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TOWARD EFFECTIVE DATA-DRIVEN SUPPLIER VALUE MANAGEMENT

A multiple case study

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Abstract

Growing complexity and uncertainty in supply chains alongside the trend of companies focusing on their core competencies has led to increased reliance on suppliers for organizations with large, global supplier bases. At the same time, the added value derivable from suppliers beyond cost savings has become more commonly recognized by sourcing and procurement professionals in recent years. Key enabler of freeing up time from operational activities to strategic ones and managing suppliers for value is data and the software tooling powered by it. The amount of available relevant supplier data to use in decision making has increased both through adoption of information systems, such as purchasing ERPs, and emergence of 3rd party data sources, such as sustainability assessment databases. Existing supply chain management research does not provide a comprehensive overview on data driven supplier value management. Therefore, the objective of this study was to generate novel knowledge on supplier value aspects and the data driven software capabilities to extract this value.

This study was conducted as a multiple case study consisting of six case companies operating with global supplier bases and thousands to tens of thousands of suppliers from varying industries. Sourcing and procurement executives and managers were interviewed to get expert views from practical perspective. First, the results of this study show that while definition of supplier value is not unambiguous, it can be categorized in three distinct areas: performance related, sustainability and risk management related, and relationship related value aspects. Second, six key capabilities for data driven supplier value management software are defined. To realize the value from supplier management activities, companies should seek to utilize both internally generated and externally sourceable data to construct a comprehensive, objective view on suppliers. By this, pain points and opportunities in supplier base can be efficiently identified, and scarce employee resources directed where most needed.

Keywords procurement software, supplier analytics, supplier management; internal data; external data; supplier segmentation; supplier value

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Toimitusketjujen monimutkaisuuden ja epävarmuuden kasvaminen, sekä yritysten keskittyminen ydinkyvykkyyksiinsä enenevissä määrin on johtanut lisääntyneeseen riippuvuuteen toimittajiin erityisesti yrityksissä, jotka operoivat suuren ja kansainvälisen toimittajakunnan kanssa. Toisaalta hankinnan ammattilaiset ovat alkaneet tunnistamaan toimittajien kautta kulusäästöjen lisäksi saadun lisäarvon viime vuosien aikana. Tärkeänä tekijänä ajan vapauttamiseksi operatiivisista toimista strategisiin, ja toimittajien hallitsemisessa lisäarvon tuottamiseksi toimii data ja sitä hyödyntävät ohjelmistot. Käytettävissä olevan oleellisen ja päätöksenteon tukena toimivan toimittajadatan määrä on lisääntynyt sekä hankinnan tietojärjestelmien, kuten ostojärjestelmien, sekä kolmansien osapuolien tarjoamien tietolähteiden, kuten kestävyystietokantojen kautta. Nykyinen kirjallisuus ei tarjoa kattavaa kuvaa datavetoisesta toimittajan arvon hallinnasta. Siksi, tämän tutkimuksen tavoitteena oli luoda uutta tietoa toimittajan lisäarvon tyypeistä, sekä datavetoisista ohjelmisto kyvykkyyksistä, joilla tätä lisäarvoa voi tuottaa.

Tämä tutkimus toteutettiin monitapaustutkimuksena koostuen kuudesta moninaisilla toimialoilla olevasta tapausyrityksestä, jotka toimivat globaalien, tuhansista ja jopa kymmenistä tuhansista toimittajista koostuvien toimittajakantojen kanssa. Hankinta- ja toimitusketjujohtajia haastateltiin asiantuntija näkemyksien saamiseksi käytännön näkökulmasta. Ensiksi, tämän tutkimuksen tulokset osoittavat, että vaikka toimittajan lisäarvo ei ole yksiselitteinen, se on luokiteltavissa kolmeen osa-alueeseen: toimittajan suoritukseen ja kilpailukykyyn perustuviin, kestävyyteen ja riskien hallintaan perustuviin, sekä ostaja myyjäsuhteeseen perustuviin näkökulmiin. Toiseksi, kuusi keskeistä kyvykkyyttä datavetoiselle ohjelmistolle tunnistettiin. Lisäarvon realisoimiseksi toimittajanhallinnan aktiviteeteista, yritysten tulee pyrkiä hyödyntämään sekä sisäisesti luotua, että ulkoisesti hankittavaa dataa luodakseen kattavan ja objektiivisen perustuvan näkymän toimittajista. Tällä tavoin kipupisteet sekä mahdollisuudet toimittajakannasta ovat tehokkaasti tunnistettavissa, ja rajatut työntekijäresurssit suunnattavissa sinne missä niitä eniten tarvitsee.

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1 Introduction

1.1 Background

Shifting attention to core competencies and increased complexity of supply chains have driven companies to be more reliant on their suppliers than ever before. It is well established in existing literature, that suppliers affect a company's performance significantly (Prajogo et al., 2012). Consequently, companies have started to explore and realize the value extractable from suppliers beyond traditional cost cutting perspective that has dominated the procurement executives priorities for decades (Rimkūnienė, 2013; Spekman et al., 1999). As result of this shift in mindsets of companies regarding added value generation opportunities of procurement and sourcing functions via effective supplier management, the strategic importance of those has increased and gotten more aligned with company overall strategy (Villena, 2019).

Due to the recency of wider supplier value thinking, referring to companies transitioning to compete on supply chain level instead of internal, existing literature does not define a unanimous and clear picture of what is supplier value in practice. Therefore, it is unclear what supplier value means to procurement and sourcing leaders. Moreover, while some added value aspects addressable through supplier base, such as sustainability and risk management (Foerstl et al., 2010; Hofmann et al., 2014; Kim et al., 2019) are acknowledged in existing research, the challenges in measuring them and their actual significance in the eyes of procurement leaders are largely uncovered.

Given the scarcity of resources to manage suppliers for any company operating with large, global supplier base, a data driven approach to monitor, assess, and develop suppliers needs to be employed in procurement function. Otherwise, procurement not enough function resources can be freed to more strategic, value generating activities from mandatory operational ones. A common first step to doing so, is identifying all supplier value management relevant data, and enabling it to be analyzed and utilized efficiently in decision making. Existing research discusses various sources of supplier data, such as internal ERP located data generated through transaction such as invoices and purchase orders (Hong et al., 2018), externally sourced databases, such as third party risk indices (Kauppi et al., 2016), and employees' expert opinions (Sen et al., 2008). However, the software tooling and required capabilities to empower data driven supplier value management are less discussed.

To address the shortcomings of existing literature and to create novel knowledge on the way sourcing and procurement leaders of large companies view and address supplier value management with data driven systems, this study examines six companies in varying industries. The studied companies operate with global supplier bases extending up to tens of thousands of suppliers. As a result, in addition to contributing to supply chain literature, this thesis generates practical implications for sourcing and procurement managers on engaging in strategic supplier value management through specialized software tools that help in systemizing and optimizing e.g., supplier development and improvement processes (Bai & Sarkis, 2011).

1.2 Research questions

While the concept of suppliers being a source of strategic value for the company is recognized, neither the definition of this value nor frameworks for how this value is managed in data driven way have been proposed. Thus, the study conducted in this thesis has two main objectives that guide the scoping and methods to examine the intended phenomena of data driven supplier value management. First objective is to define the value features derivable from supplier management efforts and how data can how data can be utilized in this process. Second objective is to examine data driven software capabilities necessary to support deriving supplier value. These objectives translate to following research questions addressed in this study:

RQ1: How do large companies' procurement managers perceive supplier value and key factors that affect it. What are the data related aspects and challenges in driving supplier value management?

RQ2: What software tool capabilities do procurement managers of large companies regard as essential for capturing information and carrying out actions relating to supplier value management?

To answer proposed research questions and to achieve the defined objectives for the study, a qualitative multiple case study is conducted. The methodology applied to collect data during the case studies is semi-structured interview, where subject matter experts with long domain experience are interviewed based on the questionnaire defined from examination of previous literature. A total of six distinct cases on large, global enterprises is

conducted and data from each analyzed separately as well as from cross-case commonality perspective. The cases are selected based on background research on companies and relevant personnel to ensure fit to both supplier management and data driven procurement topics. As a result, supplier value aspects are defined, software capabilities identified, and a framework of supplier value management system proposed.

The paper is structured in four sections. First section introduces the topics examined in this study and relevant previous research findings. Second section discusses the methodology employed to conduct the research alongside case descriptions and data collection details. Third section presents the findings in structured manner and discussed them in both individual and cross case context. Finally, synthesis of findings and relevant implications for theory and managers, limitations of conducted study, and suggestions for further research are presented

2 Literature review

This chapter introduces key concepts and themes of this thesis to both motivate the study and provide the reader adequate understanding of the previous research on the topic. First part discusses supply chain management and its relation to strategic procurement on a high level. Second part introduces concept of supplier value management as a strategic process. Third part reveals the existing research conducted on data driven supplier management with final part concluding the themes and presenting research questions of this study.

2.1 Supply chain management

Supply chain management (SCM) as a concept and term gained popularity in the 1990's as companies started to pay more attention to engaging on the whole supply chain with more coherent practices (Mentzer et al., 2001), and is still relevant in today's research and practice. Presutti (2003, p. 219) describes this SCM phenomenon as "exploding onto the business scene as one of corporate management's major concerns over the past decade", partly due to 70% of an average company's sales revenue going to supply chain related activities, such as material and services purchases, logistics and final customer service. Evidence of the rapid raise in prominence among SCM as a term and mind set was, for example, the change of words present in the titles of session containing "supply chain" from 13,5% in 1994 to 22,4% in 1997 event of Annual Conference of the Council of Logistics Management (Mentzer et al., 2001). Given the fast pace of e-commerce, supply chain and SCM may in fact be nowadays more popular and important than ever before.

This change in the mindsets of many companies towards recognizing SCM as something worth paying attention to, was and is still driven by the overall evolvement in the business environment. As companies thrive to excel and be better, customers get used to having deliveries on time, in full and exactly what was bought, which has led to customers taking these aspects as given and no longer generate competitive advantage for the company (Mentzer et al., 2001). Instead, companies compete with i.e., responsiveness, product innovation, and equation of cost to quality, which puts more demand on the SCM practices as something to develop and use to deliver up to these rising expectations (Presutti, 2003). These efforts to constantly improve and respond to customer's demands, have led the companies to turn to global sources for their supplies (Mentzer et al., 2001) making management of supply chains and suppliers more complex.

Existing literature on the definition of SCM covers wide range of descriptions, such as synchronizing "requirements of the customer with the flow of materials from suppliers" (Stevens, 1989, as cited in Mentzer et al., 2001, p. 6) and "integrative philosophy to manage the total flow of a distribution channel form supplier to ultimate user" (Cooper et al., 1997, as cited in Mentzer et al., 2001, p. 6). From this, it is evident that, regardless of the definition, in the central of SCM there are typically supplier and customer involved. Supply chain as an ecosystem of various parties and processes constitutes from company's perspective of upstream and downstream supply chain, a structure which is recognized by vast number of researchers in supply chain literature (Giunipero & Eltantawy, 2004; Mentzer et al., 2001; Rimkūnienė, 2013; Villena, 2019). Upstream and downstream supply chains are defined from a single entity's, such as a company's perspective with upstream relating to the suppliers sourced from in the supply chain, and downstream the parties that are relevant for a company's finished product ultimately ending up to customer. Given the differences in these two elements of complete supply chain, it is common practice employed in SCM related research (Andersen & Rask, 2003; Kim & Wagner, 2020) to focus on either just one on the perspectives, or handle those separately within the research scope. Consequently, this study is scoped to focus on the upstream implications and more specifically supplier related topics of SCM.

Figure 1 presents an adaptation of Mentzer et al. (2001, p. 5) illustration of the complexity of ultimate supply chains, which includes "all the organizations involved in all the upstream and downstream flows of products, services, finances, and information from the ultimate supplier to the ultimate customer". In addition to the original figure, there are upstream and downstream parts of the chain visualized. Noteworthy is that the supply chain participants can be multiple different counterparties, depending on the perspective the supply chain is examined from. Also, a single organization may have multiple similar supply chain structures co-existing, for example for different products.

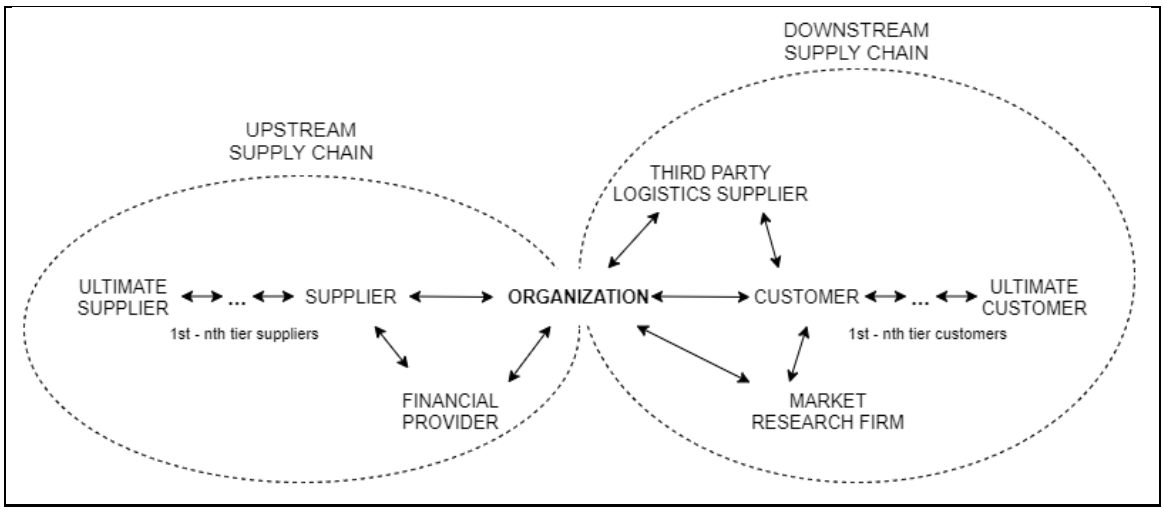

Figure 1. Complexity of ultimate supply chain (Mentzer et al. 2001)

Finally, Mentzer et al. (2001) present an important point about the distinction between supply chain and supply chain management. Essentially, supply chains are something that exist in any business regardless of actions, while supply chain management demands for management philosophy and efforts to exits and actually have impact on the competitiveness of an organization's supply chains. When it comes to SCM in upstream supply chain management context, affecting the sourcing and purchases made are dependent on working procurement function, which plays a key role in implementing SCM practices towards suppliers (Andersen & Rask, 2003).

2.1.1 Procurement as a strategic function

If SCM is defined as a management philosophy (Mentzer et al., 2001) that takes part in all activities in supply chain towards efficiency and performance, procurement can be seen as the function within an organization that translates company's product and service needs generated by this philosophy into stimuli that lead into concrete actions from the upstream supply chain participants, the suppliers (Cavinato, 1992). Moreover, Rimkūnienė (2013) defines procurement as a core business function that is tasked with the purpose of acquiring goods and services from multiple sources and suppliers, to support and enable the key activity of the business. Essentially, all organizations that have supply chains, are engaging in procurement activities one way or another, even if dedicated function and procurement personnel would not be defined. Therefore, procurement in organizations is an essential function of executing SCM practices, especially towards upstream supply chain.

Many SCM researches recognize the key operational function and responsibility of procurement to distinct the suppliers from whom the purchases of goods and services are

made (Cavinato, 1992; Giunipero & Eltantawy, 2004; Villena, 2019). As the outsourcing and increase of responsibility allocation to smaller set of strategic suppliers in order to focus on a company's core competencies is trending, the importance of selecting and maintaining a suitable and performant supplier base has become crucial (Andersen & Rask, 2003). Given that the trend continues, procurement should be seeing an increased importance and focus from top management of companies also in the years to come. Apart from gaining increased criticality, studies also show that procurement's role in cross-functional collaboration and decision making has become common practice (e.g. Kar & Pani, 2014). For instance, the relationship between finance and procurement as functions is considered as essential for effective cost and savings management on organization level.

As with all functions within an organization, one of the major phenomena shaping and developing the role of the function is emerging new technology. In the early 2000's, concept of e-procurement was a widely discussed and examined topic in procurement related research (e.g., Johnson & Whang, 2002; Presutti, 2003). Definition of e-procurement varies by author, but essentially it comprises of technology that enables procurement processes through digital applications and internet (Presutti, 2003), which is enabled by customized software supporting the combination of technology and procurement. While e-procurement as a term is no longer widely used, it provided a foundation for today's data-driven procurement actions by recognizing the need for electric data handling and collection. Also, the topics of real time data usage and supplier information exchange (Presutti, 2003) still apply in the more recent analyst reports on next steps of digital procurement, or "Procurement 4.0" as it is commonly referred to as (Alicke et al., 2016; Reinhard et al., 2016). Further, Handfield et al. (2019) suggest that cloud computing and distributed computing technologies are enabling, and will enable usage of supplier related data to be used in ways that have never been covered before.

Given the tight relationship between procurement performance and management of supplier base, this study aims at unveiling the realistic value factors of SCM practices from procurement practitioners' perspective while also examining the latest capabilities brought by advanced procurement analytics technology. Also, to get as informative and extensive results as possible, this study focuses on large companies with global supply chains that typically deal with more critical and complex supply chains than smaller ones.

2.2 Supplier value management

Development towards more complex and customized offering across industries is making companies rely more on outsourcing and external parties in being able to match the demand for products while at the same time being able to focus on the core competencies of the company (Kannan & Choon Tan, 2002). This shift has put more strategic focus in procurement function and therefore it has become an important responsibility for purchasing managers to engage with suppliers on more comprehensive level than just as a transaction counterparty, to fulfill the strategic needs and advantages derived from supplier value management objectives (Prajogo et al., 2012).

At the same time, many companies and their procurement managers are afraid of becoming too reliant on suppliers (Kannan & Choon Tan, 2002) and losing control of the relationship as suppliers recognize this development (Spekman et al., 1999). This is relevant for the procurement to acknowledge as managing supplier value may prove to be challenging due to the reality of buyer-supplier relationship not always being constant power direction wise. Kim & Wagner (2020) stress that in some cases, supplier may be equally powerful, or even more powerful than the buyer. Thus, there needs to be good supplier management practices in place to acknowledge areas where little power over the relationship exists. Supplier power may prohibit buyer from extracting value beyond getting good prices for the sourced products and services, which is the best case scenario in supplier management (Gutierrez et al., 2020). Kannan & Choon Tan (2002) suggest, that to increase the emphasis on supplier relationship building on top of internal changes, such as communication procedures, also reducing non-compliant and non-collaborative suppliers from the supplier base may be necessary. More research on the analysis on including the relationship as a criteria in supplier evaluation and methods of relationship building that would facilitate win-win contracts between the buyer and supplier are suggested in literature (Park et al., 2010).

The question that a few studies (Florez-Lopez, 2007; Kar & Pani, 2014) have been trying to answer, is what the value adding factors from supplier value management are, if not price and delivery, and how to measure them. Florez-Lopez (2007) uncovers in their study that these more intangible value factors can be i.e., cooperation, commitment of resources, trust, customer orientation, communication, responsiveness, and customizability. Additionally measures such as sustainability (Foerstl et al., 2010; Hofmann et al., 2014; Kim et al., 2019; Villena, 2019) and risk management (Babich et al., 2007; Blackhurst et al.,

2008; Kauppi et al., 2016; Kim & Wagner, 2020) have been acknowledged by many studies as factors where supplier management may bring significant value.

Florez-Lopez (2007) proposes an added-value perspective approach, where both quantitative and qualitative data are considered in supplier selection with intention to capture and base decisions on the value that the supplier creates for the buying party, which may also be non-contractible, as in benefits that are generated from supplier but impossible to contractually specify (Kar & Pani, 2014). Kannan & Choon Tan (2002) find evidence that softer, non-quantifiable decision criteria, i.e., suppliers' strategic commitment to buyer tends to have larger effect on a company's performance than hard, directly measurable criteria such as on-time delivery. In their study, performance measure was the market share and return on assets ratio of the company, which correlated positively with supplier attributes such as strategic commitment, honesty, and integrity. Moreover, recent studies provide evidence on the negative effects of corruption (Kim & Wagner, 2020) and sustainability (Kim et al., 2019) risks ,coming from upstream suppliers, on a company's shareholder wealth.

It seems evident that soft features requiring more supplier management and data related efforts than price and delivery measures, do provide concrete value for the firm. However, as noted earlier, the challenge in measuring some qualitative attributes, such as expert opinions sway companies away from this sort of approach causing the value added perspective to be discarded (Florez-Lopez, 2007). It has been shown that despite acknowledging the variety of value perspectives, procurement managers do resort to the easiest and most evident measure, typically price. (Verma & Pullman, 1998) find that despite managers perceiving several features of a supplier, such as quality, as most important attribute, these attributes do not hold weight in decision making and the selection is often based on the lowest cost supplier as the information is easy to deal with.

2.2.1 Supplier management as a strategic process

Supplier management is more than mere operational activity. "Supplier management and development have been critical issues for organizational strategic and competitive advantage. As globalization, outsourcing, and core competency management philosophies become more pervasive the supplier–buyer relationship has become more central to organizational strategy" (Bai & Sarkis, 2011, p. 13505). Suppliers are one of the key drivers affecting a company's performance, which is caused by sourcing from them generating approximately 70% of the total costs to firm (Prajogo et al., 2012). The importance of well executed supplier management in company's operational performance is widely studied and

identified topic in supply chain management literature (Prajogo et al., 2012). Shou et al. (2018) find that engaging suppliers and establishing processes to control supplier specific risks enhances the operational performance metrics,such as quality, delivery, and cost directly. Research has found that increasing amount of companies have started to reshape their relationship with key suppliers towards more strategic partners through stronger involvement in company's development processes starting from the 1990s (Andersen & Rask, 2003).

However, the relationship of supplier management practices and financial improvements is more complex, as the costs of implementing such practices may outweigh the financial impact of operational efficiency gains. The financial gain should not be used as the only metric when evaluating benefits of supplier management practices, as multiple intangible and accurately measurable metrics are not accounted for. These sources of value from supplier management are e.g. protection from reputation risks, production uptime, and innovation coming from suppliers (Bartels & Jones, 2020). Recent trends in supply chain writing have also questioned the focus on financial performance without including more dimensions into examination of supplier management value add (Marshall et al., 2016).

Figure 2 illustrates Spekman et al. (1999) definition of three key sourcing dimensions that enable efficient sourcing via supplier management. Good alignment between strategy, operations and processes or systems in supplier base management leads to well-integrated supply chain (Spekman et al., 1999). This study focuses on the alignment of strategy and process. In other words, how processes and systems are supporting strategic supplier management in large global organizations. Simultaneously to other direction, how supplier management strategy should define the systems used and processes managed with these systems.

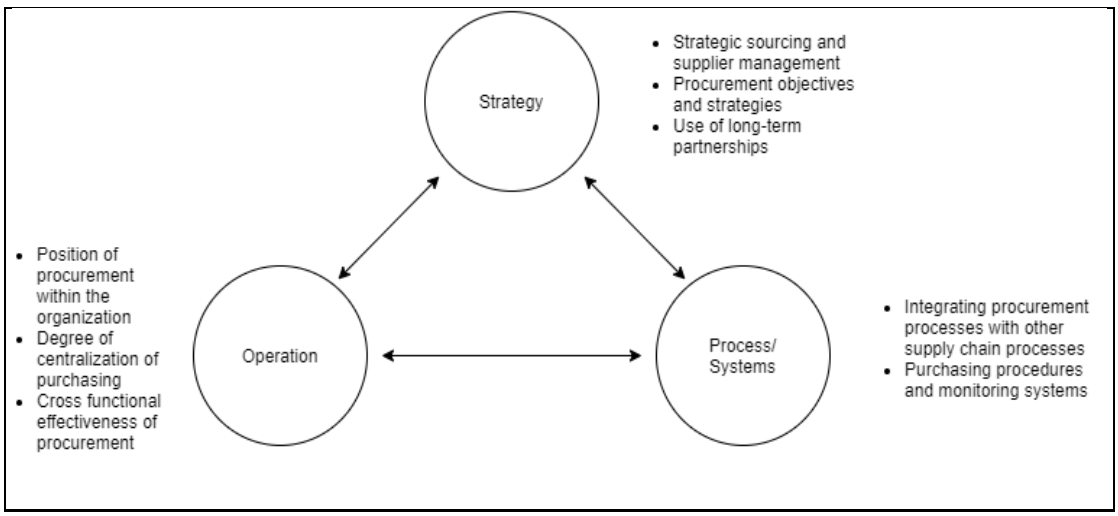

Figure 2. Definition of three key sourcing dimensions (Spekman et al. 1999)

The supplier management lifecycle starts with supplier selection (Matook et al., 2009). This is an important stage of supplier management process, as choosing the optimal suppliers to work with, will make allow for more value extraction of the supplier relationship in the later stages of the process. Spekman et al. (1999) suggest that the key challenge companies should focus on in strategic supplier management is proper selection of suppliers who will be rather partners than transactional relationships. Thanaraksakul & Phruksaphanrat (2009) define four steps for supplier selection: defining objective, formulating selection criteria, qualifying the alternatives and final selection. Especially in the objective definition and selection criteria phases, it is important to consider the availability of information that the decisions can be based on. On one hand, the increasingly dynamic business environment has set challenges to supplier selection processes, but on the other, availability of data and real time models, such as machine learning and simulation, to aid the decisions, have recently enabled new ways to create value and efficiency to companies (Cavalcante et al., 2019).

Second stage after supplier selection can be considered the continuous evaluation and monitoring of strategic suppliers. Traditional approach to supplier evaluation is formulating business context specific key performance indicators (KPI), setting targets for suppliers and monitoring the progress of these KPI's (Thanaraksakul & Phruksaphanrat, 2009). Also, more advanced models have been created to help decision making by going beyond simple weighted KPI's with techniques such as supervised machine learning and clustering (Cavalcante et al., 2019) and technologies such as cloud-based computing and microservices (Handfield et al., 2019). However, Zimmer et al. (2016) suggests that in related literature, comprehensive supplier evaluation models rarely are based on quantitative methods alone and are often supported by qualitative data such as expert opinions and supplier questionnaires.

Third stage of strategic supplier management is supplier development constituting of formulation of development activities and evaluation and selection of these activities (Zimmer et al., 2016). Besides improving internal performance metrics, such as on time delivery and cost , development of strategic suppliers is cornerstone of transitioning towards more proactive supplier risk management (Matook et al., 2009). In turn, reduced risk in supply chain helps ensuring resilience to delivery disruptions and intangible benefits including company's public image and employee satisfaction. Existing literature on supplier

development models is lacking with only a few articles examining formulation of such programs (Zimmer et al., 2016). Further, Bai & Sarkis (2011) find that despite continuous improvement of suppliers plays an important role in supplier performance, in many organizations, identification efforts for development programs may be toned down in expense of supplier monitoring efforts. This implies, that the challenges of efficiently monitoring suppliers may be one of the inhibitors of realizing the value from those activities in form of engaging on development activities. Without development efforts, also a noticeable part of strategic supplier value management efforts in earlier stages is lost. Thus, this study focuses on the challenges of data gathering and utilization, which may be the key driver behind incapability of extracting value from the supplier management efforts.

The supplier management context is often limited both in literature and practice to 1st tier suppliers, meaning those suppliers that a company has direct buyer – seller relationship and possibly a contract with. According to Zimmer et al. (2016), only 10% of supplier management papers examine approaches extending from 1st tier suppliers to entire upstream supply chain. Villena (2019) speculates on the infeasibility of n-tier supplier management being driven by 1st tier suppliers' unwillingness of sharing data on their suppliers and enforcing i.e., environmental and labor standards with their own suppliers. At the same time, some companies can utilize their negotiation power to enforce practices beyond 1st tier suppliers with positive impacts on performance for also the supplier adopting these practices to 2nd tier. However, these instances are limited and forcing practices over 1st tier may also induce unwanted friction in the supplier relationships (Marshall et al., 2016). Zimmer et al. (2016) suggest that in practice, having control over n-tier suppliers is challenging because: (1) 2nd tier suppliers are not known when selecting suppliers to work with in the first place, (2) the contracts are made mainly with 1st tier suppliers limiting the power a company has over n-tier, (3) The exponential growth in upstream suppliers beyond 1st tier sets an boundary for information handling and approaches available, (4) up to date information on n-tier suppliers is almost impossible to gain especially in technologically highly volatile industries. Due to these reasons, this study will primarily be focused on 1st tier supplier value management.

2.2.2 Dimensions of supplier assessment

Supplier evaluation starts with gathering and analyzing the information available on supplier in situation where pre-existing knowledge on the supplier may be very scarce. Qualitative, subjective information from procurement experts is used in decision making when no historical nor quantitative data on potential supplier is reliably available. However, even

in the continuous evaluation and monitoring processes in supplier management, procurement functions are often relying on expert opinions and personal knowledge (Zimmer et al., 2016). It should be noted, that reliance on this type of information puts the company at risk of knowledge dilution, as each time a buyer changes department or company, the source of information is lost (Zimmer et al., 2016). Acknowledging this, many procurement organizations seek to establish standardized and repeatable supplier evaluation processes, where suppliers are evaluated on a constant basis utilizing both subjective data and most importantly objective, quantitative data (Sen et al., 2008). Ultimately, the definition of the evaluation process and data used, is dependent on the criteria the suppliers are evaluated on (Thanaraksakul & Phruksaphanrat, 2009).

Despite the need for standardized supplier evaluation, the process must consider differing angles the suppliers are evaluated from. For instance, Sen et al. (2008) and Thanaraksakul & Phruksaphanrat (2009) report existing research on supplier evaluation criteria finding criteria differing based on dimensions such as industry and product category within a firm. However, criteria selection can be investigated from perspective of levels of buyer-supplier relationship, competitive situation, and company's strategy, as done by Sen et al. (2008). While acknowledging the multiple dimensions criteria can be prioritized on, this study also takes the approach of mainly discussing supplier evaluation as part of strategic supplier management supporting company wide strategic targets.

Thanaraksakul & Phruksaphanrat (2009) propose a five-part balanced score card approach for classifying measures for supplier evaluation: Financial, Customer, Internal business process, learning and growth, Corporate Social Responsibility (CSR) perspective. Financial perspective includes aspects of suppliers' financial status and economical view of currency fluctuation, tax impact and governing economic policies. Customer perspective includes metrics that consider the supplier's engagement with its customers. Such metrics are number of customers, strategic compatibility market share, customer satisfaction, warranty time and geographic accessibility. Internal business process perspective contains the metrics around cost, delivery, flexibility, research and development and product reliability. Learning and growth perspective measures cultural differences, terrorism risk, accident statistics and outlook for the future. Finally, CSR perspective covers environmental policies and competencies along with pollution management. These perspectives together cover a wide range of angles supplier evaluation can be carried out from. Existing literature suggests that while criteria for internal business processes, such as cost, quality and delivery are seen as most important in procurement organizations, other metrics involving risk management,

sustainability and innovation are being included into considerations in increasing frequency (Sen et al., 2008) (Bartels & Jones, 2020).

Possibility of multiple criteria conflicting with each other adds a layer of complexity in formulating supplier evaluation strategies (Sen et al., 2008). Therefore, to simplify the process, companies tend to give higher priority to one KPI over the others as a strategic choice (Prajogo et al., 2012). Further a shift in priorities in for example changes in competitive environment or emergence of new technology cause also changes in dimensions that suppliers should be evaluated on (Van Wassenhove et al., 1991). This implies that in order to stay competitive, especially in dynamic industries under constant change, the procurement management needs to understand a wide array of metrics to benchmark supplier performance and viability given the context.

Traditional focus on supplier evaluation measures among procurement organizations has been on directly influenceable metrics such as price, delivery , alongside more indirectly measurable features such as flexibility, innovation, and quality (Cavalcante et al., 2019; Krause et al., 2001). Also, more recently risk management (Florez-Lopez, 2007; Kauppi et al., 2016), with growing demand for reputation and operational risk related criteria included in supplier evaluation, such as sustainability, ethicality and supplier default risk (Foerstl et al., 2010).

Existing literature on supplier evaluation perspectives is unanimous on the role of financial costs incurred from sourcing being historically one of the most important considerations procurement organizations make when choosing and assessing suppliers (Spekman et al., 1999; Thanaraksakul & Phruksaphanrat, 2009; Zimmer et al., 2016). This makes sense given the procurement management's traditional tendency to focus primarily on cost cutting as a performance measure for the activities within the function (Prajogo et al., 2012; Rimkūnienė, 2013). Deloitte's annual report on CPO's priorities throughout the most recent decade supports the findings made in supplier management literature (Flynn et al., 2021). Literature suggest that this concentration on cost cutting is driven by companies' incentive policies encouraging especially cost savings related activities (Prajogo et al., 2012; Spekman et al., 1999), which is naturally reflected also in supplier management processes.

Sen et al. (2008) suggest that cost is also a commonly favored dimension due to its nature of being readily available, quantitative, and easily comparable. Further, the impact of supplier offered prices and costs incurring from selecting a low-cost supplier versus high-cost supplier being easily measurable in profit and loss of a firm, make cost perspective an attractive selection for criteria. It is important to separate cost and price as terms, as price is

a mere component of overall cost and cost reducing effects can be achieved by not only negotiating lower prices with suppliers, but also through e.g. decreasing risks that may affect the costs of sourcing a material or service (Kauppi et al., 2016). Despite this, Prajogo et al. (2012) find that competitive price of products, driven by purchasing decisions, is most common singular aspect, total costs are examined from.

Given the undeniable benefits and need for measuring suppliers based on cost dimension, it is and likely will be one of the most favored KPI's procurement managers are tracking. However, the need for including other dimensions has been acknowledged for a long time. Spekman (1988, p. 76) has stated: "While this approach [talking about minimizing the price of goods and services] often results in a lower purchase price, it assumes that there are no differences in suppliers' abilities to provide value-added services, technology gains, process innovations, and other means of gaining differential advantage. Actions centered on homogeneity of supplies and substitutability of suppliers are at best naive and at worst poor management." More recent literature (Rimkūnienė, 2013; Zimmer et al., 2016) supports this statement alongside with analyst reports on direction of strategic supplier management (Bartels & Jones, 2020; Reinhard et al., 2016). Importance of multidimensional supplier management beyond cost optimization is amplified with suppliers that have been identified as long-lasting developable relationships (Sen et al., 2008).

Delivery performance has been defined in various ways in existing literature, but the research on it is often considered tightly related to purchases of direct materials in i.e. manufacturing industry (Choon Tan et al., 1998; Kauppi et al., 2016; Shin et al., 2000). Thus, in this research's context delivery performance is seen as suppliers capability to deliver a purchased good based on metrics such as quality, measured by defect percentage (Shin et al., 2000), on time delivery (Choon Tan et al., 1998), delivered quantity versus agreed quantity (Liu et al., 2000) and flexibility (Choon Tan et al., 1998). Some studies group cost performance through price competitiveness under delivery performance term (Bhattacharyya & Guiffrida, 2015), however this study considers cost and delivery performance as separate dimensions. The measures of delivery performance may hold varying importance for procurement managers. For instance, (Verma & Pullman, 1998) show that quality is perceived to be the most important attribute of delivery performance with on time deliveries taking the second priority and flexibility being least important measure. Verma & Pullman (1998) also note that the perceived priority measure is not always the one decision of supplier is ultimately made on, with cost being the actual driver in many situations. This supports the

existing literature's findings of cost being a top priority for procurement managers traditionally.

One of the reasons for supplier delivery performance importance from supplier management perspective is that it has potential to directly influence customer satisfaction levels. This causes it to be seen as strategic level performance measure for entire supply chain (Bhattacharyya & Guiffrida, 2015). Bhattacharyya & Guiffrida (2015, p. 3771) suggest that importance of supplier delivery performance has been recently on the rise among procurement organizations due to focus on improving time-to-market in "todays disruption prone global logistics". This trend is expected to continue across industries given the increasing share of outsourced work companies are issuing. Thus, having a good control over distributed supply chain to enable company's own delivery performance takes key role in supplier management and Bhattacharyya & Guiffrida (2015) propose improvements in supplier delivery performance leading to increase in overall quality of supplier management. Specifically, the change towards dynamic business and highly specified products has given flexibility of supplier an increasing amount of attention (Choon Tan et al., 1998). This, however, is contradictory with Verma & Pullman (1998) findings on flexibility popularity as an attribute of supplier delivery performance.

Given the importance supplier delivery performance is given in some procurement organizations (Bhattacharyya & Guiffrida, 2015), it is natural that this aspect is something worth monitoring and improving on a continuous basis. Existing literature has an extensive array of modelling approaches attempting to quantify and utilize delivery performance to aid in supplier selection and evaluation. Examples of these models are Liu et al. (2000) data envelopment analysis that considers i.e. quality, on time delivery among other supplier metrics in supplier comparisons, Cavalcante et al. (2019) supervised machine learning model that uses i.e. order quantities, delivered quantities, on time delivery as features and Matook et al. (2009) factor analysis that takes in delivery information as part of risk assessment. Delivery performance can also be used as more simple, singular KPI's, over which development of supplier performance is examined. As thresholds for metrics for this dimension are also often contracted, causing penalty or even termination of contract clause, it is often feasible for companies to tackle and improve the situation with suppliers. As long as the data on it is gathered and monitored well.

When sourcing direct materials, the measurement of received product and delivery performance is relatively easy to quantify. However, when assessing indirect purchases, such as consulting services, information technology and marketing and communications services.

Naturally, performance measures and success criteria can be set for services but making them coherent and comparable across suppliers poses a challenge. Further, evaluating soft dimensions with less unambiguous measures, may prove time consuming and costly for procurement (Kannan & Choon Tan, 2002). Also, level of service from a supplier may rely on subjective view of procurement experts. With most cases, the criteria for such subjective evaluation can be defined, but it is not alone enough as the relative importance between these preferred attributes needs to be quantified to be used in supplier evaluation models (Akarte et al., 2001). Further, Akarte et al. (2001) argue that despite the challenges in measuring indirect delivery performance related metrics, both objective and subjective dimensions should be included.

Besides the reasonably straight forward metrics of cost and delivery, procurement typically pays attention to other supplier metrics like quality ((Cavalcante et al., 2019; Krause et al., 2001; Shou et al., 2018), flexibility (Krause et al., 2001; Shin et al., 2000; Thanaraksakul & Phruksaphanrat, 2009) and innovation (Bhattacharyya & Guiffrida, 2015; Krause et al., 2001; Prajogo et al., 2012). As capabilities for combining and addressing multiple features of a supplier together improve within the organization, these metrics should see an increase in usage. Naturally, the dependence on these features relies on the industry of company in question to some degree, as e.g., quality may be as important as cost especially in manufacturing industry (Krause et al., 2001).

Quality of sourced goods from supplier has a direct relationship to the finished product quality that the buying company is producing. Thus, by increasing quality of supplied products and reducing the defect rate, a company can influence the quality and value of their own products (Krause et al., 2001). Further risk assessment in supplier selection can also play key role in impacting the quality of sourced goods, as a risk resilient supplier tends to have more steady quality of products at economic prices (Cavalcante et al., 2019). In practice, this means that for example, a supplier suffering from natural disaster or employee strike driven production errors is prone to delivering lower quantity over time.

Flexibility of a supplier in products sourcing context can be defined with attributes such as volume, mix and modification flexibility (Krause et al., 2001). Volume meaning the ability and willingness of supplier to adjust delivered volumes, mix the composition of ordered items and modification the ability of supplier to design and develop the existing and new products. With the current emphasis on sharing the responsibility of product development (Bhattacharyya & Guiffrida, 2015; Shin et al., 2000) initiatives with key suppliers to answer demand for customized products and solutions from customer, especially the latter

is interesting focus area for procurement. Research into criteria favoring in practice supports this, as (Thanaraksakul & Phruksaphanrat, 2009) find that flexibility and mutual arrangement ability between buyer and supplier have also gained significance in supplier evaluation due to shortened product lifecycles.

Lastly, innovation is a metric that some authors have included or at mentioned in studies involving supplier evaluation metrics. (Krause et al., 2001) define innovation as ability of supplier to develop new products and services with acceptable level of technological capabilities, alongside the willingness of letting a buyer to benefit from the technological information possessed by the supplier. Particularly industries that rely on development of new products at fast pace acknowledge the role and critical importance of operating with suppliers that are open to knowledge sharing. Moreover, academic literature has shown evidence of the positive relationship between supplier base innovativeness and a company's innovation output (Villena, 2019). Therefore, given that the company and its procurement are absorbent for the information, there are significant implications from the innovation of supplier network to a company's own innovativeness available. However, measuring innovativeness of a supplier can be reasonably challenging.

It is important to note that the various metrics of supplier evaluation do not operate in a vacuum with relation to one another. For example, a supplier may be improving delivery in the expense of quality by speeding up production processes. Also, pushing the supplier to keep up with technological changes and exhibiting innovation might put a strain in the supplier's capabilities through supply disruptions (Thun & Hoenig, 2011) and increase costs. Thus, risk management is something to constantly address while selecting performance metrics and evaluating suppliers.

2.2.3 Risk measures

Supply chain risk can be defined as unpredictable events and their adverse effects on organization that are generated from the company's supply network, and objective of supply chain risk management to protect the company from these effects by predicting and hedging for the risks (Gaudenzi & Borghesi, 2006). Christopher & Peck (2004) distinguish supply chain risks as internal and external risks. Moreover, internal supply chain risks can be divided into cross-company based risks and internal company risks. The former can be defined as extended organizational boundaries, extending to company's supply chain, within which the company can indirectly influence the amount of risk present. Further, cross-company risks, can be divided into purchasing risks and demand risks. Purchasing risks relate to the

upstream activities of a firm, where single supplier related features, such as financial stability, delivery consistency and technological missteps, can present risks to a firm, whereas demand relates to downstream activities coming from customers (Thun & Hoenig, 2011). As this study is focused on supplier management, it discusses the context of purchasing risks and the relevancy of supplier management to mitigate the effects generated from those activities. When it comes to external risk, that is something mainly out of the reach of company's direct or indirect influence, however do present a direct or indirect impact to the company's supply chain (Thun & Hoenig, 2011) through i.e. geographical events, such as earthquakes, or political events such as terrorist attacks (Kleindorfer and Saad, 2005). However, as these factors are the company can attempt to mitigate these external risks by taking these geographical, political and economic factors into account in supplier selection (Bhattacharyya et al., 2010).Besides direct impacts, such as delivery disruptions, it is important for companies to also understand the indirect effects of supplier risk. Existing literature suggests companies being vulnerable to possible "chain liability" effects where the company shares the negative consequences of its supplier's misconduct (Kim & Wagner, 2020).

When considering purchasing risks, classified as internal risks, especially supplier risk management plays a key role in mitigating supply chain risks as a company's extended organization is composed of individual entities, suppliers, that present the risk for company's supply chain (Matook et al., 2009). The traditional approach to risk management has been hedging for the risk internally through safety stocks and lead times, however increase in supply chain dynamicity has shifted the focus to more out looking and proactive risk management via supplier base management (Blackhurst et al., 2008). Further, Kim & Wagner (2020) find that for example, corruption risk related events from upstream suppliers are associated with company's stock price and therefore shareholder wealth. This finding provides further evidence to support the importance of direct supplier management as strategic practice.

Besides corruption risks, suppliers may present a multitude of alternative risk types, such as financial (Bhattacharyya et al., 2010; Giunipero & Eltantawy, 2004), sustainability (Kim et al., 2019; Villena, 2019), and technology (Bhattacharyya et al., 2010; Matook et al., 2009). These supplier risk dimensions pose varying kinds of impact to the firm, which can be defined as more direct operational impact and indirect policy and public image impact.

Sustainability risk emerging from a company's supplier relationships has a wide array of definitions and dimensions in the existing literature. Varying definitions also cause

trouble for procurement organizations when trying to identify which matters to devote resources towards in order to address in supply chain (Foerstl et al., 2010). Villena (2019, p. 1150) argues that supplier sustainability in general "encompasses economic, social, and environmental performance". Hofmann et al. (2014, p. 160) define sustainability related supply chain risks as "social, ecological, or ethical problems" that exists within supply chains. The narrower view of sustainability concerning only environmental effects affecting the planet do not cover everything that sustainability as a term includes. Thus, Kim et al. (2019, p. 72) focus on the, often disregarded social aspects of sustainability and use term supplier sustainability risk (SSR) to scope risks that are considered as "damaging effects that a buying company has to bear when news of its suppliers' ethical/moral misconduct become public" and "occur when buying companies are caught doing something that may trigger adverse stakeholder reactions".

Despite the lack of understanding of the impact of sustainability related supplier risk management both in practice (Villena et al., 2020) and research (Hofmann et al., 2014; Kim et al., 2019), there is evidence that these risks impose a significant threat to shareholder value and should thus be actively engaged by sourcing procurement directors (Kim et al., 2019). According to Dyllick & Muff (2016), business executives agree that sustainability is tightly linked to a company's competitiveness and they report engaging on sustainability topics in growing numbers. Further, Villena (2019) argue that leading sustainability multi-national corporates have recently started to drive sustainability especially through procurement managed supply chains, as suppliers are the source of major sustainability related risks for a purchasing firm.

The drivers behind supplier sustainability management can be divided into voluntary and involuntary, regulatory driven actions. Villena et al. (2020) found in their China focused research on sustainability drivers that regulatory pressure is the key reason companies engage in environmental related sustainability. However, besides not complying with regulation, the reputation risk of sustainability related issues is something that drives the voluntary actions to social risks. Research shows that companies may try to prevent only the reputation risk by finding out ways to resign them from suppliers that are found to act unethically, instead of actually trying to affect the suppliers way of doing business (Villena et al., 2020)

Foerstl et al. (2010) find that "supplier assessment, selection, and development must be tightly interlocked to effectively manage the sustainability risk exposure". For enabling meaningful allocation of resources in mitigation attempts, most crucial suppliers need to be identified, for example via purchasing volume, and their sustainability metrics evaluated

(Foerstl et al., 2010, p. 127). In order to get the highest possible value out of the efforts, a "cascading effect" of requiring the identified first tier suppliers to comply with company's sustainability requirements and force the requirements on their own suppliers can be employed, yet the effect rarely sees success in practical applications (Villena, 2019). One of the reasons for this may be the power balance between buyer and supplier, as (Kim & Wagner, 2020) remark that in some cases the supplier may be even more powerful than the buyer thus reducing the ability of supplier in managing supplier responsibility even in the first tier. With this in mind, the procurement organization should seeks to address supplier sustainability risks already at the selection process, as the earlier in the process the company considers sustainability risks, the more influenceability they have compared to their suppliers (Foerstl et al., 2010).

Supplier financial risk in literature, is commonly attributed to supplier going to default and thus not being able to deliver the contracted services or goods to a buying firm, and possibly causing losses from already made transactions (Babich et al., 2007; Costantino & Pellegrino, 2010; Zimmer et al., 2016). Babich et al.(2007) argue that companies should pay attention to their suppliers' default risk, as it is usually very costly for the purchasing company and adds a significant layer of uncertainty to the company's own delivery capability in the worst cases. Thus, degree of a suppliers financial risk through performance indicators, such as their liquidity, fixed assets and profitability development is commonly included in supplier evaluation models (Bhattacharyya et al., 2010; Kannan & Choon Tan, 2002). One of the easiest checks a company can run for their suppliers' financial stability is the size of the company by revenue, as it also has a indication of the suppliers probability to get acquired. Further, suppliers that are larger companies, may have traded equity, debt and possibly other assets that may help them better continue business during financial distress, than smaller suppliers (Babich et al., 2007). The flip side is that if a company only sources from larger, more financially established companies to avoid financial risk, they expose themselves to risk of falling behind in innovation and flexible development of sourced services or products, that smaller suppliers may be able to offer.

Companies can more accurately evaluate financial risk by obtaining data on the supplier's financial performance from supplier directly and by using external indices or i.e. country level information on the financial stability (Bhattacharyya et al., 2010). It may sometimes be in the best interest of a supplier to be transparent about their financials to a customer, as with the most strategically important suppliers, supplier development may include efforts from buyer side to enhance the suppliers financial performance either directly through

investments (Matook et al., 2009) or indirectly through shorter payment terms or increased prices. Financial standards help companies to be able to trust their suppliers accounting information and financial stability compliance. However, in depth assessment of the supplier base's financials can be an extremely labor some tasks, which is why procurement organizations often lean on diversification of supplier base to make the financial risk more independent of a single supplier's status.

Decision of single, or multiple sourcing a certain material or service is a complex choice of great strategic importance for a firm. Costantino & Pellegrino (2010, p. 28) state the benefits of multiple sourcing as it "allows a buyer to switch the order of the default quantity to other suppliers without need for searching and negotiating with a new supplier" in case of supplier default. Thus, sourcing the same goods form multiple proven suppliers offers a company way of hedging from supplier financial risk without extensive supplier financial stability assessment. It also provides flexibility and negotiation power to the buyer. Moreover, multiple sourcing does not only balance the risk of supplier default, but also social and environmental supply chain risks, which will benefit multi-sourcing strategies as those aspects become more prevalent in the future (Zimmer et al., 2016). At the same time, multi-sourcing does generate more costs to the company, as a higher amount of suppliers need to be managed and via loss of scale economies benefits (Costantino & Pellegrino, 2010). Shin et al. (2000) find existing literature on the topic to conclude two additional reasons to why companies may prefer single sourcing strategy: a reduced supplier base counteracts mistrust issues between buyer and suppliers that is caused by lack of communication between the parties and number of preferred suppliers is limited globally, which leads multi-sourcing include less preferred suppliers.

External supplier risks come from factors that are not completely predictable and come from outside of a single supplier, while at the same time affecting the buying company second hand, through direct implications to the supplier being sourced from (Thun & Hoenig, 2011). While the management of external supplier risks isn't by default as granular as internal supplier risk management, it considerably more efficient. For internal risks, supplier level information is available, but handling and analyzing of the data may prove to be time consuming and less value adding than evaluating suppliers based on grouped data, as is common with assessing external risks on country or region level. Moreover, even if external supply chain risks are less likely to realize than internal risks, according to Thun & Hoenig (2011) findings, they don't bear more significant consequences to the company than internal ones. However, this doesn't mean that companies wouldn't seek to mitigate external supplier

risks, as efficient hedging from risks, such as geographical, political and economic is acknowledged to be a good way to drive financial performance and shareholder value through operational performance improvement that is generated from more predictable and reliable supply chain (Shou et al., 2018).

Geographical risks stemming from supply chain relate to the country or part of continent that the company's suppliers are operating in. Disruptions in suppliers' operations reflect as disruptions in the company's operations if these disruptions aren't hedged. These disruptions from supplier may arise from various factors, such as operational contingencies, natural hazards and political unstableness (Kauppi et al., 2016). In order to efficiently manage the risk from these difficult to predict- factors, procurement organization's usually seek to evaluate the risks on country and region level and then connect the suppliers and their operations to certain country or region (Bhattacharyya et al., 2010; Kauppi et al., 2016).

One of the more stable over time factors of geographical risks is the environmental aspect, which typically indicates the possibility of natural disasters i.e., earthquakes, tsunamis and tornados influencing a suppliers delivery capability (Kauppi et al., 2016; Thun & Hoenig, 2011). For global companies, selecting only the suppliers in safest countries, however is not possible, as the decisions are driven by multiple other factors as well, such as cost and supply chain logistics (Cavalcante et al., 2019). Thus, companies may resort to identifying the high risk areas and instead of cutting supply from those areas, focusing on recovery strategies after disruptions and methods like surplus inventory and geographical supply base diversification to manage the implications these risks cause when realized (Cavalcante et al., 2019).

Political risks also relates to geographics, as they typically realize on country level through human driven incidences; for example war, terrorist attack (Thun & Hoenig, 2011) or sabotage (Kauppi et al., 2016). The political instability of a country can also poses unwanted and unpredictable problems to suppliers. Countries implementing regularization that disrupts the supplier's business is one example of risks that companies can predict by gathering information on the assessment of a specific country's political situation and recent decisions affecting the business within the country. Such information can be derived from external data sources such as, Transparency International's Corruption Perception Index and Freedom House Index (Cavalcante et al., 2019).

Economic risks are related to political risks on both macroeconomy and microeconomy level, they are commonly caused by political decision making. These types of economic factors influencing company's suppliers may be on microeconomics level for example

strikes (Thun & Hoenig, 2011) and increase in labor costs due to raise in wages (Bhattacharyya et al., 2010) and macroeconomics level downturns or bubbles. A highly political factor influencing the overall economies and a specific company's supply chain efficiency is tariffs. An example of unexpected change in that aspect was Brexit in 2016 where the Great Britain decide to depart from European Union causing rearrangements in tariff deals between European countries and Great Britain. Also, the economic context a supplier is operating in, opens one way to assess the operational contingencies risks that the supplier is prone to. For instance, the infrastructure including railroads, ports and general quality of machinery and equipment driven by a country's financials and regulatory standards are something that have possibility of causing disruption for suppliers operating and delivering under these conditions (Kauppi et al., 2016).

Figure 3 illustrates the supplier risk management framework process developed by Matook et al. (2009). The first stage relates to creating basis for successful supplier risk management by identifying various risk types and drivers. This phase is highly related to success of supplier risk management efforts as a whole, as it is the phase where organizations exposure to uncertainty is either detected or left out of considerations leading to potential crises (Neiger et al., 2009). The third phase highlights the importance of reporting the supplier risk analysis and capability to direct the efforts into concrete results, such as segmentation of suppliers to high and low risk ones. Finally, the last step of identifying the outcomes of supplier risk management is vital for being able to evaluate the gains to resources used for these efforts. Moreover, according to (Matook et al., 2009) even though the process is visualized as sequential flow, it is important for practitioners to recognize that implementing such process successfully requires agility to adjust and provide continuous feedback to the process based on the observed results.

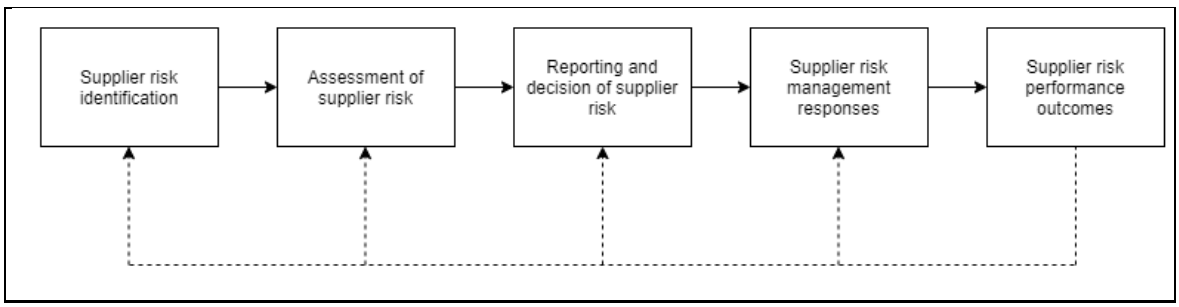

Figure 3. Supplier risk management framework (Matook et al. 2009)

2.2.4 Supplier value management technology

Given the opportunities and the challenges of utilizing the available data for effective supplier management for value, models and applications, such as specialized software to drive this process may be necessary components of the equation. Up until the past decade, the research on Supplier Relationship Management (SRM) systems has narrowly focused on "specific subjects, such as purchasing strategy, supplier selection, collaboration, and supplier development" but not covered from a more comprehensive perspective (Park et al., 2010, p. 496). According to a case study on a large, global manufacturing company's supplier information system adoption, the use of such systems allows for better facilitated information management and empowers supplied management actions, such as consolidation (Kar & Pani, 2014). Further, taking an ERP and e-Procurement software into use for collecting and managing supplier related data, such as "volumes they supply to the company, the criticality of their supplied goods, the degree of delivery compliance met with, the percentage of total supply each supplier commanded for a given product category and price comparisons among similar product category" (Kar & Pani, 2014, p. 498).

According to Kar & Pani (2014) findings however, the adoption of such tools raised some initial resistance from the suppliers, as they felt such efficient information visibility may harm their position in future negotiations and had no benefits to them. This evidence further supports the combination of value from supplier data utilization and integrative relationship building to be important and achievable through proper tools (Bartels & Jones, 2020; Park et al., 2010). Park et al. (2010) propose two approaches to buyer-supplier collaboration research: strategic process focus or usage of SRM like information system to execute the planned collaboration strategy. This study is focuses on the latter approach as part of supplier value management software capabilities study.

One way to balance out the perceived non-benefit from the suppliers' side is to make tooling and information systems enable information to both directions. Empowered by technology, some supplier information sharing strategies have been adopted to provide data, such as feedback on delivery arrivals and predictions on global shipments to manage the supply risk, but also help the supplier develop their practices (Shou et al., 2018). Existing SRM literature (Park et al., 2010; Shou et al., 2018) suggests that supplier information systems technology is the component companies are and should be investing in to enhance supplier collaboration. Information sharing to supplier can be done via an supplier portal

(Bartels & Jones, 2020; Park et al., 2010) where the both the data and communication towards supplier is managed.

2.3 Data empowering supplier management

In age of digital procurement, options for usable data are abundant. “New technologies will lead to new business needs, which will be reflected in new requirements for the procurement department. One of these requirements will be capturing, analyzing, and acting on real-time data … Increasingly, key data will be registered using sensors, analyzed in real time, and transformed into actions by actuators and other devices, all the while being made available in real time to value chain partners.” (Reinhard et al., 2016, p. 7). This implies that data is increasingly in the center of also procurement business and being able to act quickly on changes in the environment will provide procurement professionals a wider toolset to influence the procurement performance. Not only is data available, but it is available at faster pace and in larger amounts than in the previous. The vast number of suppliers that companies are dealing with on a daily basis creates the need for efficiently detecting, gathering and analyzing the most important data to stay ahead of the constant change in the supplier base. Also, besides using the data generated from interactions with suppliers, such as ERP data regarding transactions such as invoices (Hong et al., 2018) and purchase orders (Liu et al., 2000), call for using secondary data is gaining popularity in procurement literature (Kauppi et al., 2016). Secondary data comprises of organization external data that can be used in decision making regarding i.e. supplier evaluation, such as risk, sustainability and ethicality indexes (Bhattacharyya et al., 2010).

The dimensions of internal and external data provide further evidence for the need of efficient supplier management process and tools for procurement to utilize the information in a proper manner. Handfield et al. (2019) forecast that in future, the data used in e.g., supplier delivery performance assessment will come from multiple parts of the supply chain outside of basic internal, transaction originated information. Further, new technology enabled innovation like supply chain clouds, platforms in which companies can share logistics infrastructure and planning between customers and suppliers to save costs and learn from each other (Alicke et al., 2016), highlights the benefit of supplier segmentation and integration. Zimmer et al. (2016) argue that the greatest benefits of supplier management relating to i.e., sustainability are derived when procurement organizations integrate all members of the upstream supply chain. However, Zimmer et al. (2016) also find that the lack of good

and validated data often stands as a roadblock for analyzing and integrating suppliers with means of addressing environmental and social supplier risk.

An important notion relating to analysis of suppliers with data is that existing literature finds the data not being always universally equally beneficial across industries. Thanaraksakul & Phruksaphanrat (2009) find in their research on formulating a supplier evaluation framework based on balanced scorecards, that extensive research into what criteria are significant for a specific context that the company is operating in. For example, a grocery goods company ordering perishable items may be more interested in the on time delivery performance of a supplier than a consulting company ordering office supplies. Thanaraksakul & Phruksaphanrat (2009) also suggest that a framework or KPI definition when evaluating supplier should be selected based on a particular condition, even within the various functions of the company.

Figure 4 demonstrates the data ecosystem for supplier value management relevant data and availability of it through both internal and external processes. Supplier integration poses an opportunity for enriching and utilizing both sources of data through wider and more frequent availability of information.

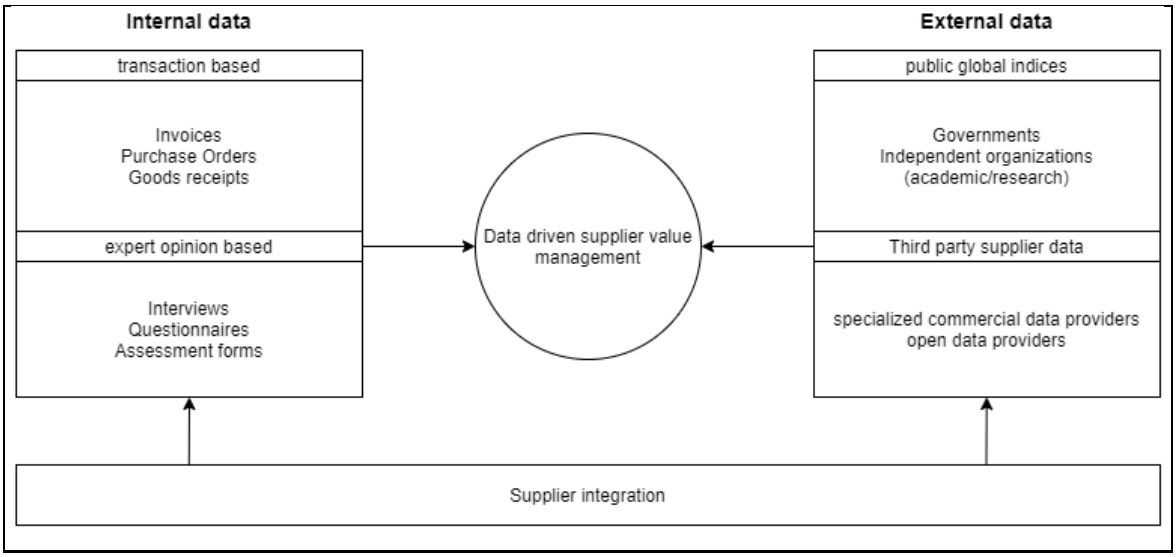

Figure 4. Supplier value management data ecosystem

2.3.1 Internal data

One of the most natural and easiest ways for companies to obtain data on their suppliers is through the invoices they are receiving for each purchase they are making (Hong et al., 2018). When received in a form like e-invoices, invoice data is one of the most crucial and comprehensive stand-alone data the company can collect from its buyer-supplier relationship and all of this can be very automatic as e-invoices are registered into the purchasing

solution, i.e. Enterprise Resource Planning (ERP) system without the need of manual labor and data sorting (Hong et al., 2018). The main information derived from invoices and the overall transaction history with the supplier are i.e., total cost of purchases, duration of partnership and transaction frequency or trends, which can all be utilized in assessing the value of the supplier and even used to segment suppliers into core and non-core suppliers as done by Hong et al. (2018) study on automobile parts manufacturer context. Further, the purchase orders made by procurement unit are a source of additional information, such as material unit prices and quantities that the buyer is issuing from the supplier, enabling even wider range of data points to use as internal data when evaluating supplier performance and viability.

Goods receipts corresponding to purchase orders are also often linked in ERP's, which enables collection of delivery performance related information such as on-time delivery and speed of delivery (Modi & Mabert, 2007; Prajogo et al., 2012), number of incoming defects, percentage of orders delivered completely and time from order placement to final receipt of order (Modi & Mabert, 2007). For direct purchase heavy industries, such as manufacturing and Fast-Moving Consumer Goods (FMCG) the importance of supplier delivery performance is often emphasized, as the frequent number of transactions and movement of goods is essential for the business. The aforementioned features collectable form internal sources are in the core when identifying and assessing suppliers as argued by multiple studies on supplier evaluation (Prajogo et al., 2012; Thanaraksakul & Phruksaphanrat, 2009; Zimmer et al., 2016).

Given the access to internal data for supplier analysis is sorted, the issue to solve is how to utilize the massive amount of data and derive correct conclusions from it. Even comparing material purchases from supplier to another is often a process that includes evaluating multiple different aspects besides the price paid, such as incoterms, supplier delivery performance and payment terms offered. As determining the most viable supplier for a sourced goods is information intensive task with variable extent of data available for each potential supplier, a degree of subjective decision making from the procurement professionals, often referred to as "expert opinion", is observed in the literature examining supplier selection models (Sen et al., 2008; Zimmer et al., 2016). As this sort of internal, but intangible data is involved in almost all organization decision making, procurement is no exception to the areas where handling and analyzing such data would be valuable despite the challenges of quantifying and comparing it. However, recent literature has presented avenues of utilizing such data through i.e. Fuzzy Logic method, which "can deal with linguistic judgements of

experts" and can transfer them adequately into crisp numbers according to Zimmer et al. (2016). Moreover, Zimmer et al. (2016) find that expert opinions have a drastically more significant share of the decision making in comparison with other supplier data sources when evaluating suppliers on such criterion as sustainability, where internal capabilities of capturing such feature are limited.

One way to approach supplier evaluation through the available internal data is using segments to provide a high-level classification of suppliers to binary segments, e.g. core and non-core suppliers or multidimensional segments such as strategic, tactical and transactional. Often procurement professionals are able to easily detect who their strategic suppliers are without having a highly defined framework or criteria in use (Gutierrez et al., 2020). Hong et al. (2018) employ Random Forest machine learning model to predict the segmentation of the supplier to the binary classes, core and non-core using supplier invoice data from ERPs as inputs. The results of this study indicate that a machine learning model could be viable option to reduce the impact of subjective assessment of supplier importance and could therefor make the supplier management process more efficient and sustainable. Despite the promising findings, Hong et al. (2018) remark that the labels used to training the model for segment classification are generated from experts judgements. Therefore, the model is still prone to subjective opinions and the possible errors and biases that such data contains. Finally, Hong et al. (2018, p. 10) observe that "Item-level classification could not be considered due to the limitation of e-invoice data… item descriptions of e-invoice data, in particular, are often missing or inconsistent. The item-level data were compromised, making it difficult to apply them to our model." This is an interesting finding as the author of this research has encountered similar intriguing challenges in the practice of utilizing free text-based invoice data in procurement analytics.

2.3.2 External data

As complementary source of information, external data can be utilized to aid supplier evaluation and risk assessment as such data can provide the companies with more comprehensive and complete understanding of the multiple factors affecting the suppliers' viability from i.e., sustainability and risk perspective (Bhattacharyya et al., 2010). In this research, external data is defined as data that is not generated in the company's internal processes nor is reliant on internal experts' knowledge and research. External data plays key role in expanding the visibility provided by internal data, which is essentially the primary goal of today's procurement analytics (Handfield et al., 2019). Ideally, this third-party data would

fill in the gaps in available information that would be too costly for a single company to acquire or otherwise not worth the effort to upkeep as internal data. Also, the existence of parties with long experience of analyzing i.e., country specific metrics makes utilizing the existing experience on the topics a compelling option for many procurement organizations (Bhattacharyya et al., 2010).

One of the more common formats for external data are country indices that measure e.g., political, economic, geographical, and humanitarian stability of certain countries thus providing a proxy for assessing the suppliers operating in each country (Bhattacharyya et al., 2010). This information is especially useful for large global organizations with widely geographically distributed supply chains. Bhattacharyya et al. (2010) suggest that in order to capitalize on third party indices, a company must assess, whether the data given is trustworthy and truly measures the quantity of interest accurately. In the research, it is however suggested that well known world bodies like World Bank, and WTO are generally trustworthy sources of index data. Bhattacharyya et al. (2010, p. 27) raise an example of deceiving third part data from a past incident: "Argentina was providing deceptive inflation statistics by removing products whose prices rose too sharply from its consumer price index (CPI). As a result, the Argentine government misinformed international stakeholders by showing a 0.6 percent inflation when in reality, inflation was in the double digits".

Besides the mentioned research on country related indices and their usage as source of complementary data, the existing literature does not cover the recent influx of supplier or material specific third-party data that can be used to enrich internal data in supplier value management process. However, practical analyst reports show that there is an increasing demand for such data (Belissent, 2020). An Forrester industry report shows that external data acquisition is extending to other business organizations outside of IT, such as procurement (Belissent, 2020). Nowadays, there exists highly specialized data providers that have strong experience in assessing supplier related information, RiskMethods, Supplier.io and Ecovadis to name a few.

Despite the evident benefits of being able to integrate external data such as country or risk indices into company's supplier management, Bhattacharyya et al. (2010) remark that a commonly encountered challenge in being dependent on external index data is that it often isn't well suited for capturing short-term changes in suppliers or environments. For instance, a risk index that updates monthly, quarterly, or even yearly may lose its meaning as procurement organizations aim at being more agile and responsive to shifts with supplier's status. Moreover, real time data handling with proactivity and reactive alerts to guide procurement

actions is something that will be a significant trend in the digital procurement in future (Alicke et al., 2016; Reinhard et al., 2016). Here, system integration with suppliers and data suppliers may open new avenues for also external data utilization.

2.3.3 Supplier integration as source of mutual data sharing

Internal data usable for supplier management goes beyond unilateral relationship of buyer gathering data based on transactions with the supplier and expert views. More in depth and valuable data can be gained through supplier integration process that allows for getting to know the supplier the company is operating with better, for enhanced decision making (Shou et al., 2017). On a high level, supplier integration tends to include features such as information sharing, collaboration, collaborative decision making and even system coupling between the buyer and supplier. Combining internally generated information and supplier integration related information, these two sources of internal data complement each other as the benefit of recognizing segments or similar classifications for suppliers based on their relevancy for the business, is the option of focusing procurement professionals' efforts into more specific subgroups of the supplier base. This further helps to determine the proper level of buyer-supplier integration given the context and criteria of the supplier is assessed on (Sen et al., 2008). Context may mean for instance, the product category or geographical unit relevant for the purchases from a supplier and criteria various quantitative measures such as price and delivery capability or other qualitative aspects such as supplier innovation and long term relationship goals. Sen et al. (2008) also test the feasibility of starting from required level of supplier integration and determining the suitable qualitative and quantitative KPIs for supplier selection.

Well executed supplier integration has shown to improve companies' operational performance measures and strong performance in delivery and cost management are related to building successful partnerships with the suppliers (Prajogo et al., 2012). Shou et al. (2018) show that supplier integration is a viable mean to moderate the balance between. Supply Chain Risk Management (SCRM) and operational flexibility. This means that having a tighter relationship and information sharing with key suppliers has the potential of generating operational flexibility related to being able to answer customer specific needs together with suppliers that are closely integrated into the company's development and delivery processes. At the same time, supplier integration also boosts the awareness required for mitigating supplier generated risks in the supply chain. Shou et al. (2018, p. 1339) also raise and example of this: "For example, BMW, the German automaker, had to shut down some plants

and suffered a loss of profit due to its dependent supplier Bosch's inability to provide sufficient number of steering gears in 2017 (Boston, 2017). If BMW had back-up suppliers or had more supply information in advance, they would not suffer so much". Prajogo et al. (2012) note that supplier integration and relationship building should be considered as continuous process instead of a one-off exercise if the company truly wants to realize the associated operational benefits. This shows that supplier integration has potential for being a significant factor in supplier value management beyond basic supplier evaluation on traditional non-supplier involving methods. For it to be successful, there needs to be firstly processes in place, but also IT technology tools to execute on the supplier relationship activities. This kind of tool could work as a one stop shop for accessing the relevant supplier information as well as engaging actions such as communication and information requests to the supplier in question.

From data perspective, the benefit or integrating key suppliers more closely into the company's supply chain and procurement operations is the access to more data for decision making in constant supplier evaluation and selection. Besides deeper integration where data such as real time production quantities are shared with the buyer firm, supplier on-boarding questionnaires and other RFx (Request for x, with x denoting bid, proposal, quotation, etc.) process involved supplier qualitative information could be stored and potentially utilized in supplier selection and evaluation. Existing literature on how to efficiently utilize this information in i.e. decision models is lacking but would open an interesting avenue for future research (Zimmer et al., 2016).

In order to remain competitive, companies are increasingly going beyond basic supplier information sharing as means for supplier integration, and seeing suppliers as strategic partners whom to involve in their product own development, but also to help supplier with their own challenges (Modi & Mabert, 2007). Matook et al. (2009) recognize information sharing as one of the most important success factors for supplier development activities. These efforts are initiated to maintain a high performing and innovative supplier base. Supplier development also creates additional uses for supplier evaluation. Reinhard et al. (2016) suggest that provided data analysis results of their supplied products and therefore help improve the research and development (R&D) efforts on the supplier's end. By sharing the evaluation reports and data with their suppliers, companies can communicate their expectations and increase visibility of the performance with the supplier (Modi & Mabert, 2007). In a way, this practice also works as a competitive motivator for suppliers as their awareness of being compared with actual data against their competitors is more transparent. This is one

of the four supplier development strategies suggested by Modi & Mabert (2007). Second one is certification programs, which set the baselines for supplier evaluation metrics and grant certain suppliers a certification of meeting the requirements and being a preferred vendor in sourcing decisions, hence boosting the supplier development motivation. This relates to the third suggested strategy, which is creating an incentive-based relationship with the supplier, clearly defining the benefits of engaging on common development interests. Finally, a direct involvement, i.e., investing in or partly acquiring the supplier can be considered to ensure unified vision of the future relationship.

None of the supplier integration advantages, however, can be realized if the supplier integrated doesn't conceive the process as beneficial to themselves and isn't satisfied with the approach (Matook et al., 2009). Traditionally, the function of buyer- supplier relationship is seen as the buyer exerting a certain amount of power over their suppliers and thus being able to influence them (Kim & Wagner, 2020). However, the challenge is often that simply terminating relationships with non-compliant suppliers may not be feasible due to strategic reasons, i.e. the goods sourced being vital and unique (Matook et al., 2009). This relates heavily to literature on buyer-supplier power balance, as the more power buying company has over the supplier, the easier it is to implement integration processes without risk of collaboration issues. Zimmer et al. (2016) suggest that degree of influence over the upstream supply chain parties, suppliers, is one key obstacle to overcome, if the company desires to be able to analyze and increase the performance of their supply chain. Therefore, credible supplier value management and good supplier relationship management can be a source of significant competitive advantage for a firm. Moreover, buyer side barriers for supplier collaboration and development do exist. Gutierrez et al. (2020) argue that the long-term commitment and relationship building required may lead to companies electing to prioritize simpler and easily executable initiatives around traditional goals like cost reduction.

2.4 Literature review summary

Procurement playing field has become increasingly complex and dynamic (Shou et al., 2018) as companies are focusing on their core competencies (Prajogo et al., 2012; Zimmer et al., 2016) and relying more and more on their suppliers to deliver products and services to support them though outsourcing of non-core operations (Akarte et al., 2001; Costantino & Pellegrino, 2010). At the same time, this change has caused many companies to recognize the strategic importance of procurement as one of the key drivers to execute strategy (Rimkūnienė, 2013) and progress initiatives, such as sustainability (Foerstl et al., 2010;

Villena, 2019) and social factors (Hofmann et al., 2014; Kim & Wagner, 2020). Also, external pressure from regulators has driven companies to focus on environmental development (Zimmer et al., 2016), which has caused more demand for supplier value management practices outside of the traditional cost and delivery based views (Verma & Pullman, 1998).

Existing literature estimates that up to 80% of the value added of a company's final product is generated in the upstream supply chain from the suppliers goods and services (Bai & Sarkis, 2011; Zimmer et al., 2016). This means that paying attention to supply management has the potential to bring competitiveness to company engaging in those practices, as competition is today often viewed on supply chain level (Prajogo et al., 2012). Moreover, evidence on supplier management practices correlating positively with procurement, and overall company performance has been found in earlier research (Choon Tan et al., 1998; Kar & Pani, 2014). However, companies and procurement managers still resort to limiting the value from supplier management by focusing mostly on cost (Flynn et al., 2021) partially due to its easy availability as an data point and incentives built around cost reduction (Sen et al., 2008).

While literature on various methods of monitoring and managing supplier value, such as selection (Sen et al., 2008; Spekman, 1988; Verma & Pullman, 1998), evaluation (Akarte et al., 2001; Handfield et al., 2019; Kannan & Choon Tan, 2002), development (Liu et al., 2000; Matook et al., 2009), and risk management (Babich et al., 2007; Foerstl et al., 2010; Kauppi et al., 2016) exists, the research on how supplier management is perceived and different aspects are prioritized in large global companies is lacking. Therefore, this study aims at creating new knowledge on the perceptions on supplier value and practical frameworks employed to drive it in these companies.

RQ1: How do large companies' procurement managers perceive supplier value and key factors that affect it. What are the data related aspects and challenges in driving supplier value management?

Arguably the most significant factor affecting the supplier value management capabilities is the data available for decision making (Prajogo et al., 2012) as suppliers are compared and assessed across relevant performance metrics. Besides using the data generated from interactions with suppliers, such as ERP data regarding transactions such as invoices (Hong et al., 2018) and purchase orders (Liu et al., 2000), call for using secondary data is gaining popularity in procurement literature (Bhattacharyya et al., 2010; Kauppi et al., 2016).

Secondary data sources may be public or commercial indices relating to regions, countries, suppliers or materials sourced from a supplier, such as sustainability, and geographic risk indicators (Bhattacharyya et al., 2010). Further, new technology enabled innovation like supply chain clouds, platforms in which companies can share logistics infrastructure and planning between customers and suppliers to save costs and learn from each other (Alicke et al., 2016), highlights the benefit of supplier segmentation and integration as source data used in supplier value management.

The data and processes involved in supplier value management are empowered by procurement purpose tailored software tools (Choon Tan et al., 1998; Marshall et al., 2016) that ideally combine all relevant information and functionalities required for decision making and operative tasks. Moreover, Forrester's analyst report (Bartels & Jones, 2020) reports that supplier value management tooling is growing in popularity at a fast pace. The existing literature (Park et al., 2010; Shou et al., 2018) does acknowledge the use and implementation of information systems to enhance supplier management, but lacks insights on the procurement managers views and theory around practical features and key success criteria considered for successful system.

A recent Forrester report (Jones, 2020) addresses the current landscape of supplier risk and performance management focused procurement software tools, e.g. Coupa, Aravo and Ivalua. Also, the report highlights next significant technologies and features to be natural language processing and machine learning to automatically evaluate supplier filled questionnaires and predict risk based on such unstructured data. However, a recent practitioner report by SCM World shows that still most procurement technologies are focused around automating processes in the expense of addressing the capabilities of deriving value from available data (Handfield et al., 2019). Moreover, currently the existing academic studies on procurement specific analytics platforms is "nascent" (Handfield et al., 2019), which first and foremost, calls for better understanding of the procurement needs for utilizing analytics and technology. Thus, this study seeks to shed light into this topic from practical point of view.

RQ2: What software tool capabilities do procurement managers of large companies regard as essential for capturing information and carrying out actions relating to supplier value management?

3 Research Methodology

This chapter presents the methodological approach to answer research questions presented in previous chapter. First, the approach is described, and validity of the research given the method applied is addressed. Second, the case selection and descriptions are presented. Third, the data collection and analysis process are discussed.

3.1 Multiple case study approach

To provide answers to the research questions presented, a suitable methodology for conducting the research is selected. A common, high level division, of research methods is considered as defining whether the data and phenomena investigated is from qualitative or quantitative angle (Eisenhardt, 1989; Ketokivi & Choi, 2014). Qualitative study approach is often used interchangeably with case study research (Eisenhardt, 1989) and case study is the selected method as the research questions are answerable by qualitative approach: "examining concepts in terms of their meaning and interpretation in specific contexts of inquiry" as defined by (Ketokivi & Choi, 2014, p. 233). Further, Barratt et al. (2011) argue that qualitative case studies are a method of empirical research that employ contextually rich data in order to evaluate and assess a phenomenon in a real-world setting. This justifies the approach, as the aim is to gain insights from the practitioners, procurement CPOs' and managers' views on supplier value and data to drive supplier value management efforts. Thus, the best way of gathering this type of context sensitive and elaborate data is to conduct the research as a focused case study.

There are generally three types of case studies: a theory generation type, which aims at generating new theory where existing one is not in place, a theory testing type, which aims at testing existing theory utilizing empirical analysis of the phenomena, and a theory elaboration type, which aims at elaborating a generalized theory by contextualizing it (Ketokivi & Choi, 2014). This research fits the description the former of these types, as existing theory on the subject is not well defined given the novelty and recency of data-driven supplier value management in practice. Also, an empirical case study is a good way of creating new theory as it allows for deeper investigation of uninvestigated phenomena (Barratt et al., 2011). Besides answering the research questions, it is in the interest of this study to complement existing literature, as well as formulate new theory on the subjects. To achieve this, an inductive process is conducted to tie the data gathered through case study interviews and the existing theory to discover new ways of structuring the findings to a theoretical framework.

A multiple case research approach is selected, as it allows for engaging in cross-case analysis and comparing the cases where common, measurable aspects are detected (Ketokivi & Choi, 2014). Also, while the results of case study are hardly generalizable due to the lack of sufficient sample size (Yin, 2014) gathering data from multiple cases is valuable from the perspective of capturing various procurement organizations and manager's experiences as well as covering more than one industry. This is beneficial for the study as it is not focused around one industry but seeks to provide insights on a wider scope of large companies with global supply chains. Also, the motivation is to get compelling evidence to back up the generated theory, for which a multiple case study approach is often considered more compelling and robust (Yin, 2014).

Although a literature review is conducted to confirm the novelty of the subject and need for generating theory, it is revised after the explorative analysis. This ensures that the context of the research question is derived from the explorative phase, the case studies (Ketokivi & Choi, 2014). The explorative case study approach is beneficial, when it is not entirely sure what can be expected from the data gathering (Yin, 2014), in this case the interviews. Thus, even though a research protocol is created based on the structure suggested by Yin (2014) to guide the researcher during data gathering, its section on data collection questions (Appendix 1) is revised during the process to adjust for the interview findings. This approach is in line with the iterative multiple case study procedure suggested by Yin (2014). Consequently, redesigning the interview questions according to the findings brings credibility to the study as no unexpected findings are ignored during data collection. This type of approach is often referred to as a semi-structured case study (Barratt et al., 2011). True to the semi-structured case study approach, interview tool, in this study the questions, are updated as new data emerges during the interview process, as suggested by Barratt et al. (2011)

Finally, it is also reasonable to acknowledge the criticism that a case study approach in research has received. This is important especially keeping in mind the validity of this research. One of the most significant challenges with case studies is that they often leave room for researchers subjective interpretation on the case or cases (Flyvbjerg, 2006). This in turn puts the results of the study in risk of being heavily biased towards what the researcher wants to think instead of objective truth. To tackle this threat, the research is conducted with open mind and room is left to changing views. Further, questions of the semi structured interview are adapted to increased understanding of the phenomena as the cases are studied as suggested by Yin (2014). Also, generalizability of the research outcomes has many times

been doubted, according to Flyvbjerg (2006) and Yin (2014). This is due to the low sample size of the cases and applies to this study as well. However, keeping this in mind when analyzing the cases and already in case selection to have nonrandom sample, so called information-oriented selection, as suggested by Flyvbjerg (2006), the researcher keeps this worry in order. The generality of the potential theory formulated from a case study may be challenging due to it describing highly idiosyncratic phenomenon (Eisenhardt, 1989). Eisenhardt (1989) also raises the complexity of empirical evidence, in this case interviews, to potentially lead to overcomplex theory as a result. Therefore, the researcher is careful when drawing theory implications for research question 2.

3.1.1. Research validity

Case studies carried out in close interaction with practitioners, such as this one, are known for suited for providing relevant insights for managerial perspective as they deal with real management topics (Gibbert et al., 2008). However, this requires excellent rigor from the case study to come true. Given this and the known weaknesses, four validity criteria: construct validity, internal validity, external validity, and reliability (Yin, 2014) are addressed when designing the case study research. Construct validity of a research refers to "extent to which a study investigates what it claims to investigate, that is , to the extent which a procedure leads to an accurate observation of reality" (Gibbert et al., 2008, p. 1466). To assure construct validity and further the information amount of the study, multiple case study is selected with multiple sources of evidence: interviews, news articles and corporate reports. Further, a clear chain of evidence is built in this paper, to allow for logical path from research question to conclusions as suggested by (Gibbert et al., 2008). Internal validity is often defined as criteria for the study to display evidence of causality between conditions that are examined and also take into account other factors behind patterns found. (Stuart et al., 2002; Yin, 2014). Pattern matching and explanation building techniques for the analysis of findings are done for internal validity.

One of the most common and serious points of criticism case-based researches receive, is the lack of generalizability due to typically low amount of sample cases included not being able to generate statistically significant findings (Stuart et al., 2002). As the case study relies on analytics generalization instead of statistical generalization (Yin, 2014), a multiple case design will also aid in ensuring external validity for the research. Lastly, reliability of a case study is the "absence of random error" (Gibbert et al., 2008) leading to the same conclusions being reachable by other researchers by following same steps as taken in the case study to

reach the conclusions making the findings transparent and replicable (Gibbert et al., 2008; Yin, 2014).To make the research reliable, case study protocol suggested by Yin (2014) is created before data collection and to guide data collection efforts along the way. Also, the information gathered during data collection is gathered and documented in a case study database. Table 1 describes the four key themes of the case study protocol for data collection interviews, which are based on the purpose of this study and therefore the literature review conducted.

Table 1: Case study protocol themes

Theme number	Theme	Theme description
1	Procurement and supplier management strategic role development	This theme worked as an introduction to the topics of supplier value management and sought to confirm existing literature's views on growth of procurement led supplier managements strategic importance for the entire firm.
2	Supplier value	This theme focused around exploring the interviewees views on what value engaging in supplier management activities can bring for the company and how critical these values are in their opinion.
3	Data driven supplier management	This theme was designed to uncover how data is helping the organizations to drive the value points described in theme 2.
4	Supplier management technology	This theme elaborates on theme 3 to explore what features of technology, such as Supplier Relationship Management software are especially valuable from procurement leaders' perspective now and in the future.

3.2 Case selection

The case companies were selected based on criteria that the turnover for the case company had to be significant, over 1 billion EUR annually and the companies needed to have global supply chains with reasonable number of suppliers to warrant for advanced supplier value management efforts. In lack of knowing the exact supply chain landscape of potential targets, turnover and quick background check of the company business worked as a proxy to guarantee the global, complex supplier base criteria in the screening phase. Also, where able to, existing relationships were utilized to maximize the likelihood of getting a positive

answer to interview request with the intended personnel within the target companies. Due to the extent of the research questions, roles in the upper management with wide experience in supply chain or procurement domain was sought after when determining the correct people to interview. Flyvbjerg (2006) presents that when selecting cases, a random sample of case(s) may not be the best option when looking to achieve the greatest amount of information on the topic examined. Therefore, careful background research, including Linkedin revision and company supply chain management reports study, within the limits of available information was conducted to make sure the approached case companies and people were most likely to generate usable information for the study.

3.2.1 Case descriptions

Case A

Case A is an industrial machinery company headquartered in Finland with global operations. Given the industry, the company has heavy emphasis on direct purchases in comparison to indirect and has a scattered supplier base worldwide.

Case B

Case B is an IT services company headquartered in Finland with European operations and global customer base. Majority of the purchases can therefore be classified as indirect purchases with the traditional indirect and direct split.

Case C

Case C is a paper products company headquartered in Finland. It's market and supplier base are global, with most significant portion in Europe and Asia. Given the industry, most of the purchasing is direct but also with significant portion in indirect. For Case C, the interview was held with two representatives from the firm, which allowed for multiple perspectives to be accounted for.

Case D

Case D is a consumer goods company headquartered in Finland. It delivers to over 40 countries with operations and suppliers largely based in Nordics, Baltics, and Russia. For case D, two interviewees were included in the interview to cover the expertise and perspectives for the research scope, similarly to case C.

Case E

Case E is an industrial machinery company also focusing on service business. It is a truly global company with operations and suppliers in most parts of the world. The company operates with a globally scattered, large supply chain and supplier base.

Case F

Case F is a consumer goods company headquartered in Switzerland. As with all the other cases, the company operates globally with relatively vast supplier base to manage.

In total, the study consists of six cases, selected with the described scoping, that are researched in similar format to allow comparability. Table 2 displays the relevant features of each case in compact manner.

Table 2: Description of case study companies' relevant features

Case company	**A**	**B**	**C**	**D**	**E**	**F**
Industry	Industrial machinery	IT services	Paper products	Fast moving consumer goods	Industrial machinery	Fast moving consumer goods
Company Headquarters	Finland	Finland	Finland	Finland	Finland	Switzerland
Revenue bracket (2020)	1-5 B Eur	1-5 B Eur	5-10 B Eur	1-5 B Eur	5-10 B Eur	1-5 B Eur
Number of Employees (2020)	15-20 k	20-25 k	5-10 k	5-10 k	60-70 k	10-15 k
Supply chain	Global, over 1 k suppliers across most continents	Global	Global, approximately 20 k suppliers mostly in Europe and Russia	Global, over 7 k suppliers across most continents	Global, over 30 k suppliers across ~100 countries	Global, over 10 k suppliers across ~100 countries
Interviewee(s) domain experience	15+ years	20+ years	15+ years	20+ years	15+ years	15+ years

3.3 Data collection and analysis

The data collection for the case studies was executed as interviews with each distinct case. The strengths of interviews as source of evidence are e.g., the ability to focus directly on the case study topics as well as ability to provide more in-depth explanations to the inquired questions (Yin, 2014). By developing the case study protocol and acknowledging the potential risks of interviews as source of evidence, such as bias due to poorly articulated

questions and reflexivity (Yin 2014), these factors having indications for the validity of the results were mitigated. Also, one pager worth of background information and themes to be discussed was sent out to participants in advance, to avoid inaccuracies that may result from not recalling certain critical factors about the research topics. All six interviews were completed within one month's time taking place in May and June of 2021. The interview type was a focused interviews (Yin, 2014) due to the limited availability of the busy interview participants. This resulted in the length of the interviews varying from 46 minutes to one hour 27 minutes in time. Further, to maximize the theoretical contribution for research by making the unit of analysis clear, replicable, and comparable (Yin, 2014), time and scope dimensions are defined. Time of the data collection is 2021 and scope is the procurement, sourcing, or supply chain leaders of global companies with large supplier bases.

When conducting case studies it is preferred to use multiple sources of evidence (Barratt et al., 2011; Eisenhardt, 1989). Therefore, this case study does not rely on single source of evidence, the interviews, but also considers other sources of evidence on the cases. These sources are news articles on company supplier management activity and the companies' own disclosure, such as annual reports, sustainability reports and sustainability reports where available. This approach is often referred to as data triangulation (Yin, 2014) and further constructs the validity of the research.

The interviews were recorded, apart from case C where the recording did not succeed. However, for case C the notes were written and completed from fresh memory right after the interview. For all other cases the recording was successful allowing the researcher to revise later in time and be able to complete transcriptions and notes of the data collected. All interviews were conducted over video call mainly due to corona pandemic limiting on-site meetings. Table 3 lists the general information for the six case interviews held.

Table 3: Description of case study interviews

Case company	**Date**	**Duration**	**Role of the interviewee(s)**	**Interviewee description**
A	24.5.2021	46 min via video call	Director (15+ years of domain experience)	The interviewee is a seasoned expert in supply chain management with experience ranging from supplier development and supplier management tooling to strategic purchasing. They are responsible of entire supply chain of a major business division as well as global

				responsibility of a group wide category, with emphasis on strategic development of the function. Therefore, the interview represents information from both division and group-wide procuring and supplier management perspective.
B	26.5.2021	1 h 10 min via video call	Head of unit (20+ years of domain experience)	The interviewee has extensive and long experience from various supply chain management activities and roles, including procurement, in multiple different industries. The interviewee manages a group procurement organization responsible of vast portion of the group spend for the firm. Strategic alignment of procurement and company strategy are also included the interviewees expertise.
C	3.6.2021	58 min via video call	Vice President (15+ years of domain experience) Vice President (15+ years of domain experience)	Both interviewees have extensive background in supply chain management and supplier management also in managerial and executive roles. One with focus in supplier sustainability topics in the recent years and the other with focus in category management. The interviewees possess experience from wide range of industries.
D	4.6.2021	59 min via video call	Director (20+ years of domain experience) Manager (5+ years of domain experience)	The first interviewee possesses lengthy experience from working at the case company's procurement. Experience ranging from operational procurement to procurement business and strategic development at group level in managerial and executive roles. The first interviewee has also pioneered various new procurement practices and responsibility areas at the case company. The second interviewee is part of the procurement strategic development team in the case company with procurement project management role in their previous company. They specialize in procurement tooling development recently

				focusing on supplier management tooling and analytics development.
E	7.6.2021	57 min via video call	Senior Vice President (15+ years of domain experience)	The interviewee for case E is seasoned expert who has climbed through the ranks during their long career at the case company and handled with multiple sourcing roles. They have been working in many parts of the world along the career at the case company, recently being responsible for the entire supply chain and supplier base of the company.
F	15.6.2021	1 h 27 min via video call	Manager (15+ years of domain experience)	Besides the case company, in which the interviewee is responsible for procurement processes and tooling in managerial position, the case company interviewee has a wide experience in procurement activities in e.g., supplier management, supplier collaboration and procurement finance consulting. The interviewee has firsthand experience in implementing procurement digitalization transformation related processes, tooling, and analytics at the case company with long experience granting an expert view in procurements development towards a strategic function over the past decade.

3.3.1 Unit of analysis

As proposed by Yin (2014) and Barratt et al. (2011), the unit of analysis for the study is derived from the two research questions presented. It is not ideal to make idiosyncratic topics the key definition for case study research (Yin, 2014), which would not have a reference point in existing research. Therefore, the unit of analysis for this research is the technology enabled supplier value management processes within organizations, the cases included in this research. As found in the literature review part of this research, supplier management and supplier value are topics widely studied, while the data driven technology enabling it, mainly due to its recent surge in popularity during past few years (Jones, 2020), is a less studied one. This unit of analysis captures both the views of procurement executives on supplier value definition as well as the data driven technology enabling the value extraction.

3.3.2 Data analysis technique and process

To further define the type of case study, the research aims at confirming the theories proposed by earlier literature by exploring the views of practitioners. Therefore, the general strategy for analyzing the data resulting in held interviews can be classified as one basing on theoretical propositions, as defined by Yin (2014). Essentially the aim is to find both support for both the theories presented, as well as to find out what are the data driven technologies employed by leading procurement functions. This is beneficial to answer the second research question of the study. Therefore, the research also has an explorative nature to be accounted for in the analysis approach. Secondly, the technique applied is pattern matching. Pattern matching technique is chosen, because clear existing predictions are in place for research question 1 and coinciding predictions with results, helps to build internal validity for the study (Yin, 2014). For research question 2, a special type of pattern matching, explanation building is chosen as it is fit for an explanatory case study approach and aims at developing ideas for further research (Yin, 2014). This is in line with the study's goal for the second research question.

The first step after collecting the data was reviewing the recordings and gathering findings from the interviews into logical groups, themes as defined in the case study protocol. This procedure ensured that no critical information was left out during the first round of note gathering immediately after the interviews had taken place. Each case was also analyzed on their own by reading through the notes and creating a good understanding of the topics discussed and the most important features of the case. This approach was inspired by the within-case analysis technique proposed by Eisenhardt (1989) to be a solid first step in the analysis. The following steps taken for the analysis of the findings are in line with the approach suggested by Yin (2014). Second step was to review the case study protocol questions and compose a good understanding of what each case contributed to the single questions. Thirdly, the questions were categorized to the main themes of the protocol to have more holistic view on what the data collected tells about the research questions. This was done by careful pattern matching between cases to find similarities and potential contradicting findings. The last step was to formulate a proposition based on the analysis on the data. Figure 5 illustrates the data analysis steps.

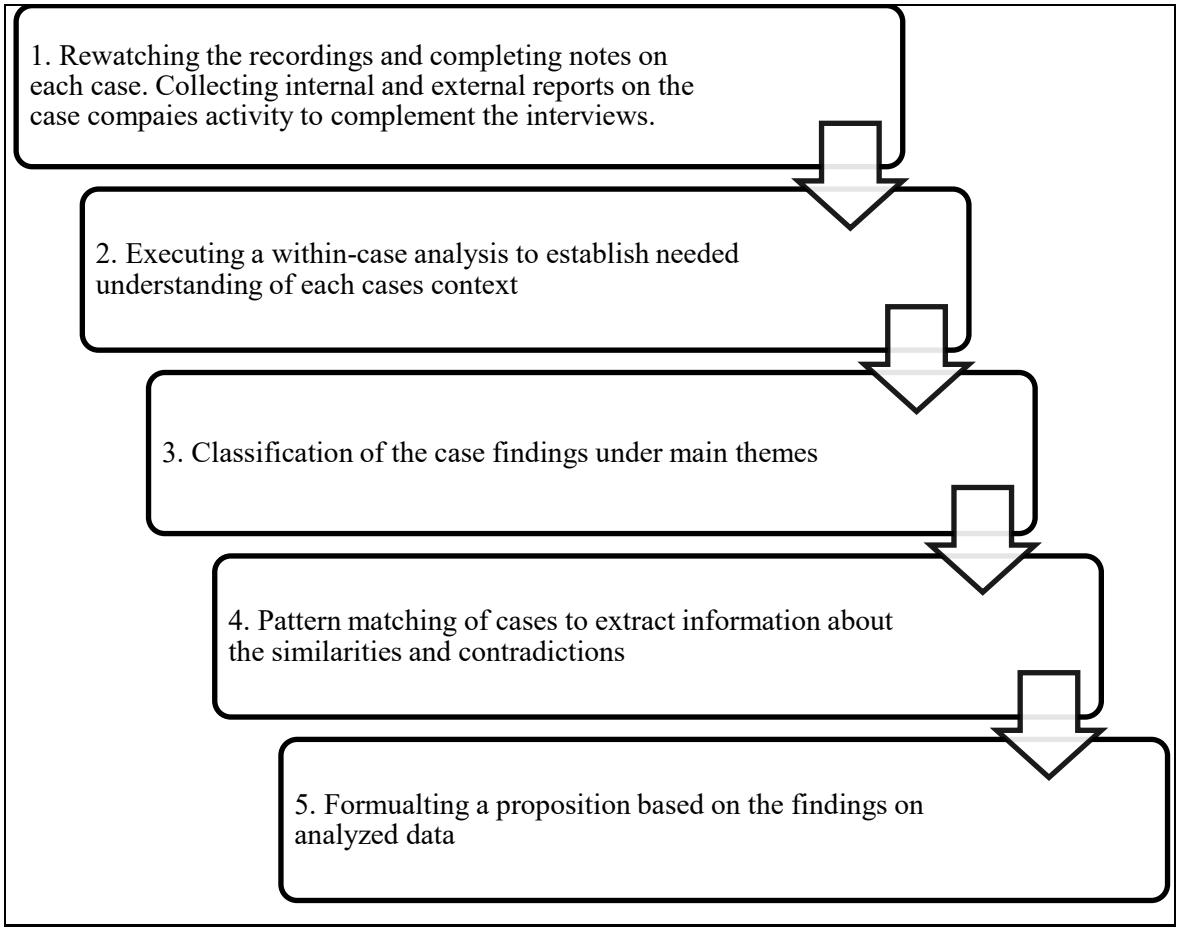

Figure 5: Case study interview analysis steps

4 Findings

This chapter concludes the findings of the research conducted. First, a summary of relevant information from all six cases individually is presented. Second, analysis of cross case commonalities is discussed, and finally a solution proposal based on the findings is outlined.

4.1 Within case analysis

This sub-section comprises of within case analysis conducted on each case separately. It describes the most relevant findings from the cases regarding key topics discussed during interviews. As presented in Table 1 The first theme is the interviewees perspective on development of strategic importance of procurement or sourcing function with supplier management as the specific activity in scope. Second theme is about what kind of value angles can be achieved from active supplier management. Third them is exploring the data enabling this supplier value extraction efficiently with supplier management technology utilizing this data being the final theme. The purpose of this section is to provide required information on each case and construct a background for cross case analysis and pattern matching.

4.1.1 Case A

Supplier management strategic role

The interviewee for case A specified during the beginning of the interview that they consider procurement a mere part of supply chain management (SCM), which is by default, not strategic but transactional in a way that procurement considers “buying predefined items on time and upkeeping the relationship with the supplier in order to achieve this objective”. Instead, they consider SCM a wider scope that also involves the strategic focus: strategic procurement supplier selection, long term supplier development and supplier validation. Therefore, the interview was carried out on SCM perspective level with the focus still on supplier management. The interviewee describes that during past 10 years, the focus of SCM efforts has shifted from prioritizing price, lead times and availability, to also pay closer attention to risk management, proactive issue forecasting, compliance, and ethics. Therefore, SCM has become more multidimensional requiring the companies to tie SCM closer to companies’ overall strategy.

According to interviewee, the underlying reason for this increased scope and focus for SCM activities is partly due to companies focusing on core competencies. This means doing less inhouse and more and more outsourcing non-core products and services. The

interviewee sees that suppliers have become an "arm" for big organizations meaning that managing them strategically has become more important than ever. The interview reveals that this development has its flipside: companies need to pay closer attention to how their suppliers and supply chain as a whole, can impact the image of the firm. Image risk is something that comes along with increased reliance on suppliers. Also, the challenge with large supplier base is that impacting suppliers beyond first tier is challenging and mitigating risks coming from n-tier suppliers is something only a handful of industries, such as automotive, have been able to tackle.

Supplier value

Given the various dimensions supplier of the company can affect, recognizing the most valuable features and how to nurture them is key question for any company operating with large supplier base. The interviewee considers the most valuable aspects of a supplier for the case company to be sharing capabilities that lead to competitive edge for the firm, willingness to develop long term strategy together, and being active in the development of the portfolio of products sourced from the supplier. Interviewee considers that nowadays, good delivery performance and competitive price are taken for granted and those are no longer the value drivers behind supplier management.

Another trending supplier value factor in supply chains, according to the interviewee, is sustainability. Especially emissions coming from upstream supply chain are vastly driven by the company's suppliers and there are emissions targets set within the organization. This is partly due to the public image implications of sustainable business and rewarding policy of the stock exchange the case company is listed in. Further, the interviewee also stresses that sustainability should not be considered as only environmental, but also from e.g., human rights perspective as the image risk implications emerging from suppliers of the company mistreating their employees or using child labor is something that needs to be controlled.

Lastly, one of the most important features for a valuable supplier are considered to be proven willingness to co-operate with the firm. With willingness to co-operate, the supplier is included in supplier development from the case firm, which includes collaborative product development, compliance checks and relationship building meetings on weekly or monthly basis. The collaborativeness and commitment to the company is listed by the interviewee to be one of the three dimensions in suppliers' segmentation to a strategic partner. The other three are supplied product know-how, which means the extent to which the product is owned

by supplier, and the quantity of alternative supplier options, in other words the complexity of replacing the supplier for the given product or service.

Data enabling supplier value management

Assessing the suppliers in case company A, is a mix of several metrics. The company employs a 'supplier requirements list' which they expect all of vendors doing business with them to comply with. This includes sustainability related dimensions such as ethics, environment, health, and safety. Another key point of interest for the company is the performance of the supplier what comes to delivery and quality, as well as being able to continuously improve and develop. This supplier performance tracking is done by utilizing internal data coming from day-to-day operations with the supplier, such as PO deliveries and deficiency rates. Overall, the interviewee considers this data to be in good shape and reliable. Another source of internally generated data is a web-based questionnaire tool that they frequently issue to suppliers in order to keep track and analyze the more qualitative aspects. If there is something that raises alarms from the questionnaire, the next step is typically to do onsite audits to go through more detailed discovery focusing on the area in which the supplier is not living up to expectations.

Case company A is also utilizing 3rd party data to assess suppliers and control risk. One of the application areas for such data within the company is financial risk that their suppliers impose. The interviewee describes that although attention is paid to financial risk of the supplier base, it is not of most criticality as for as big a company as case company A, the default of a singular supplier is not going to be excessively impactful. Strategic suppliers, however, are naturally slightly more important from also this perspective. It is pointed out that the quality of external data is sometimes not great, as there are multiple smaller suppliers or unlisted companies in the company's supplier base that don't have public financial data nor requirements to disclose is. Therefore, the 3rd party data is still leaving a significant blackspot in financial risk assessment efforts. When it comes to compliance assessment though data, the company is operating a hybrid model of employing some internal audit data from the survey tool in combination with external indices on e.g., sustainability and geographical delivery risk are sourced from outside.

Supplier value management technology

The interviewee describes the supplier value management technology of case company A in use scattered across various platforms. One of the software in use is a supplier portal

application which allows the suppliers of the company to upload information and documents for case company A to analyze. The information exchange happens to both directions, as the company is also sharing the supplier's information on their performance in effort to push them to improve. However, the challenge of having direct data sharing with suppliers is that they are often reluctant to share their data in fear of disclosing information, such as profit margins, that affects the buyer supplier relationship unfavorably. The second tool in use at the company is a risk management tool combining risk related data and raising alerts and enabling reaction to worrying signals on suppliers. Thirdly, there is a supplier compliance management tool in place to trigger assessment requests to suppliers. The results of these assessments, filled by suppliers, may lead to further actions in case of the information containing signs of compliance risk.

The challenge, as outlined by the interviewee, is that there are too many tools to monitor and control supplier value. This is something the company is looking to tackle by integrating all external tools currently in use into common SRM platform that would make data driven supplier management more efficient. From their perspective, there is no solutions in the market now that could provide comprehensive set of functionalities to satisfy the needs of case A supplier management needs. The interviewee sees the solution field too specialized in a way that "best-of-breed" providers are only able to fulfil one requirement area, such as supplier sustainability or order management. Therefore, the company is looking to develop this kind of "umbrella tool" internally, by integrating the existing external tools.

Ultimately, the interviewee considers the ideal state of supplier management technology at A to be one where there is one single dashboard including all the details from high to low level. This system would integrate the necessary data and functionalities from various databases and systems. However, the interviewee believes this kind of set up must be to some extent customized for A. Besides data analysis capabilities, they are looking for functionalities such as managing supplier related actions, assign tasks to sourcing professionals, and developing action plans on supplier and category levels. They also highlight that a perfect supplier value management tool would be able to dynamically adjust to present situations by changing weights of accounted factors for supplier value. An example of this would have been to raise the importance of supplier country risk during corona outbreak. Finally, data should be increasingly real time which would enable quicker reactions and actionability.

4.1.2 Case B

Supplier management strategic role

When it comes to development of procurement role over the past decades, the interviewee for case company B sees the present-day significance being emerged in 1990's when multiple consulting companies pushed for companies achieving significant cost savings through procurement efforts. This focus on cost is, according to interviewee, still relevant in today's procurement landscape. However, they see that this type of focus is nowadays narrowminded and value of procurement does not equal low price sourcing anymore. This wider perspective on procurement value is something that they sense has grown among the procurement leaders in the recent years. The interviewee describes procurement being more tied to overall company's strategy and vision: "On key to nurture this value mindset is to start from the question, what do we want to achieve as a company? And this kind of thinking is where the procurement is heading towards to in the grand scheme of things.

The interviewee also points out that there are noteworthy differences in the strategic importance of procurement and supplier management between, and even within industries such as manufacturing. They don't believe that companies focusing on core competencies, and therefore outsourcing more non-core products and services, has driven the need for supplier management up on average that much. Instead, as procurement workforce in organizations has reduced over the past decades, there are fewer people to manage suppliers which demands more efficiency and effectiveness in supplier value management from procurement as a function. The interviewee also sees that companies are nowadays more willing to hand out responsibility to suppliers and this way increase the dependency on them.

Supplier value

On the topic of supplier value, the interviewee reminds that supplier value is defined and depends on the goods or services sourced: "In services procurement it is significantly harder to measure the value of a supplier and pinpointing the concrete value is harder [than in physical products]". They point that before measuring supplier value, one needs to take a step back and consider what the big picture operative and strategic goal of the organization is. When that is clear, determine how to measure the achieving this goal. From their experience in manufacturing, delivery and lead times and are important in the industry and clear value points for supplier. These metrics are also relatively easy to measure. On other hand, features of a supplier such as innovation capabilities may be just as if not more important,

but measuring that trait is harder. In case company B's industry, IT services, the sourced technology is often the most crucial element.

The interviewee describes that flexibility of the service provider when sourcing services in IT industry is often one of the key criteria for suppliers. This means being able to reduce or increase the level and amount of service depending on how the business is going overall, which is highly valuable from buyers' perspective. In case company B, procurement is also driving values such as sustainability, compliance, and ethics through supplier management. However, the way of doing so is different from manufacturing industry where e.g., co2-emissions are calculated per stock keeping unit (SKU) as environmental and social sustainability are mainly influenced through demands to comply with case company B's rules on these topics. Geographical risk is also focused on mitigating the risk from services that are outsourced to developing countries. The interviewee highlights, that image risk coming from upstream activities is lower for a Business-to-Business (B2B) company such as them, in comparison to Business-to-Consumer (B2C) companies, which is why it doesn't draw as much attention from value perspective.

Data enabling supplier value management

At case company B, supplier value management data in use is mainly from self-evaluation questionnaires sent out to suppliers. These questionnaires include structures, predefined questions that the suppliers answer and scoring for supplier is derived from the answers. Besides these questionnaires, some spot audits are carried out to ensure that case company B's standards for working conditions are fulfilled from the supplier's side. This is also motivated by demand from investors of B to engage in the compliance activity. Suppliers are assessed on non-frequent basis and in non-standardized format. Given the industry, at best there are KPI's based on service level agreements (SLA), which state the contractually expected performance level of a supplier, that are tracked for the sourced service.

A form of intangible data, the relationships, are highly valued at B. The interviewee describes that they engage in quarterly or bi-annual strategic discussions with key suppliers in attempt to develop the relationship for mutual benefit. However, it is stated that the exact measurable value of these efforts is unclear. They also raise the challenge of technology sector with massive technology companies being suppliers in power position. An example of this is a company like Microsoft or IBM that "are too big to care" about singular buyer's opinions and development efforts.

Supplier value management technology

In case company B, there is an RFX tool in place, which is used to both request information and proposals from new suppliers and send and manage the self-evaluation questionnaires. The principal of needing to first define the goal sough to achieve with the sourcing decision is applied also in this tool to guide the sourcing activities. In the same tool, they have a module for not only RFx processes but also supplier management. However, the interviewee sees that none of the supplier management solutions available in the market the current moment is perfect to an extent that they fill are the needs and use cases of theirs.

The interviewee is defining the first step for an ideal supplier management software to provide visibility to internal, unstructured data such as supplier negotiation notes and structured ERP data in one consolidated place. This software would then include standardized analytics on the state of affairs with given supplier that is easily accessible when needed in e.g., supplier negotiations. Secondly, they prioritize the integration of external data sources, such as sustainability records, financial data, and supplier annual report-based information together with the internal data. “To boost supplier management efforts’ efficiency, such tool would also include incidence dependent reporting that triggers notifications for the procurement professionals when a predefined threshold is broken”, says the interviewee. This threshold could be for instance a key supplier gearing ratio getting unreasonably high or a geography-based incident affecting the supply chain. This kind of a functionality would reduce the need to browse through dozens of events and instead provide the information on time when they occur.

When it comes to supplier value management technology market, the interviewee states that although there has been discussion on the topic for past decade, the market for such solutions is still in its infancy. This means that while software for supplier management exists, none of them are great. Simplified, need for receiving all necessary information on supplier and having actions triggered based on the data is something that near everyone is looking for but solutions for the use case are lacking. Part of this, according to interviewee, is due to supplier value being difficult as a definition and often resource heavy to measure.

4.1.3 Case C

Supplier management strategic role

For Case C company, there were two interviewees included in the discussion. They highlighted that technology is first and foremost enabling centralized procurement, instead of de-centralized organization structure with e.g., local, or division-based procurement units.

Technology, such as order and supplier management software, is seen as enabling more efficiently run procurement operations from one consolidated unit. Further, in general the importance of procurement has been increasing during the past century according to the interviewees. This development has been driven by increased outsourcing activities and growth in supplier base leading to more responsibility on procurement to manage the suppliers and sourcing process.

At the same time, this outsourcing trend has led the companies to realize that while less is done in house, suppliers are a source of more value, such as sustainability, than mere cost savings and that procurement is in key position to extract this value. "Technology is once again in key role in allowing us to execute on supplier management more efficiently", reminds one of the interviewees. Another concrete example of the risen procurement status is that the case company's CPO is nowadays reporting directly to CEO, whereas they used to report to CFO in the past. This is, again due to higher management realizing the vast opportunities in utilizing suppliers to the maximum potential and doing this via procurement efforts.

Supplier value

Cost savings are no longer a key focus point in supplier management at case company C. Focusing on core competencies has also led to definition of supplier value evolving at C, according to the interviewees. It is described to have given more priority to not only existing supplier specific Intellectual Property Rights (IPR) and specialization, but also supplier innovation and product development to continuously translate the suppliers' capabilities to C's own products and services. Besides innovation capabilities, various other value types are defined for suppliers and supplier management activities, such as sustainability and risk management. Out of these two, especially sustainability is driven by the customers, who demand it from C. C further demands it from its suppliers therefore making it one of the key focus points in procurement. However, it is stressed that more "traditional" value points like price, quality and delivery performance are still today vital qualifications of a valuable supplier, with on time delivery (OTD) having been included as one of the key measurements as of late.

To manage supplier sustainability, C has taken multiple measures to actively engage in the topics. One of those is set of ethical guidelines that they are looking to achieve 100% acceptance rate across the entire supplier base. While C's current focus in emissions tracking is on scope 1, which is the emissions occurring from sources directly controllable by the

company, they are already looking into measuring scope 3, the emissions occurring from sourced goods and services. With better emissions tracking and measurement, the goal for C is also to act on emissions insights and pursue their suppliers to innovate in order to ultimately achieve target of direct materials purchases being completely emission neutral in the future. Lastly, sustainability as a supplier value is influenced by conducting supplier site visits and audits to ensure desired level of sustainable business is achieved at key suppliers.

The interviewees remind that all the value points are not always perfectly aligned. There may be cases when there is a trade-off between cost of supplied products and compliance with C's sustainability values, which makes for challenging situations with business goals being in contradiction. However, in these cases sustainability values are ultimately prioritized. When it comes to managing supplier base originated risks, they acknowledge that full coverage of the supplier base is nearly impossible to achieve, forcing C to focus on certain suppliers and identifying risks efficiently among the thousands of suppliers they are dealing with on a regular basis. C is also engaging in supplier development with most important suppliers in order to build more collaborative partnerships with these suppliers. However, there is no precisely defined process for the development activities apart from more frequent meetings and discussions.

Data enabling supplier value management

With large supplier base comes the challenge of engaging with correct suppliers given limited resources in procurement. At C, this is tackled by employing supplier segmentation, which allows for defining various supplier segments and focusing on certain suppliers based on the segmentation assigned. On high level, this segmentation is done based on risk factors and further classified within the initial segments. This is something C has recently been working on developing to replace old, simpler non-critical or critical segmentation. This segmentation set up is based on data, which they gather on e.g., supplier geographical risk. However, the interviewees point out that as most of the supplier base of C is in Europe, it is not seen as the most significant factor.

When it comes to external 3rd party data in use for supplier management, the interviewees report to have multiple sources in use. To monitor supplier country corruption index especially for suppliers outside of Europe, there is a corruption index derived from a public database to detect potential risks based on supplier location. Additionally, C is looking to get more insights from financial risk providers and supplier sustainability sources to aid visibility and actionability in these areas. Besides basic internal data on supplier performance,

they also run self-assessment questionnaires and occasional supplier audits to get unstructured internal data on the suppliers. Further, there is a rigorous process to store intangible but relevant information e.g., negotiation notes, to a software system so that the information from procurement professionals is archived and accessible even when people are moving within or outside of the firm. One of the challenges from data perspective is that getting information and grasp of suppliers beyond first tier is often very limited. One of the interviewees reminds that ever so often the underlying suppliers beyond the direct supplier that C is in relationship, are eventually traceable to China, which makes monitoring human rights and other metrics for first tier suppliers less sufficient.

Supplier value management technology

C has an SRM software in use, in which they collect spend related data, negotiations information, and KPIs relevant for each supplier to have a comprehensive set of data for supplier management. This tool has been essential in empowering supplier value management processes for the firm, and it has allowed procurement to translate and align overall company strategic KPI's with supplier relevant KPIs. There is also flexibility to adjust the assessment metrics according to changes in overall strategic ambitions of the management, bringing procurement supplier management efforts closer to the company's general vision. However, there are still challenges in obtaining information especially in supplier selection process when there is no pre-existing history with a potential supplier. The interviewees also consider maverick purchasing, adding new suppliers into C's supply chain instead of utilizing existing relationships and contracts, one of the key challenges which technology could help to solve. Now, they are looking to utilize the self-assessment questionnaire data more effectively by quantifying the answers and giving more precise ratings for the supplier answers in automated fashion.

Interviewees describe capability of putting supplier specific data into a logical context, such as category, and comparing suppliers against their peers as one of the more significant perks of supplier value management tooling. What they would like to see in the future, is better utilization of less tangible and hard to capture data, such as SLA information. This would allow for designing supplier custom dashboards and monitor service level agreed in contracts to the realized level more efficiently. Finally, the interviewees remind that people need to use the tools to reap the benefits of technology in general. Therefore, procurement professionals need to be encouraged to adopt to new capabilities introduced by data driven supplier management.

4.1.4 Case D

Supplier management strategic role

For case company D there were two interviewees from procurement development team in the interview session. The more experienced interviewee considers that procurements role in D has always been significant, but it has certainly grown to next level during the past two decades. The driver for this development has been the wide list of activities and achievements that procurement has been able to produce as a function, leading to the rest of the company to realize how wider definition of value can be driven from procurement apart from sourcing at low cost. The interviewee elaborates that while in the past, procurement has been seen as organization mainly responsible for cost reduction, this view has changed in D as they have brought the business functions closer to themselves and actively participated in business development activities. One key part of this has also been as gap closer between business and suppliers and being able to also integrate strategically important suppliers to development efforts by utilizing the valuable ideas and innovation they possess. Mere cost reduction from supplier management perspective has also come to its end as most of the cost reduction potential has already been explored and employed. Therefore, while D has focused on their core competencies, they have brought their suppliers closer and been able to extract value from the relationships while being increasingly reliant on e.g., external ingredients for their products. They strongly believe supplier selection, in other words working with the best suppliers, to be in key role in enabling innovation from supply base to flourish: “We can’t be an expert in all topics and have to be able to trust our suppliers to exhibit expertise in the products and services we source from them”.

Supplier value

Being a company known for high quality, D ranks this feature high in priority for their suppliers. Alongside quality, other more traditional supplier values, such as competitive prices, good payment terms, and reliable delivery performance are considered still to be essential. Recently, innovation coming from suppliers to find ways of driving down costs through product or process development has also been priority when defining valuable suppliers and their capability to create long term value for D. The interviewees also recognize the risk management capabilities from supplier management efforts when it comes to e.g., image risk and delivery risk. These supplier base stemming risks are actively being monitored and mitigated through means such as contracts clauses.

The interviewees also stress the importance of procurement lead sustainability efforts, in which suppliers and emissions coming from sourced goods of those suppliers, are in key role. In fact, one of the interviewees considers firmwide sustainability to be most actionable through procurement function: "The world is changing and there really isn't a better function within a company than procurement to drive sustainability efforts. And having sustainability agenda has become prerequisite for existence of a large company. Therefore, the value procurement brings also on this front is significant". With quality, sustainability forms the set of two most important value drivers in supplier management as of current at D. "With all the focus around sustainability of suppliers, there still needs to be a balance between it and cost perspective" reminds one of the interviewees.

While supplier innovation is important to D, managing and empowering it effectively is a newer topic for the organization. However, process for better utilization of supplier partnerships has been in the makings and the aim is to include supplier scorecard combining supplier performance data, and frequent meeting schedule with supplier stakeholders as part of the collaboration process. The suppliers are motivated to participate in closer relationship with the aim to build more business with them. In return, D will ideally be benefiting from suppliers' innovation and product development by being able to translate it to their own end product. Therefore, there is an incentive in place for both parties.

Data enabling supplier value management

Data is in the central of supplier value management activities at D. The vision of having the supplier specific scorecard includes combining internal quantitative data from spend data, such as on time delivery and defect rate metrics, with qualitative information, such as internal stakeholder questionnaires on suppliers. However, the planned dimensions don't stop there and also include i.e. contract coverage, purchase process, and sustainability scores by supplier. D is also utilizing 3rd party data as part of their supplier assessment already in the present. Indexes, such as financial risk evaluations, compliance and responsibility certificates, and sustainability audits are sourced from specialized data providers. Most recently, they have also been looking to retrieve active sanctions information from selected provider of this kind of data.

Supplier value management technology

Given the extent to which data driven supplier management capabilities are recognized and employed, case company D can be considered reasonably advanced with technology usage

in this domain. To monitor one of their key values, quality, D has employed a quality monitoring tool that besides tracking quality metrics in ongoing basis, also automatically sends out assessment reports to suppliers to keep them aware of their performance from D's perspective. This kind of communication and data sharing capability is something that, according to interviewees, is highly valued in a supplier management related tool and are looking to increase these capabilities also in other software in use. This kind of data sharing also works both ways. The interviewees describe that long term goal is to have a robust process and tools in place, that allow for suppliers to keep relevant information on themselves up to date, which will reduce the need for D to dedicate time for this sort of data gathering. As part of this goal, they also want to capture information already when the relationship is starting with a new supplier, meaning an onboarding tool gathering background information such as founding details, size metrics, and contact information is stored in one standardized way.

Segmentation is another area where D acknowledges the efficiency gains that technology can help to achieve. The company is currently developing a segmentation to better classify suppliers into logical buckets and have already defined their strategic suppliers to satisfying extent. However, as the information required to determine a supplier's segment is scattered across various tools, such as spend analytics, third party data providers, audit archives and quality control tool there would need to be enhanced integration of the data to make segmentation easier. Essentially, the challenge is not having data, but it being in various noncommunicating systems thus not being combinable for segmentation purposes. The interviewees also highlight that segmentation is not only based on quantitative metrics such as frequency and scale of purchases, but also the capability and willingness of the supplier to improve and develop together with D: "A large spend supplier, e.g., a raw material vendor is not automatically a strategic one despite their supplied volume". Therefore, the opinions and views of D's procurement professionals are still in key position in supplier segmentation.

Lastly, the interviewees remind, that the technology doesn't necessarily need to be all in one system or tool. Rather, fluent communication and data flow between the tools is what makes supplier value management a better experience. Also, the demand is heavily towards increasingly real time and up to date data with triggers that are automatically activated in case data indicates something alerting with a supplier.

4.1.5 Case E

Supplier management strategic role

Having long experience in sourcing at case company E, the interviewee considers that the function has become more relevant for not only E, but also other enterprises that are increasingly getting higher revenue share from services, while being traditionally considered a manufacturing company. The interviewee describes that in the past, sourcing was seen as more of a support function rather than active value adding function. Further, while to some extent, there still are supportive features to sourcing's role within the company, it is clearly becoming more strategically vital function. This change is due to recent increase in geopolitical disruptions leading to shortages in supply, which in turn has rapidly led to extremely complex supply chains as a whole. Also, for E, as well as in general across companies, in-house manufacturing has reduced leading to more reliance on suppliers. Consequently, the mere volume of our business consisting of externally sourced goods and services makes the functions tight alignment with overall strategy a no brainer, according to the interviewee.

The interviewee also describes that a decade back, his colleagues were jokingly comparing sourcing to law and accounting functions due to its role as a "no sayer". However, this comparison has grown old due to the function becoming proactive solution producer and a true business partner in a way that it challenges the way business is being done and creates change while simultaneously guaranteeing compliance related aspects, such as anti-bribery in E. Further, the interviewee considers robust supply network being in company "DNA" to give increasingly more trust towards both market and customers. This way, sourcing provides also more intangible signaling assets from whole company's perspective.

Supplier value

When assessing supplier value at E, multiple dimensions are considered. Traditional metrics include performance metrics such as on time delivery capabilities and competitive costs. Besides these factors, also supplier sustainability, including environmental, social, and ethical sustainability, is monitored across supplier base. Besides sustainability related risk, sourcing is active in bringing value to the company through other risk management aspects that are related to supply chain. For instance, E is active in real time analysis of events such as political or natural disasters which occur close to suppliers and therefore put the supply chain at disruption risk.

Besides engaging in monitoring and evaluation supplier value, sourcing at E is ramping up supplier innovation and development activities currently. Although E already has various supplier development programs, which include e.g., steering meetings and data sharing for supplier performance visibility, these programs are typically more related to reactive corrections to supplier weak spots or worrying trends rather than active and continuous development. However, despite supplier innovation not being in E's "DNA" just yet, interviewee considers it essential future development topics as E is operating in rapidly evolving market and needs to not only keep up but be ahead of it. The interviewee highlights that these activities should not be only based on relationship building and executive discussions without concrete, measurable results. Instead, they consider that supplier development is truly meaningful when both parties are exhibiting clear results from the activities: "Relationships are important, but they only work when both parties are good students. If you deliver consistent price reduction, quality, and realistic long term product roadmap you are an important supplier for us. However, if the while the intangible relationship may be good, if the supplier screws up (with e.g., delivery) it becomes a secondary factor very quickly". Therefore, the interviewee sees that supplier value E is still mostly about who brings the best costs, quality, and delivery improvements to the table. However, motivating suppliers to innovate and develop is a recognized challenge which calls for solutions.

Data enabling supplier value management

At E, data is employed in various ways to assist in supplier value management. For the core assessment activity, E is using a semester-based analysis, in which they track KPIs for contract coverage of purchases, should cost simulation, quality, and delivery. This data is based on internal spend data. Further, the KPIs vary between sourcing categories, as for most indirect purchases, delivery and quality are not applicable as such. Instead, Service Level Agreements (SLA) are compared to realized service to evaluate the fulfilment level. However, interviewee reminds that comparing SLAs to realized services is often not straight forward, which highlights the importance of defining SLA measures that are realistically measurable. Otherwise, the agreements become pointless. Besides performance related factors, suppliers are also tracked on so called "certificate layer", which is designed to make sure certain suppliers possess the required certificates, such as ISO.

Case company E is utilizing external data resources to complement internal analysis. For instance, VDA audits regarding E's strategic suppliers are sourced from a company specializing in these process assessments and integrated into supplier assessment process.

Further, human rights compliance audit data and background checks for litigation and other relevant information on a new or potential supplier are also retrieved from external vendors. Finally, E also has cybersecurity risk information for their supplier risk management portfolio, which is conducted by a company doing cybersecurity attacks to E's suppliers and seeking to find weaknesses. This is done with suppliers' content and when weaknesses are found, the feedback is provided to supplier which often has led to the supplier being thankful for the finding that they wouldn't have made without E's process.

While quantitative internal and external data is in good use at E, they also seek to benefit out of more intangible, sourcing professional know-how more efficiently. The interviewee considers it important to be able to capture this know-how and mitigate the employee turnover caused information leakage. At the same time, they note that there is always a trade-off between using too much time on documentation and keeping up with as much information as possible. To maintain this balance, it is vital to also prioritize these efforts among the supplier base.

Supplier value management technology

To classify suppliers into segments and manage them for value effectively, a rigorous supplier segmentation based on tangible data is in use at E. Supplier segmentation is seen as essential governing tool to answer the question of how to manage relationships with suppliers. The key benefit, according to the interviewee, is that segmentation allows the organization to focus on certain suppliers believed to bring value to the company now and in the future by allocating managing resources efficiently. The segment hierarchy consists of six levels and is segmentation for each supplier is modeled based on various dimensions such as reliance on the supplier, investment to integrate the supplier to E's processes, and their innovativeness. All of these factors are based on data.

When it comes to supplier value management tools, the interviewee describes that there are plenty of technologies in use to do data driven supplier management and orchestrate mutual data sharing and communication with suppliers, but they don't believe tooling to be the most important aspect: "Tools are tools, but at the end of the day, people are what make the difference". They also consider that the greatest challenge for supplier value management technology in general, is that it is mainly capable of addressing first tier suppliers, while n-tier suppliers are largely obscure:" the effort put in having robust first tier suppliers is gone to waste if the supplier of your suppliers is a liability".

4.1.6 Case F

Supplier management strategic role

Based on the interview with case company F, procurement has transitioned from operational function, to tactical and then again to strategic one in the past decades while still keeping some operational activities in its core. Concretely, according to the interviewee, there has been a shift in focus from operational activities, such as day to day purchasing, invoice and purchase order management and sourcing with lowest possible price, to strategic context involving category strategy development, supply market intelligence and supplier performance management. They describe that technology is what ultimately enables strategic procurement, as operational activities are being completed more efficiently freeing up employee time for strategic activities. Case company F is looking to increase procurement resources devoted to strategic focus from 40% to 80% in the upcoming years and technology, including software to assess and manage suppliers, is key in making achieving this goal.

Increase in strategic focus has also led to procurement being more active and recognized within other business functions in organizations. Nowadays, procurement is seen as a value driving function that is closely tied to companies' overall strategy. In F, the function is expected to manage suppliers for value which will translate into tangible cost savings and therefore income statement trackable savings in collaboration with finance function. Supplier management is also related to the companies legal and compliance efforts, as supplier originated compliance risks are best mitigated from procurement activity. Finally, they are also in close relationship with research and development, marketing, and sales when managing partnerships with suppliers.

The interviewee recognizes that to some extent they have become more reliant on suppliers due to focus on core competencies, but thinks that at the same time, the suppliers are responsible to participate in development efforts knowing the specific area they are supplying so well. As a concrete example, interviewee describes one initiative, where they engaged in product development with a supplier, sharing both risks, costs, and benefits with them. From F's perspective, having mere vertical, transactional relationships with suppliers is not sufficient, as the dynamic business environment forces companies to partner up with their suppliers for added value.

Supplier value

At F, they consider total of five key values for suppliers when determining suppliers that they want to engage with. Being a consumer goods company with high quality associated to the brand, they want to ensure quality of sourced goods from their suppliers is also on par with expectations, as it is in direct relationship with their own end products. Also tightly related to the B2C nature of business, diversity and sustainability are in core of the company to which procurement is in good position to contribute. In fact, sustainability, including sustainable procurement, environment, labor rights, and ethics, is a prerequisite for a company to become a supplier of F. This is ensured by an assessment mandated to be filled out by supplier before starting the relationship. Lastly, also financial risk and compliance risk management related aspects are closely paid attention to when defining valuable suppliers.

In order to allocate focus effectively, F has supplier segmentation in place, which constitutes on two-dimensional matrix, x- axis being supplier power and y-axis supplier's impact on business of F. These dimensions are further broken into multiple criteria, each for which a score and weight is assigned to calculate weighted score and ultimately specify the segmentation for a supplier.

As partnerships with suppliers are important for F, there is an established process in place to extract the sought-after benefits form these relationships. The concept is on a high level to have category specific leads who are responsible for assessing their category context on a quarterly basis. As part of this process, they exchange information with suppliers and provide them visibility on how they are performing form F's perspective. Active product and process development from these suppliers is expected. From their earlier organization, the interviewee recalls also congresses being held, where suppliers were invited to learn the company's situation and outlook for the near future. This helped the suppliers to be aligned with their customer's, the case company's goals.

Data enabling supplier value management

Supplier value management data and technology wise, case company F is seemingly advanced. Evaluating suppliers and utilizing multiple sources of data to do so, is part of daily procurement activities, and there are tools in place to facilitate these data driven processes. They manage internal, spend analytics data to assess performance indicators for suppliers, like on time and in full delivery rates, quality related defect rates as well as procurement professionals' assessments on more qualitative aspects. Further, external data is integrated to ensure the vital supplier value dimensions like sustainability and financial risk mitigation

are met. However, utilizing all the data efficiently is something that F is looking to continuously improve on.

Supplier value management technology

Major part of employing the available data on suppliers effectively, is the tooling enabling it. While segmentation is recognized to be an efficient way of allocating focus and correct actions in supply base, it is currently highly manual process for which F is looking to change when they implement a central SRM solution in the organization. This means, that while some metrics are still evaluated by procurement professionals, the tooling would accommodate uploading the information for specific scopes, like category and organization easily and determining the segment automatically. As essential feature of future SRM tool, the interviewee highlight's ability to onboard suppliers and manage qualification process fluently, as it builds the whole basis for following supplier value management efforts.

While the goal is to combine quantitative and qualitative information in the tool and to store all related documents in one consolidated place, the challenge of storing procurement professionals' knowledge is recognized. To capture and make more the information more usable, F is looking to utilize existing Source to Contract (S2C) tool as the platform where standardized information is filled and analyzed. The interviewee reminds that while one source of truth and the software for all supplier value management activities is vital, people should not be forgotten from the equation. Therefore, the tool needs to be intuitive and the first step before implementation is to develop the competence and awareness of the employees: "There is plenty of data available, the challenge is to get employees to know how to utilize it".

4.1.7 Summary of within case analysis

Table 4 summarizes the significant findings of each case company.

Table 4: Summary of within case analysis

Company	**SVM strategic role**	**Supplier value**	**Data enabling SVM**	**SVM technology**
A	- Focus on core competencies has partly increased the strategic scope of SCM	- Three most valuable aspects of a supplier: sharing of knowhow, willingness to develop long term strategy	- multiple metrics employed, such as performance and compliance with A's requirements	- Supplier management relevant software landscape scattered - Looking to develop an umbrella

	- Suppliers have become an "arm" for large companies - Companies must start paying more attention to how suppliers can e.g., impact the image of buying firm	together, active product innovation - sustainability and emissions control manageable through suppliers	- Both internal and external data in use - Perceived quality and availability of some 3rd party data, such as financial risk indices not always up to par.	solution that integrates the various tools and data in one place - Real time data becoming more important for faster and more dynamic reactions
B	- Procurement leaders have realized the untapped value aspects the function can achieve during the past decades - On average, outsourcing activities have not been the key driver increasing supplier management efforts - More responsibility is being handed to suppliers than before	- Value of supplier depends on the good or service sourced - Value of supplier should be in line with the higher-level company strategic goals - flexibility to adjust service level is valued highly, but also sustainability and ethics topics can be driven through suppliers	- Main source of supplier management data derived from self-assessments and - Given the industry, not many simple and generalizable KPI's exist – SLA information needs to be utilized for benchmarking	- SVM tool would ideally bring visibility to internal unstructured data such as negotiation notes, and structured ERP data together - The greatest need is to have all necessary information in one place to manage suppliers for value effortlessly
C	- Technology enables more resources to be used for strategic procurement activities - outsourcing activities and growth of supplier base has put importance on supplier management - Nowadays CPO reporting directly to CFO in the organization	- Cost savings no longer the key criteria for supplier value - Sustainability efforts seen most impactful through supplier management - Innovation also important trait for suppliers but traditional performance metrics are not forgotten	- 3rd party data widely in use for supplier management activities - self assessment questionnaires and audit data used alongside basic performance data - Challenge is that information on suppliers beyond first tier is limited	- SRM software in use that collects spend data and negotiation information for easy access - Ability to put the suppliers to comparable contexts and selecting the best out of peer groups is one of the sought-after perks of SVM tooling

D	- Procurement has developed from cost reduction organization to more multidimensional value adding function - to realize this value, supplier have been more closely integrated to innovation efforts - cost reduction potential largely tapped, next focusing on other value aspects for suppliers	- Quality and cost efficiency still relevant criteria - supplier innovativeness increasingly important -Risk management means through suppliers recognized but not actively engaged besides contract clauses	- Some supplier related data already in spend analytics solution - Looking to create one stop shop for all related information, such as delivery performance, quality, and contract coverage - 3rd party data utilized for external supplier scores e.g., sustainability audits	- Utilizing data driven tools, such as quality monitoring, to assess supplier performance - Automatic data sharing and assessment triggering would be valuable in SVM tool - Greatest challenge to solve is integrating the various solutions in use so that they work as a unified environment
E	- Sourcing is becoming more integrated with company's strategy - In-house manufacturing has reduced leading to more reliance on suppliers to deliver non-core products - Robust supplier network is a strong signal to market in itself	- Traditional cost and delivery performance metrics important - Sustainability and risk management are recognized to be improvable through supplier engagement - Supplier innovation key factor for a valuable supplier	- Internal supplier performance data related KPIs revisited on a quarterly basis - External services also employed in supplier assessment, such as cybersecurity and human rights compliance audits	- Plenty of technologies to execute on data driven supplier value management activities in use - Challenge is addressing n-tier suppliers and gaining reliable data on them
F	- Procurement has transitioned from operational to tactical to strategic function - Technology is key in freeing time to strategic activities - Managing suppliers for value generates synergies across the business functions	- Quality of suppliers sourced goods is vital from F's perspective - Demand from customers for sustainability and diversity puts pressure to progress those through supplier base as well	- Advanced in recognizing various internal and external data points over which suppliers can be evaluated and developed - Qualitative evaluations on intangible aspects utilized to high extent	- Looking to establish an ecosystem of specialized tools to answer all the needs for data driven SVM through out the supplier lifecycle

4.2 Cross case commonalities analysis

This sub-section discusses the common patterns across cases and formulates a solution proposal for the research questions of this study.

4.2.1 Role of sourcing organization in strategic supplier management

Sourcing or procurement organization has increased in significance and responsibilities, as well as overall alignment with company's overall strategy according to the interviewees across case companies.

> *"Integration of sourcing activities across the supply chain is becoming more and more a strategically vital aspect. -- Geopolitical disruptions, shortages in raw materials, shortages in currencies, shortages in containers are creating so complex supply chain that nowadays supply chain robustness is by default the most strategic approach that enterprises may have in industries like ours." Case company E*

> *"The world is changing and there really isn't a better function within a company than procurement to drive sustainability efforts. And having sustainability agenda has become prerequisite for existence of a large company. Therefore, the value procurement brings also on this front is significant." Case company D*

Overall, the consensus across all case interviews was that there has been development in importance of sourcing organization towards more proactive and value adding function. Concrete signals of the increase of significance vary between cases. Some examples of these are more interaction and collaboration initiatives with sourcing and other business functions of the companies, and reporting hierarchy being streamlined to be in direct contact from CPO to CEO with no CFO in between. Most of the interviewees described that underlying reason for this development is focusing on core competencies of the companies and outsourcing non-core products that don't need to be manufactured in house. However, not even this explanation was unanimously agreed upon cases. For instance, interviewee for case B, argued that in absolute figures, outsourcing activities have not been the main driver for increase in company spend during past decades.

Given the increase of outsourcing activities putting more emphasis on managing suppliers effectively, it is evident that alongside the functions grown importance, also the

suppliers have become more important for the companies in general. At C, procurement is now aligning supplier related KPIs with overall management set KPIs. This alignment is done to make supplier management efforts better serve the company's strategic ambitions and will be dynamically adjusted when management readjusts strategic focus in the future. Some interviewees described that the semi unilateral cost savings efforts where suppliers are managed for reduced costs, have already been exhausted to certain extent, and other avenues of benefiting from supplier relationships have opened simultaneously:

> *"Recognizing that suppliers can be utilized for all sorts of activities has led to management realizing the capabilities of procurement in driving company's performance and therefore also the importance of procurement has evolved." Case company C*

However, while motivation to engage in closer management within supplier base and develop supplier relationships further has seen increase, sourcing professional's labor is still required to proceed with the efforts. This means that scarcity of human resources works as an inhibitor to getting the most out of supplier management. Few case companies argued that strategic procurement is mainly enabled by advances in technology and software to manage thousands of suppliers efficiently with limited number of employees. Therefore, the technology is key catalyst on the way towards more strategically focused sourcing:

> *"We are not, unfortunately I would say, all in strategic procurement, as we should be, due to lack of automation and lack of digitalization. -- Still 60% of our FTEs are working in operational, non-strategic procurement". Case company F*

4.2.2 Supplier segmentation and suppliers beyond first tier

Given the limitations in resources to manage suppliers, a common theme across all case interviews was that a method to identify those suppliers that should be paid closer attention. This is commonly referred to as supplier segmentation or supplier categorization among the interviewees. Given the scope of the case companies, the need for this type of process becomes evident. All the case companies are operating with thousands, some even tens of thousands of suppliers (see table 2), on a regular basis.

> *"We have dedicated files for each strategic supplier. You do it [talking about meeting notes documentation and action logs] for suppliers for which it makes sense. I don't see*

the benefit of hiring twenty people just to write memos. Therefore, this kind of tracking we only do for critical suppliers. We wouldn't have resources to do it for all. -- Supplier segmentation is a governing tool to answer the question of how we should manage our supplier relationship. It is not means to give indication on how much to assign business to each supplier" Case company E

The quote from case E describes well, that supplier segmentation, first and foremost, works to define standardized processes for managing the supplier relationships and allows for spending the right amount of employee resources for supplier analysis and relationship building, such as quarterly meetings. Case company C also mentions that they plan to utilize supplier segmentation to also focus supplier evaluation efforts, meaning that more thorough screening is conducted for most important suppliers according to segments.

Based on the discussions on supplier segmentation during interviews, there was significant variance in the maturity of supplier segmentation processes. For instance, D and C are in the process of implementing supplier segmentation, F is looking to decrease the degree of manual effort that goes to the process, while A and E have an established system in place that they are comfortable with. Between the case companies, there is also differences in what criteria are employed to determine segmentation for each supplier. These criteria include e.g., business criticality, amount of available optional suppliers, willingness, and capability to cooperate, delivery performance, cost efficiency, sustainability.

The definitions and amounts of supplier segments varied from case to case, with common denominator being strategic supplier or equivalent term being the set of suppliers considered most important long-term partners. For F, the segment was determined with a two-dimensional, four quadrant matrix with axes "supplier power" and "impact on business" divided further into scorable subdimensions. Similar matrix type of approach is implemented in E and C, with also qualitative risk and sustainability factors being considered in the latter company. At C, suppliers are further classified within their segments. In the past, C was segmenting on more simple division: critical or non-critical. This and other segmentation development efforts within case companies highlight well how accessibility of data has led to more capabilities in recognizing vital suppliers for more effective resource allocation:

"We have a great segmentation system in place. It is just currently in a manual way, and we need to make it work in digitalized way standardize the process and share with all our business units. What we want to do is to move the segmentation from spreadsheets

into a tool where the buyer will select their own business unit and category and be able to see the automatically the segmentation for a supplier given this scope." Case company F

Moreover, besides identifying the different supplier relationship segments among first tier suppliers, few case interviewees brought up the challenge of addressing suppliers beyond first tier. Company C described that their aim is to improve the degree of visibility and control they have over n-tier suppliers, as it is rarely enough that they monitor e.g., the sustainability or labor rights compliance of the direct supplier they are engaging with. The challenge is, that in their industry, as in many others, eventually lots of the sourcing can be tracked to countries like China where those topics are not in as good of a shape as in western countries. E also highlighted n-tier suppliers as one of the major supplier management related challenges while acknowledging the challenge of increasing visibility and control beyond first tier:

"At the end of the day, you put a lot of effort into professionally the tier one companies in which ever segment they belong to, and then all that effort is screwed up when they select the cheapest and crappiest supplier from China themselves. – You can be very selective of course for tier two and three suppliers, like we do in certain categories, but clearly you cannot do it for all." Case company E

However, the topic of n tier supplier base management efforts warrants for extensive research on its own, and therefore it was excluded from the scope of this study and not elaborated further during the interviews.

4.2.3 Supplier value: What makes for a valuable supplier?

This sub-section covers the commonalities and differences between interview findings of supplier value according to the interviewed sourcing and procurement executives. The section answers the first research question (RQ1) of this study.

A common observation among the cases was that there is no single feature of a supplier that is solely looked at, or even often heavily prioritized over others when evaluating the supplier value for the buyer firm. Instead, multiple different factors are accounted for, and supplier value estimated through combination of those identified key value factors. While the case companies are from a wide range of different industries, there are evident common

value factors for suppliers across the cases. Most of the interviewees agree, that the definition of valuable supplier has been drifting away from the more traditional metrics, such as price, quality, and delivery performance. However, this doesn't mean necessarily that those metrics aren't important for the case companies. On the contrary, competitive costs and deliveries on time are still very relevant but are no longer the criteria for supplier added value. Case A interviewee describes that those features are nowadays taken as granted from suppliers of B and are mere a minimum requirement for being a supplier of B. Moreover, case F and D interviewees establish that especially for a B2C companies known for high quality products, quality of supplier sourced products is still the extremely essential feature. Out of the traditional metrics, price seems to be the one feature not seen as most relevant value add across all of the cases:

> *"Approach of focusing on price [when measuring supplier value] is still observable in today's procurement discussion. The way I see it, with this mindset you are barely focusing on the price, not actual value. It is evident, however, that a wider concept of value is gaining traction. One key to nurture this value mind set is to start from thinking:" what do we want to achieve as a company?" and derive the criteria for supplier value from the answer to that. And this thinking of way to drive procurement is where the world is heading towards." Case company B*

Beyond the basic supplier evaluation metrics, the case interviews reveal that new definitions and value points for supplier added value have been recognized and taken into use in supplier evaluation. Based on the interviews, these features are closely tied to the supplier's way of conducting sustainable business, including topics such as environmental, social, and ethical compliance. All the interviewed case companies have procedures, most commonly supplier self-assessments, external audits, and site visits, in place to try to ensure supplier's sustainable business. Case companies C, D and F outline environmental sustainability, driven from demands of customer base to be amongst the most important features of a supplier, as it has direct implications on the buying company and its image. Other motivations also affect the prevalence of sustainability topics for supplier value. At A, emissions targets and achieving those are rewarded by the stock exchange A is listed in.

Features such as delivery performance and sustainability are directly related to another value factor gained from supplier management: risk mitigation. The interviews confirmed that supplier base is often seen as significant cause of business unpredictability via delivery

and image risk. Therefore, a less risky supplier may in itself be more valuable supplier to the companies, as the degree of unpredictability is reduced from the buyer's perspective. While risk is not considered individually in the supplier evaluations among all cases per se, risk aspect is built into other supplier management activities and scores, such as ethically sustainable business and financial status of suppliers. Most of the case companies reported collecting financial risk data in some form, to anticipate potential disruptions in supply due to supplier default. For instance, at A risk management is executed in a way that default of a singular supplier won't impact A's business critically due to multi-sourcing practices:

> *"In our industry during the last 10 years there has been much more focus on risk management, anticipating problems rather than reacting to them. Also, compliance and ethics have become important." Case company A*

Besides concretely measurable or estimable features for supplier, partnerships, innovation, and supplier development were also brought up across all the case interviews, which is likely a result of development towards suppliers as partners and wider definition of supplier value emerging overall, discussed in the earlier parts of interviews. All the case companies rely on, and seek to facilitate innovation from the supplier base, which would translate to also the products and services provided by the buyer. Interviewee for B describes that while quantifiable metrics for supplier evaluation are employed, the relationship with supplier is often the most important aspect for value creation.

At D and F, supplier innovation is considered essential part of qualifying to supply for the companies, as they are best at knowing the requirements and development within the specific context, they are supplying in. At A, journey to become a strategic supplier for A, the supplier needs to demonstrate readiness to co-operate and build relationship with A:

"You can't start from scratch and immediately become a strategic partner. Ability and willingness to co-operate has to be demonstrated from the supplier over time." Case company A

Also, all the case companies engage in supplier development by having regular steering meetings with the suppliers' representatives and addressing topical pain points and areas for improvement. The degree of standardization for such supplier development processes varies across cases. For instance, C is now looking to add structure to supplier development efforts besides unsystematic partnership meetings, while at E, there is a defined process and

dedicated supplier relationship managers who are responsible of reviewing both short- and long-term development roadmaps with suppliers on a frequent basis.

Table 5 describes the supplier added value relevant dimensions brought up during the case interviews. While it should be noted that not necessarily all dimensions were mentioned during the interviews per each case, the table gives indication of supplier value priorities with what features were considered to be most critical and additional value adding besides baseline for each case and give indication on the popularity of the dimensions across the cases. Moreover, it should be noted that in practice the value features are context dependent, e.g., the good or service being sourced and not applicable to all suppliers of the case companies. Further, case B is distinct from other cases with heavy focus of sourcing being indirect side services. Therefore, traditional cost and delivery related metrics do not apply for the company comparably to other cases.

Table 5: Supplier added value mentions across cases

feature \ case	A	B	C	D	E	F	Total
Traditional							
Cost			X	X	X		3
Delivery				X	X		2
Quality	X		X	X		X	4
Flexibility to adjust volume dynamically		X				X	1
Sustainability and risk							
Environmental sustainability	X	X	X	X	X	X	6
Ethical sustainability	X	X	X	X	X	X	6
Social sustainability	X	X	X	X	X	X	6
Diversity						X	1
Financial risk	X		X			X	3
Geographical risk			X		X		2
Cybersecurity risk		X			X	X	3
Relationship							
Image risk	X		X	X		X	4

Collaboration willingness	X	X			X		3
Innovation	X	X	X	X	X	X	6
Commitment to long term strategy	X		X		X		3

4.3 Solution proposal

This sub-section covers the commonalities between interview findings of supplier value according to the interviewed sourcing and procurement executives. The section answers the second research question (RQ2) of this study. Figure 6 illustrates the solution proposition composed of the case study findings. The solution proposition captures the ecosystem and process of data driven supplier value management system, that allows for deriving strategy aligned value from supplier management efforts in a company with large and complex supplier base.

4.3.1 Supplier management data

The interviewees reveal that especially supplier performance related aspects, such as cost competitiveness, on time and in full deliveries, quality and service level is evaluated utilizing the internally generated data. This data is coming from transactions with suppliers, generating structured data in form of purchase orders. Another non-performance related factor utilized from these transactional datapoints is the frequency and volume of purchases, which enables the companies to put the suppliers into context by evaluating their significance to them as buyers. Moreover, at E a supplier quality assessment is used to determine the volume, so the performance related features also systematically influence, how much purchases the suppliers are allocated.

Another structured source of internally generated data on suppliers is the assessments, audits and compliance status with the companies' various requirements related to e.g., ethics and information security. However, the recognized challenge of this form of data is that it is not always located in one central repository and therefore not very accessible, for when an overall picture of supplier related audit results and compliance fulfilment is needed. More unstructured, but according to the interviewees essential part of supplier management information is the assessments and information possessed by employees. They have the most qualitative knowledge on the suppliers they are working with, and therefore important piece

in evaluating the relationship related aspects that are in vital role for managing supplier value:

> *"In reality, the evaluations and decisions in supplier management are not entirely based on systematic quantitative data. Quite often the criteria for determining e.g., supplier segment is based on qualitative criteria. Especially the expertise of a sourcing manager on suppliers within their own category is relied on." Case company D*

Also, supplier self-assessments are recognized as good way to detect potential alarming signs and tackle those. However, the challenge is recognized on how to efficiently analyze and produce triggers from this sort of semi-unstructured information:

> *"We send out self-assessment questionnaires to suppliers, that they fill in and provide back to us. This way, we have additional information to analyze and detect potential risk factors by supplier. Despite the data existing, it is however not used very frequently outside of case-by-case checks. We are looking to improve the quantifiability of and usability of the questionnaires, in order to visualize the data collected on a larger scale." Case company C*

Finally, data relating directly to suppliers, or other relevant information on e.g., the geography and industry of supplier is sourced externally to facilitate accessibility of non-performance related factors. These factors include risk indices, such as financial and compliance risk, sustainability, information security, and supplier background. Interviewee for A highlights that downside of 3rd party data in for instance financial risk information is that not even the dedicated 3rd party data provider has records on smaller companies that are not required to disclose as much financial information as large publicly listed companies. Thus, the usefulness of certain indexes and scores are not always most useful due to lacking data quality and coverage.

Essentially, data in various shapes and forms is deemed essential across the case companies to carry out activities boosting the gained value of supplier base. As an example of concrete activity, at D, the supplier quality assessments are frequently shared with the suppliers themselves through the assessment tool in place, to keep them aware of their performance and where improvement is needed. All other case companies also describe sharing

information with suppliers in some ways. Most commonly among the interviewed companies, such information is reviewed in steering meetings with suppliers.

4.3.2 Supplier value management system

Figure 6 illustrates a generalization of the supplier value management system, where data is used as input in all stages. Most often, the amount of information is limited at supplier selection stage when no existing history with the supplier exists. In those instances, the case companies utilize predefined compliance documents that the supplier candidates must agree with. In addition, a, RFX process is gone through with most significant purchases, where more information on the supplier and their capabilities is gathered. After the supplier selection is done, the supplier is onboarded, and additional information is gathered. Especially technology to manage supplier onboarding was sought after by the interviewees. Both F and D are looking into solutions to qualify and introduce suppliers into their supplier base in standardized way.

Once the supplier is onboarded, internal performance relevant data starts accumulating and further segmentation and development activities can be organized. These activities are conducted on an on-going basis and are crucial components of continuous relationship building with the supplier in order to extract value from the process:

> *"You cannot start from scratch to become a strategic partner with us. Abilities and willingness should be demonstrated during the years of relationship. There needs to be proof of being a valuable supplier. – We have a dedicated function responsible of supplier development, who define an action plan of required actions and timeline." Case company A*

The SVM tool also exchanges information with other business tools and works as a generator of strategic value out of the operational activities conducted in other tools. Therefore, it is in crucial role when organizations seek to utilize data for better supplier value extraction. Outputs of the SVM system are value aspects that the procurement and sourcing leaders recognize drivable through supplier value beyond traditional cost savings.

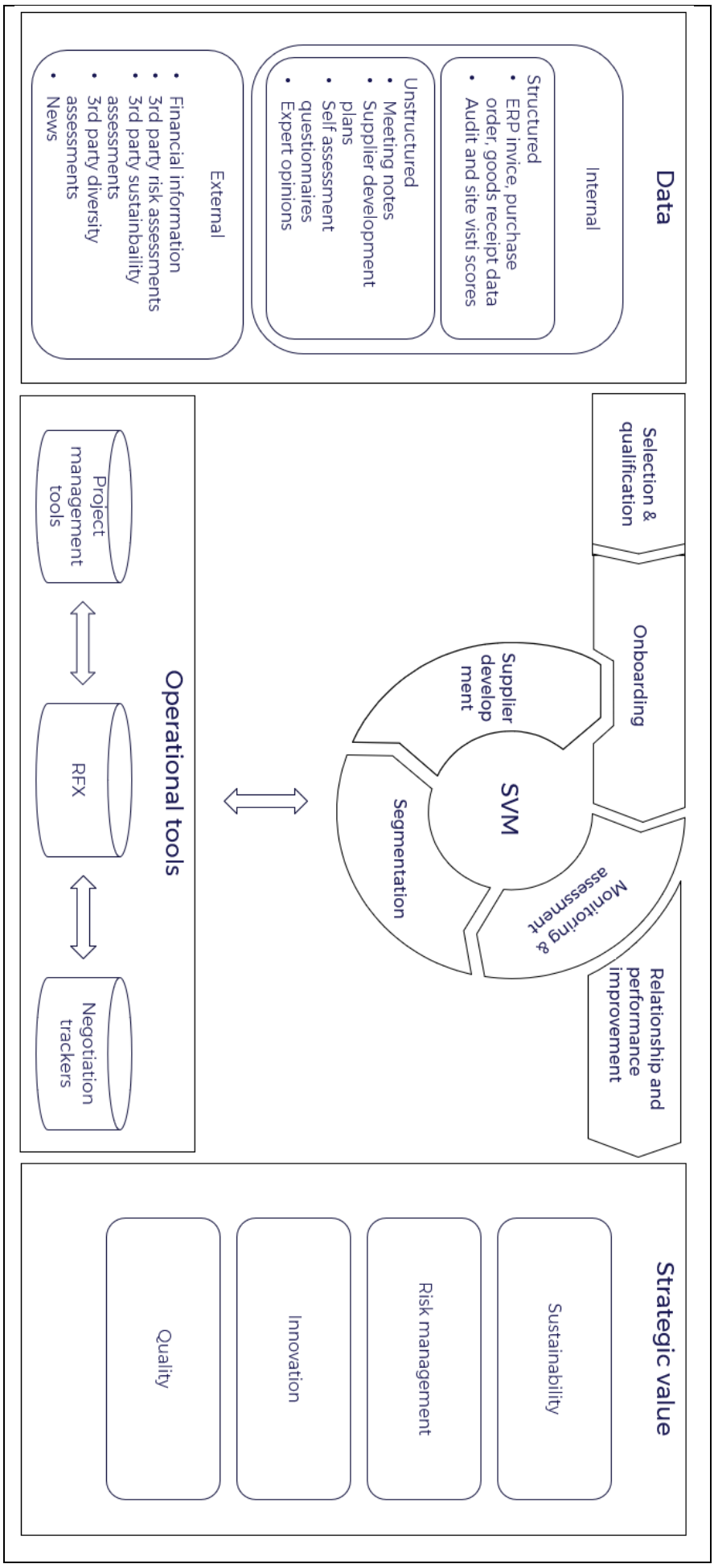

Figure 6: Supplier value management system

4.3.3 Supplier value management system capabilities

To enable the supplier data and management process to generate maximum amount of value, a wide set of software functionalities needs to be in place. The interviews revealed various needs and use cases that are either already in place at the case companies or sought after by the sourcing and procurement managers. Table 6 lists common interview mentions of certain highly valued features. A total of five key functionalities for a data driven supplier value management software was identified.

First feature is the capability of having all relevant data, both structured and unstructured in the central software where supplier related data needs to be accessible. The common challenge with the case companies was that the tooling landscape is scattered, and information has to be fetched from multiple systems in order to get complete picture of e.g., supplier performance and compliance.

Secondly, the abundance of data and scarcity of resources mandates for intelligence from the software to detect and automatically trigger alerts or actions for the procurement professionals to carry out. This saves the organizations time when anomalies and real time events don't need to be manually monitored for.

Thirdly, the unstructured data such as audit reports, self-assessments, meeting notes and action plans need to be utilizable efficiently for decision making. Already having a common place for storing supplier documents is something that the interviewed companies appreciate highly. Beyond that, there is demand for a software functionality that reads written, unstructured text and quantifies it into more objectively analyzable form.

Fourth finding on the desired features is fluent information exchange also with suppliers. This refers to both performance related KPIs and compliance related files and documents. The interviewees described that to help information to keep up to date, it would be beneficial for the supplier to be able to fill in basic information themselves in some type of supplier portal. Also, during onboarding, the necessary documents would be shared and stored via the software.

Final feature identified from the interviews was the necessity for the SVM software to integrate with other business and procurement software, such as S2P, contract management, and RFX tools. This way, the software would not be required to achieve everything in itself but can be focused on the data driven value generating activities while still being a unified part of the tooling landscape of the firm.

Table 6: SVM software capabilities

Capability	**Mention 1**	**Mention 2**	**Mention 3**
One repository and analysis platform for all supplier relevant data	"The dream of every sourcing professional is to have one central place for key supplier information. -- It is really about integrating the several sources of information coming from various activities and databases" A	"The amount of available information is not reducing. There is a need to control this information in a way there is no need for committing a lot of time in making it available. -- At the end it is about increasing the visibility of data." B	"We utilize a spend analytics solution as a hub for information. We are looking to amend the available datapoints even further in the future to have it work as one source of truth." F
Automated supplier segmentation accounting for multiple data points	"Segmentation is based purely on data... This is the way to manage a portfolio of 20 to 30 thousand suppliers with few hundred of sourcing specialists" E	"With development of tools in place, we are planning to implement further complexity to supplier segmentation that takes into account various data points" C	"Unfortunately, our supplier segmentation process at the moment is manual, it is not being implemented in standardized way. Here we need automation" F
Automatic triggers	"Especially abnormality-based triggers to take action is something I personally believe supplier management software need to be going towards." B	"To ease the amount of data to review, there would ideally be a functionality in place to actively trigger worrying findings from the data. Automation of the continuous supplier monitoring is essential" D	"What is never being considered, is that the weight of different supplier risk indicators is changing continuously. The tool should be flexible enough to adjust considered factors dynamically to macro trends to trigger real time actions." A
Utilization of qualitative, unstructured data	"We have quite rigorous process in place to store procurement experts' information on relationships, negotiations, etc. to a supplier management tool. This allows for seamless	"The challenge is that we have lots of intangible information lying with procurement professionals. We are looking to for a tool to capture this tool in processes to make it	"Clearly unstructured data is a challenge. There will always be some lost knowledge. However, one of the main targets of a SRM tool is to manage the

	information exchange internally" C	available and utilize it more effectively" F	data of ongoing activities." A
Information exchange and communication with suppliers	"We are using a solution to automatically generate quality report of supplier and share it to them monthly. Also, the supplier being able to keep their relevant information up to date would be ideal. So mutual information exchange." D	"We have plenty of tools where we run assessments, questionnaires etc. as well as share information with suppliers on continuous basis." E	"A tool that we are frequently utilizing is one where we can send out assessments to suppliers and monitor the answer status. GDPR has led to us using this communication functionality fairly often." B
SVM system integrating to network of other software	"It is not necessary to have everything in one place per se. Instead, what truly matters is that the different systems exchange information. Then, the network of systems works fluently." D	"We are utilizing a supplier relationship management system, which combines data from spend analysis, negotiations, and other relevant data sources such as audit database" C	"A supplier information hub needs to be able to integrate with other sourcing software." F

5 Discussion

This section summarizes the findings of conducted research, reflects the findings against existing literature, and discusses the novelty, theoretical implications, and managerial implications of the findings. Lastly, the section covers acknowledged limitations of the research that should be considered when interpreting the results, as well as presents suggestions for further research on the topics discovered and discussed in this study.

5.1 Synthesis of findings

The objectives of this study were to uncover the views of procurement executives of large global companies on supplier added value, its strategic importance, and what data driven software capabilities help in effectively extracting this added value in practice. Firstly, the study established justification for the strategic importance of supplier management, an inherently operational activity by uncovering the reasons behind supplier management's importance for a large firm. With this understanding, the study created understanding of what the strategic value derived from supplier management means for procurement executives of these companies and how the priorities have shifted during past decades (RQ1). Investigating the factors influencing enabling this value, the study focused on data driven capabilities impacting the way suppliers are managed. Thus, the ultimate objective of this study was to identify data backed software capabilities, that procurement executives find essential for realizing the value from supplier management efforts (RQ2).

On general level, the results of this study indicate that companies' procurement and sourcing organizations have integrated more closely to the core business and developed towards increased strategic alignment with the general strategy of the firm, leading to increase in the strategic importance of supplier management. More active and diverse value add from the organization is one of the key drivers behind this change, as the traditional mentality of procurement being simply a cost reduction function has faded.

Likewise, the importance of managing strategic suppliers and having an overall control over the supply chain has increased. Behind this change is the specialization of companies, in other words focus on core competencies and strengths, which leads to outsourcing activities and more reliance on suppliers to deliver the non-core goods and services. Consequently, the companies are directly and indirectly impacted by their suppliers through supply chain disruptions and image implications in case of unprecedent events such as natural disasters or revelations unethical behavior in supplier operations. Thus, companies also need to

integrate their supply chain to anticipate and proactively influence their supply chain risk. At the same time, through relationship building and collaboration, the buying companies can benefit out of their suppliers in whole new ways

The first research question aimed to discover what kinds of added value can be driven through supplier management. Findings from the interviews with procurement executives and managers revealed that while supplier added value is highly context sensitive e.g., depend on industry and sourced good or service, there are clear areas of added value that are recognized across all the cases. This study identified three categories for added value: traditional performance related, sustainability and risk management, and value generated by close relationship with a supplier. Traditional values consist of aspects such as cost, on-time in full delivery performance, quality, and flexibility. Out of these, especially cost efficiency has been, and still is something that is included in considerations on what makes for a valuable supplier. Representing more recent trend in supplier added value recognition, is the capabilities to influence the sustainability and risk resilience of the companies through supplier base. The results of the study show that especially sustainability is something that companies are nowadays looking to impact through ensuring and demanding sustainable operations from their suppliers. Finally, the perks of closer relationship with suppliers were identified across the cases. The increased collaboration with key suppliers is believed to bring innovation to sourced goods and services, and through it, competitive edge to buying companies offering. It should be noted however, that e.g., innovation can in some cases still be mere means to an end for improved cost efficiency meaning that companies expect innovation from suppliers to ultimately lead to more competitive prices offered.

Three categories of supplier added value aspects summarized:

- Traditional, directly performance related
- Sustainability and risk management related
- Relationship and collaboration related

To facilitate and evaluate the development of value realization described, companies have employed data driven processes in their supplier lifecycle management. More specifically most available data is sought already when selecting to allocate business to a new supplier, onboarding them and further in continuous basis. By doing this, the companies are looking to make better decisions on which suppliers to focus on to generate additional value.

In practice, this means ensuring compliance with company's requirements, such as sustainability and ethicality, as well as actively monitoring their performance and risk potential. To do all this, comprehensive understanding of supplier related aspects is established by utilizing data from multiple sources. These sources can be divided into internal and external data. Internal data is generated within the company through experiences and transactions with suppliers. For instance, the goods receipt data from deliveries of supplier enables evaluating their delivery performance, and meeting notes the collaboration capabilities and willingness. Therefore, both quantitative and qualitative data needs to be accessible and analyzable efficiently. External data relates to all information direct or indirect information on suppliers that can be helpful in assessing their added value potential or risk position. Results indicate that companies are active in sourcing data externally, to help them in supplier management activities.

The second research question aimed to construct a profound understanding of what capabilities of a data driven software tools do the procurement professionals deem essential in employing the supplier related data to generate added value. The results suggest that while technology enabling the data to be used in supplier value management is essential for strategic procurement activities overall, there are challenges with both accessibility and usability of the data. Firstly, the accessibility challenge relates to information relevant to supplier management efforts being scattered across various tools. Data is located in systems such as ERPs, RFX tools, document databases, 3rd party data services, and spend analytics platforms and thereby while it exists, it is not available for decision making in convenient manner. Secondly, usability relates to data not being in analyzable format. For instance, qualitative assessments and employees' intangible knowledge are data that is not efficiently usable in organizations.

Based on the case findings key capabilities for SVM software are constructed (table 6). Firstly, to tackle accessibility and usability of supplier value management data, the capability to integrate and handle multiple types of data sources and structures is key for effective data driven supplier management. Moreover, the information needs to be usable in multiple different ways to get the most out of it. Secondly, SVM tool needs to accommodate efficient segmentation of vast supplier base to logical segments based on the data available. Research results indicate that companies are looking to increase the extent to which data is used to identify the key suppliers to work with. This capability boosts the efficient allocation of supplier management resources within procurement.

Thirdly, study results indicate that procurement executives are calling for increased capabilities in dynamically generating close to real time action triggers from the data analyzed. Therefore, an SVM software must highlight most important events and outliers for procurement professionals, as well as adjust the priorities and weights of data points in line with larger trends, such as supply shortages caused by Covid-19. Fourthly, to truly incorporate all relevant information to data driven supplier value management, also qualitative, unstructured data needs to be analyzable in SVM software. Consequently, data such as meeting and negotiation notes, employee know how, and news data needs to be stored and useful information from these sources extracted in automated way.

Fifth, the way data is used should not only be limited to internal monitoring but extend to mutual data sharing activities between the buyer and supplier to facilitate collaboration. Through this, buyer can not only increase the amount of supplier specific data, but also develop the supplier with fact-based arguments on e.g., their performance. Finally, and ultimately, an SVM tool should be designed to free procurement organizations limited time from operational activities to strategic focus. To do this, an SVM system needs to be well integrated within the tooling landscape and supplier management processes of a firm. As a result of this study, a framework for designing SVM system was developed (Figure 6). The framework demonstrates key concepts that a data driven SVM system should encompass to generate added supplier value.

Six software capabilities enabling strategic supplier value management summarized:

- Centralized hub for supplier relevant data
- Automatic data-based supplier segmentation
- Automatic event and abnormality-based triggers and alerts
- Utilization of also qualitative, unstructured data
- Information exchange and communication with suppliers
- Integration to network of other company software

5.2 Theoretical contributions

Existing literature was utilized to provide theoretical background for executing the study. While a part of the study focused on confirming previous findings on development of strategic importance of procurement function and prevalence of supplier management to execute on a set strategy, it was also designed to be exploratively generate insights on more

practical topics, such as SVM software capabilities where no theory exists due to novelty of the topic.

This study makes two theoretical contributions in the domain of supply chain management research. First contribution relates to the strategic importance of procurement led supplier management to companies' overall strategy. Existing research on procurement functions relevance for overall company strategy was studied to understand the underlying motivation behind strategic supplier management. The findings of this study support the suggestion by Rimkūnienė (2013) that procurement's strategic significance is nowadays generally evident both in academia and practice. Further, this study finds evidence to support the drivers for this development being rapidly changing business landscape, growing awareness of socio-environmental issues (Rimkūnienė, 2013), as well as companies focusing on their core competencies and becoming more reliant on suppliers to source the rest (Kannan & Choon Tan, 2002). Given the increased reliance on suppliers, existing literature has also speculated on more intangible values of managing supplier base. The findings on supplier value being perceived as a combination of various quantitative and qualitative aspects besides cost efficiency support the arguments of Florez-Lopez (2007) on supplier value being capturable beyond what is stated in contracts.

Secondly, a few previous studies have emphasized the role of supplier information integration and use of data analytics to enable effective and analytical supplier management (Handfield et al., 2019; Hong et al., 2018; Shou et al., 2018). The results of this study reveal that procurement organizations of large companies are already engaging in usage of data driven solutions to efficiently realize strategic value from supplier management and extends the understanding of how analytics are used to free up time for strategic supply chain management in practice. Moreover, there exists studies on utilization and usefulness of external data sources, such as risk indices in supply chain management that argue this kind of data being helpful in decision making (Bhattacharyya et al., 2010; Kauppi et al., 2016). This study confirms and extends the findings of these studies by revealing that external data is utilized in supplier management alongside with internal data. The use of external data extends to multiple domains, as the companies seek to make better decisions when looking to improve the predictability or sustainability of their supply chains.

5.3 Managerial implications

The findings of this study are relevant for two distinct audience groups: Procurement executives and managers of large companies with complex supply chains, as well as software companies operating in the domain of procurement and supply chain. Insights on how supplier value is perceived and utilized through data driven methods, is valuable for both managers looking to improve the way suppliers are managed, and for the companies seeking to help enabling this development.

First, companies are increasingly managing suppliers in a way that reflects the company overall strategy. While cost efficiency has been and still is a key priority for procurement organizations, large companies with large supplier base are already looking beyond cost reduction in their procurement and supplier management operations. These companies are not only focusing in managing suppliers for cost, but for value. Value derived from supplier management is to certain degree both context and objective dependent, but based on the findings of this study, there are clear signs of leveraging suppliers in controlling the performance, sustainability impact, and risk mitigation being high in priority for value extractable from supplier management activities. Therefore, companies should align their supply chain management strategy with company's overall strategy to identify topics that can be addressed through suppliers and are not systematically managed currently. Yet, traditional indicators such as cost efficiency should not be disregarded, rather kept as one of the metrics when considering the value of a supplier.

Secondly, to be able to capture and develop the value of suppliers beyond most simple aspects, companies should employ purpose built, data driven technology to help steer the resource availability from operational to strategic focus. By combining relevant supplier data in one central software from multiple sources, the information required to make decisions on suppliers will be readily accessible without need for gathering the data case by case. Further, companies should look beyond the data they are generating internally through supplier transactions, in-house assessments, and audits. Companies operating with large supplier bases are utilizing commercial and non-commercial data sources to improve the visibility into their supply chains where no information exists or is unfeasible to gather internally. Moreover, not only structured data should be managed, but also the expert opinions on more intangible aspects such as collaboration willingness of a supplier, and negotiation notes contain valuable information that should be incorporated to supplier value management process also from the systematic data management perspective.

Finally, relevant for both companies managing suppliers for value and companies developing software capabilities to enable this, is the call for utilizing centralized data on suppliers to direct scarce procurement employee focus where it is needed the most. This is achieved by employing automatic supplier segmentation to identify key suppliers from the mass of tens of thousands of suppliers in the supply base. Supplier segmentation is the process where companies can find significant efficiency benefits and software companies utilize the supplier data ecosystem to accelerate the process itself. Moreover, the insights on supplier base should go towards increasingly timely information being triggered based on outlier events without manual monitoring.

5.4 Limitations

When deriving conclusions from the presented implications of this study, the limitations of conducted research should be acknowledged. These limitations originate from research design, case selection and availability of the information on the included cases. While a reasonable number of cases, six, was included in the multiple case study to strengthen the external validity of the research, the relative low number of samples limits the generalizability of the findings. However, the scope of the studied phenomena necessitated a multiple case study approach with closer examination of each case. Therefore, the generalizability could be addressed through more resources in arranging a study on large number of sample cases.

Moreover, although the cases selected were from a wide range of industries, especially service companies with little direct material purchases were underrepresented which may have led to some indirect purchasing relevant perspectives to be uncovered. The findings of this study imply that industry and company specific context is significant in what comes to supplier value management process and how to implement it. Therefore, also the relatively high-level scope and objective of this study do have implications on the usability of managerial implications without reflecting them specifically on the situation and supplier base the company is operating with. Also, the objective of finding procurement executives' and managers' views on data driven SVM limits the data triangulation options and construct validity of the study. Although sources such as reports and news on case companies were studied, they provided little relevant data on the studied topic. Therefore, the findings are heavily based on one source of data, the interviews.

Finally, despite the attempts to eliminate bias in designing research protocol and interview questions, the pre-existing knowledge on practical procurement and supplier analytics may have played an unconscious role in guiding the interviewees during data collection.

However, this bias was mitigated by adjusting the research questionnaire throughout the data collection process. Also, the fact results were interpreted and analyzed by one person, does pose a risk of biased perception of the data.

5.5 Suggestions for further research

Given the limitations and scope of research conducted, there are various avenues for further examination that could be carried out based on findings presented in this study. The framework for building an SVM landscape for supplier value extraction is on high level due to limitations in getting profound and detailed description of the ecosystem in use with the case companies. This is partially due to privacy of the interviewee and their case companies, and the limited availability to conduct series of interviews required to get down to more detailed level. More research is necessary to refine the framework concept and to amend it with further components relevant for building a data driven SVM ecosystem.

One key objective was to identify and define supplier value and the ways data on supplier can be used to track and develop supplier value in procurement. What this study did not address, was the practical challenges of driving supplier value regarding contracts, SLAs, trustworthiness and coverage of data used and the buyer supplier power balance, which often influences the degree to which buying party can influence its supplier. Therefore, further research on the executability of data driven decisions on supplier value extraction per each supplier value aspect needs to be conducted to evaluate where companies should drive value through suppliers and where it is not feasible despite the theoretical opportunity.

When it comes to handling and utilization of unstructured data such as written audit reports, questionnaire answers and personnel expertise and knowledge, while calling for including intangible data in SVM process, this study did not propose technical solutions to enable usage of such data. Further exploration on modern technology to analyze unstructured data in supply chain and procurement context needs to be carried out in order to fully understand the required steps in integrating intangible data into decision making systematically.

The supplier base management related topics of this study were scoped to discuss 1st tier suppliers and not the n-tier supply chain. This scoping was selected acknowledging that n-tier supplier management is a complex topic warranting research on its own. Yet, during the data collection it became evident that n-tier supplier management should be part of the SVM topic as many of the values such as sustainability and risk management cannot be fully covered without having visibility and control to n-tier suppliers beyond 1st tier. Therefore, further discovery on solving especially the visibility challenges of n-tier supplier base should

be carried out to create basis for including extended definition of data driven supplier value management to the model proposed in this study. Measures to tackle n-tier influenceability, such as cascading effect of asking 1st tier suppliers to enforce same requirements on them to their suppliers, proposed by Villena (2019) could be further explored.

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Appendix A: Interview structure

General information

- Please briefly describe your department, position, and procurement background / years of experience.
- Please briefly describe your responsibilities as well as the main responsibilities of your department.

Procurement role

- What do you consider to be the main responsibility of procurement?
- Do you consider that procurement function's role has changed over the past 5-10 years? How?
    - Do you consider the largest emphasis being on cost savings in your organization for procurement efforts? If not, what is?
    - Is there a clear connection between procurement goals and the company's strategic goals?
- How does the procurement activities impact your company's competitiveness, especially from the supplier perspective?
- Do you consider that the importance of suppliers to procurement and organization performance has changed over the past 5-10 years? How?

Supplier value

- How would you describe supplier value?
    - Do you consider that supplier management can drive risk management/sustainability/diversity/other?
    - What attributes make for a valuable supplier?
- How are these valuable suppliers identified and grouped? Do you have supplier segmentation in place?
    - If so, please describe the process that goes into supplier segmentation? Is it based on data and/or expert opinions?
- Do you consider the possible added value from suppliers to be worth investing efforts in?
- Are sustainability efforts being driven through suppliers?
- Do you engage in partnerships/collaboration with your key suppliers? How?
    - What is the value that you get from such actions? What is the value you offer to supplier from these activities?
    - Is there some type of tool in use for communicating/sharing data with such suppliers?

Sourcing process

- Please describe your general approach to sourcing from supplier selection perspective. How do you start screening for suppliers?
- To what extent is this general approach applicable, is there strong variance across the goods or services that are being purchased?
- Please describe the evaluation process of suppliers. How frequently are suppliers being monitored on their performance?
    - What are the metrics that you employ for assessing suppliers' competitiveness?

    - To what degree is supplier evaluation reliant on intangible data, such as procurement professionals' opinions and relationships in your organization
        - If such data is essential, do you have a system in place to capture and manage it?

Supplier management

- With which metrics are suppliers being evaluated on?
- How are risks, such as potential image risk, supply chain disruption that originate from supplier managed?
- How do you manage the data that you use to evaluate suppliers? Is there a tool/spreadsheet existing for unified supplier management?
    - Do you feel there is challenges in gathering data for evaluating suppliers based on these metrics? What?
    - Do you collect and utilize external data, such as certain 3rd party indices?
    - Is there some data you would like to, but have been unable to acquire or utilize in relation to suppliers?

Supplier management technology

- Please describe the tooling/software landscape relevant for you supplier management efforts
    - What would you consider as the most significant challenges when it comes to getting required data for supplier management? How about utilizing the available data?
    - Do you consider technology and data driven decisions to be important pieces in managing suppliers for value? If not, what does supplier value management mostly rely on in your view?
- What would you like to see supplier management related technology enable in the future?
    - What would be essential for your organization's supplier management now and in the future?

Closing

- Is there something else you would like to point out on the topic of supplier value management and technology enabling in place for driving it in your organization? Do you feel like I missed something important that should be still noted?