to provide 'actionable information': there needs to be an information flow that consists of clear actions to be taken based on the results. The feedback to the technical side should be mainly about data validation: data needs to be validated on a regular basis, following a structured governance model to ensure data quality.

5.1.6 Reliability and generalizability of results

Even though the qualitative research method of using semi-structured interviews provided in-depth insights into the researched topic, it is not meaningful to make statistical generalizations about the whole population, that is, all the implementations of spend analytics in this case, which is a limitation related to this kind of qualitative research (Saunders, 2011).

Although we tried to overcome this limitation as much as we could, by structuring the interviews as much as possible, researching implementations at different companies, including both successful and less successful implementations, and using quantitative scoring methods

for some questions, there might still be some other limitations as well related to the generalizability.

The majority of interviews were held with representatives of companies located in Helsinki (except 1), and all companies were large companies. This was inevitable given the time and resource restrictions of the researcher, and the nature of the solution, but it could result in less generalizable results, as the perception on this topic could be different for companies from different locations and different sizes. Furthermore, the moderate amount of interviews (8) or interviewees (10) could be considered as a limitation, but the topic under investigation was quite specific and thus difficulties arose to find respondents with sufficient knowledge and experience on the topic of spend analytics, also given the restricted time and resources of this research.

Given the research method chosen, it was also difficult to really measure the exact influence of each factor on implementation success. This would have been possible using a quantitative approach and including a bigger sample size (Saunders et al., 2009). However, this would not have fitted the exploratory nature of this research and would have not enabled the in-depth research as aimed for (Saunders et al., 2009; Strauss & Corbin, 1990).

Since the model provided by this research is (one of) the first one(s) that tries to explain by which factors spend analytics success is influenced, it is likely that the model is neither perfect nor complete yet. The model should really be seen as a foundation for future research into spend analytics (success). It can be assumed that the model will be adjusted over time, adapting to (technology) advances in spend analytics. Another limitation is that the model only takes general technological and technical factors into considerations, while a more in depth research into the different factors would be needed to generate a more complete picture of spend analytics success.

5.2 Theoretical- and practical implications, and future research

5.2.1 Theoretical implications

This research may have some implications on the current academic literature.

So far, only some selective research has been conducted on spend analytics in the academic world, focused on specific scenarios such as fraud detection (Jans et al., 2010; Ramamoorti & Curtis, 2003) and risk management (Nagali et al., 2008; Segerberg et al., 2014),

or on specific analytical techniques (Westerski et al., 2015). Thus, the literature on spend analytics could be considered rather limited (Westerski et al., 2015). Using an in-depth literature study and interviews as a method, this research tried to add to the body of existing literature on spend analytics by conducting a research into the critical success factors for spend analytics implementation success.

Four organizational factors and five technical factors were identified as critical success factors for spend analytics success. They serve as the basis for a model on spend analytics success. Additionally, spend analytics success was defined, and the interplay between the different factors was addressed. Furthermore, the different factors were examined in depth, and different aspects of these factors were identified. This exploratory research and the model on spend analytics success could serve as a foundation for future research into spend analytics (success).

Additionally, researchers have been interested in factors which are causing the low success rate for spend analytics implementation (Bjärkerud, 2015), as well as for general BI&A solutions (Bitterer et al., 2012; Chen et al., 2012; Mungree et al., 2013). This research revealed data quality to be the most apparent factor leading to the low success rate, while also other (both organizational and technical factors) were often on a non-satisfactory level and possibly behind the low implementation success rate.

5.2.2 Practical implications

This research and its model on spend analytics success could provide a blueprint for companies, who are (going) to implement spend analytics, or who are using spend analytics and want to influence their road to success. The study shows which factors need to be satisfactory to reach spend analytics success, and what elements those factors consist of. Companies who follow this should try to satisfy each factor in order to succeed, while failing to satisfy e.g. the clear business objective / vision, are also unlikely to satisfy the underlying factors, such as change management. Most attention should be given to the data quality aspect, and all the factors that lead to improving this area. Also for companies who are researching the value of spend analytics, this research provides a number of issues that are being associated with spend analytics success.

In addition to the companies who are implementing or willing to implement spend analytics, this research has value also for providers of spend analytics solutions. It shows, for instance, what are the user requirements of the data analytics component from a user' perspective. Also it shows the elements which are being perceived as most difficult, and they could try to support their customers more on those areas.

Finally, this research shows that the main reason why many implementations are unsuccessful at the moment is due to the data quality. Additionally, other factors that companies struggle with at the moment are the business objective / vision, management support, change management, user participation, data extraction, data enrichment, and data analytics. Thus there seems to be enough work to be done, both for the companies, who are using spend analytics, as well as for the providers of spend analytics solutions.

5.2.3   Future research

First of all, given the notion that this study is one of the first ones that tries to address spend analytics success, and develops a model for spend analytics success, it is probably not perfect or complete yet. For future research, it would be interesting to use the model as a foundation for new research and to further test it in practice. The model could also be further tested/explored by using a quantitative research to address the different factors' effect on spend analytics success in more quantifiable terms.

As this research focused on organizations located in Finland and Sweden, future research could focus on organizations situated in other countries, to look for differences related to the factors leading to spend analytics success or are causing the low implementation success rate.

Finally, more research could be done on the specific factors, as e.g. data analytics or data quality could be researched in more depth, but that was outside the scope of this thesis. In general, none of the factors was researched in maximum depth, as this was just a first exploratory research into a topic as (almost) no previous academic work was available on the topic.

5.3 Conclusion

As many spend analytics implementations are unsuccessful and the amount of research on the topic is rather limited, this researched aimed at gaining more insight into the critical success factors for spend analytics implementations. Based on the academic work on success factors related to similar information systems, and the limited academic work on spend analytics, a conceptual model for spend analytics success was derived. Using in-depth interviews, the model was validated and further developed in the context of spend analytics. Four critical success factors from an organizational perspective were identified (*a clear business objective/vision, management support, change management* and *user participation*), and five from a technical perspective (*data quality, data extraction, data enrichment, data analytics,* and *scalability/flexibility)*. Additionally, spend analytics success was defined, as well as the dynamics between different factors.

Finally, the present research showed that *data quality* is the factor that most companies are struggling with at the moment, but that also other factors are challenging, such as *a clear business objective/vision, change management,* and *data enrichment.*

While the model developed can help organizations to implement and continuously improve their spend analytics, the model can also serve as a foundation for future spend analytics research. Research and practice are suggested to test and develop the model further.

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Appendix A: Interview guide

Introduction

(Small talk, explain research, ensure confidentiality, ask permission to record, etc.)

Context:

1. What is your position within this company?

2. How long have you already worked here?

Spend analytics

(Define spend analytics)

3. Can you tell me what kind of spend analytics solution(s) are being used within your organization?

4. Is it an in-house or a cloud solution?

5. Could you indicate how satisfied you are with the spend analytics solution in place? (On a scale from 1 to 5, where 1 indicates least satisfied, and 5 most satisfied.)

1	2	3	4	5

Spend analytics implementation success

6. How would you define spend analytics success?

7. How do you measure the success?

Organizational perspective

8. From an organizational perspective, what are in your opinion the factors affecting spend analytics success?

9. Can you rate the following organizational factors according to importance, on a scale from 1 to 5, where 1 represents the least important (least affecting spend analytics success) and 5 the most important (most affecting spend analytics success)?

10. Are there any factors missing from the organizational perspective?

11. Can you explain why you scored them as you did?

12. Could you pick 1 or 2 factors that you perceive as the most satisfying in your organization?

13. Could you pick 1 or 2 factors that can be most improved in your organization?

Technical perspective

14. From a technical perspective, what are in your opinion the factors affecting spend analytics success?

15. Can you rate the following technical factors according importance, on a 1 to 5 scale, where 1 represents the least important (least affecting spend analytics success) and 5 the most important (most affecting spend analytics success)?

16. Are there any factors missing from the technical perspective?

17. Can you explain why you scored them as you did?

18. Could you pick 1 or 2 factors that you perceive as most satisfying in your organization?

19. Could you pick 1 or 2 factors that can be most improved in your organization?

Model dynamics

20. How would you describe the interaction between the organizational and technical perspective?

21. How do you perceive the feedback loop?

22. Can the feedback loop be seen as an ongoing, continuous, process?

23. Are there any factors missing from the model?

Closing

24. Do you have any other remarks?

25. Do you have any questions?

Appendix B: Interviews

Removed due to confidentiality reasons.