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Analysing Supplier Capability: A case study for Risk management and supplier evaluation

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ABSTRACT:

Global supply chains are complex entities in which the capabilities of suppliers are a key factor in the company's competitiveness. This thesis examines how a case company can improve supplier selection by combining fragmented indicators into a more coherent entity that supports decision-making. The current practices of the case company are often based on fragmented information, which weakens the systematic, comparability and transparency of the assessment

The study was carried out as a multi-method case study that combined both qualitative and quantitative data. The material consisted of interviews with four procurement experts and a survey directed at them, as well as a survey conducted with four suppliers. In addition, the client company's Power BI data on the performance of suppliers was analysed.

The results showed that the key challenges in supplier selection are the fragmentation of the key performance indicators in use, the inconsistency of the evaluation criteria, and the variability of data utilization. Suppliers on the other hand, emphasised the importance of forecasting and the need to develop it. The thesis gives recommendations for harmonizing the performance indicators and building a more comprehensive set of indicators. The study also recommends clarifying Power BI reporting to make the supplier selection process more consistent, and data driven.

KEYWORDS: Supplier Capability, risk management, supply chain performance, supplier evaluation

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TIIVISTELMÄ:

Globaalit toimitusketjut ovat monimutkaisia kokonaisuuksia, joissa toimittajien kyvykkyys on keskeinen tekijä yrityksen kilpailukyvyn kannalta. Tässä tutkielmassa tarkastellaan, miten toimeksiantajayritys voi parantaa toimittajavalintaa yhdistämällä hajanaisia indikaattoreita yhtenäisemmiksi ja päätöksentekoa tukevaksi kokonaisuudeksi. Hankintaorganisaation nykyiset käytännöt perustuvat usein pirstaleiseen tietoon, mikä heikentää arvioinnin systemaattisuutta, vertailtavuutta ja läpinäkyvyyttä.

Tutkimus toteutettiin monimenetelmäisenä tapaustutkimuksena, jossa yhdistyi sekä laadulliset että määrälliset aineistot. Aineisto koostui neljän hankinnan asiantuntijan haastatteluista ja heille suunnatusta kyselystä sekä neljälle toimittajalle tehdystä kyselystä. Lisäksi analysoitiin toimeksiantajayrityksen Power BI -dataa toimittajien suoriutumisesta.

Tulokset osoittivat, että toimittajavalinnan keskeisiä haasteita ovat käytössä olevien keskeisten suorituskykymittareiden hajanaisuus, arviointikriteerien epäyhteneväisyys ja datan hyödyntämisen vaihtelevuus. Toimittajat taas korostivat ennustamisen tärkeyttä ja sen kehittämistarvetta. Tutkielmassa annetaan suosituksia suorituskykymittareiden harmonisoinnista sekä kattavamman mittariston rakentamisesta. Tutkimuksessa suositellaan myös selkeyttämään Power BI -raportointia, jotta toimittajavalinnan prosessista tulisi johdonmukaisempaa ja dataohjautuvampi.

KEYWORDS: Toimittajan kyvykkyys, riskienhallinta, toimitusketjun suorituskyky, toimittajaarviointi

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Abbreviations

BDA - Big Data Analytics

BI - Business Intelligence

ERP - Enterprise Resource Planning

ESG - Environmental, Social and Governance

KPI - Key Performance Indicator

MCDM - Multi-criteria Decision-Making

RBV - Resource-based view

SCM - Supply Chain Management

SCOR – Supply Chain Operations Reference

SDE - Supplier Development Engineer

SP - Strategic Purchaser

1 Introduction

Global supply chains are becoming increasingly complex networks, and their vulnerability to disruption increases as companies increase outsourcing, global sourcing, and product diversification (Christopher & Peck, 2004; Tang, 2006). In uncertain conditions, supplier management becomes a strategic priority because disruptions affecting a single supplier can extend to the entire supply chain and increase operational risks (Santos et al., 2025). According to Tang (2006) and Ivanov (2022) some of the disruptions are related to geopolitical uncertainties, market volatility, and technology related disruptions, which highlights the need for supply chain risk management practices that are able to strengthen resilience and support decision making.

Procurement is a process that enables organizations to procure goods and services during risk management. Figure 1 shows a series of stages in the procurement process. Procurement begins with identifying needs and analysing the supplier market. Next, requests for information or offers are sent, after which the process then moves on to comparing offers, negotiating terms and signing contracts. Based on the end result, orders are made, which means that supplier relationships are managed to ensure the performance of suppliers. The triangle in Figure 1 shows how the number of potential suppliers starts to decrease as the process progresses (Logistiikan Maailma, 2025).

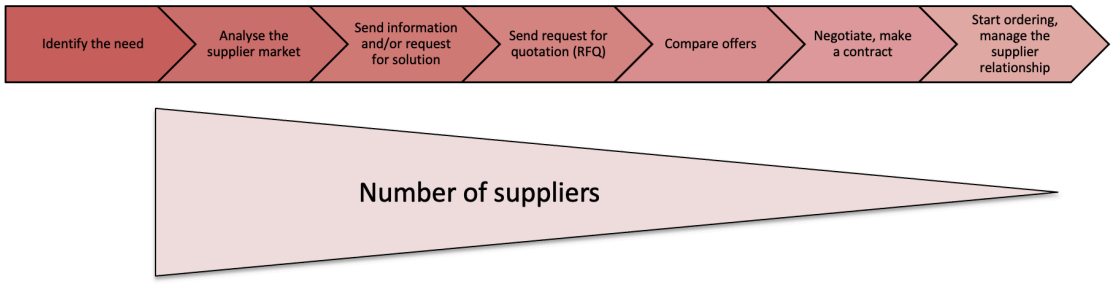


Figure 1. Procurement process and supplier limitation (adapted from Logistiikan maailma, 2025).

The aim of the thesis is to solve these challenges by studying how the assessment of suppliers' capabilities can be integrated into a data-driven framework. A data-driven framework could improve assessment, risk management and supplier selection. The first chapter of the thesis introduces the research topic and explains the gaps that the research aims to fill. The first chapter is divided into four parts. The purpose of the first part is to present the background and context of the research, after which the second part presents the objectives, research questions and limitations of the research. The third chapter presents the overall structure of the study, and the last section presents the case company.

1.1 Thesis background and theoretical framework

The global supply chain environment is constantly changing. The changes are due to market volatility, geopolitical disruption and technological developments. The challenges they pose make supplier management essential to ensure competitiveness and flexibility. Organizations need structured and data-driven approaches to supplier assessment and risk management to ensure business continuity and maintain long-term performance (ISO, 2018; Gholami et al., 2021; Onukwulu et al., 2025; Harju et al., 2023).

It is important for organizations to monitor supplier capability, as it is a key factor in solving these supply chain challenges, as it reflects the supplier's ability to meet quality and delivery requirements. Organizations' existing practices are often based on fragmented evaluation criteria, which is why they do not provide a comprehensive picture of suppliers' performance and the risks associated with it (Hossain et al., 2018; Tay et al., 2025; Khulud et al., 2023). Risk management standards such as ISO 31000 also emphasize the systematic identification and mitigation of risks, but their use remains limited in supplier selection and decision-making (Miguel et al., 2022; Dos Santos et al., 2025; Lajimi et al., 2025**).**

Decision-making in supplier management is even more complicated as requires balancing cost efficiency, flexibility, and sustainability. Even though digitalization and advanced

analytics tools offer opportunities for improving supplier evaluation, most companies still do not have integrated models that combine capability assessment, risk management, and strategic decision-making into a unified approach (Juan & Li, 2023; Fang et al., 2024; Kumar et al., 2025).

The thesis is based on three different theoretical principles. The first is the resource-based perspective (RBV), which is based on the importance of resources and capabilities in achieving a competitive advantage. The second theory is the theory of dynamic capabilities, which expands the RBV perspective. It emphasises adaptability and the reorganisation of resources in changing operating environments. The last theory is the ISO 31000 risk management framework. The framework creates criteria for identifying and assessing risks in supply chains. The theories form the basis for both assessing the capabilities of suppliers and taking risks into account in decision-making. The scientific framework of the study can be seen in Figure 2. The figure shows the relationship between supply chain performance, supplier capabilities and decision-making.

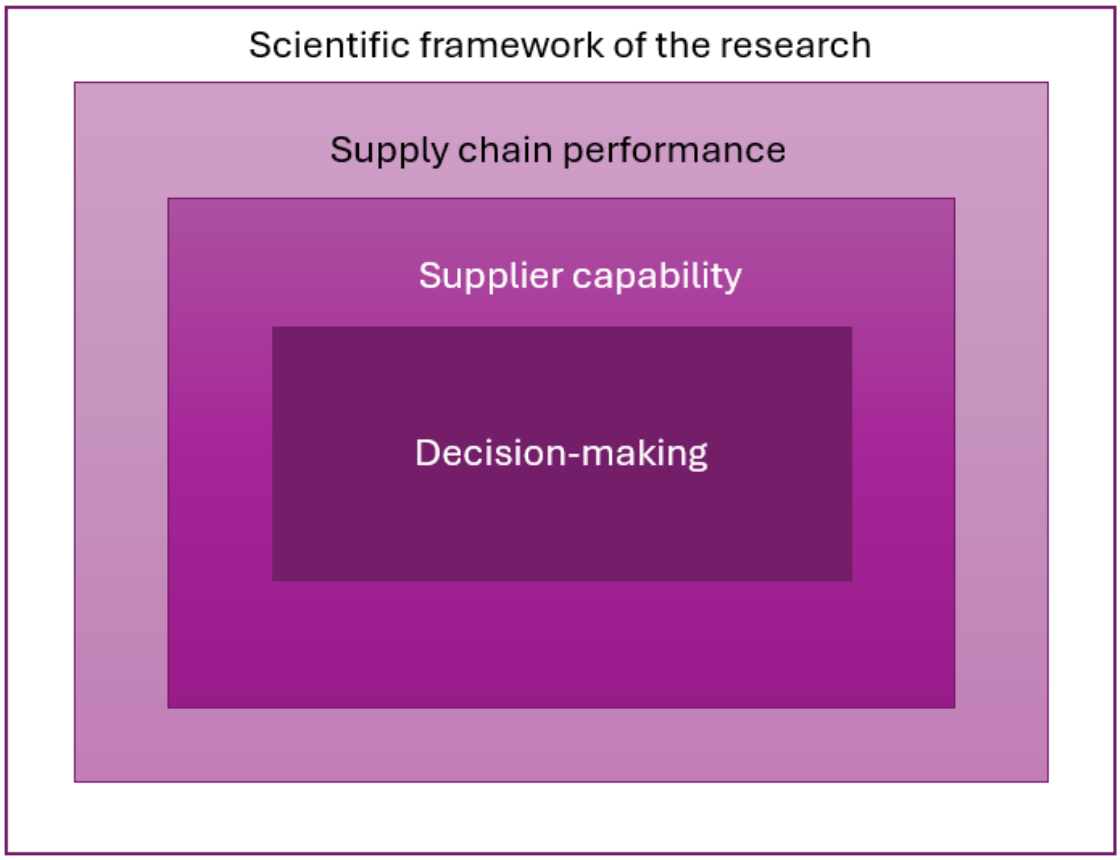


Figure 2. Theoretical framework of the research.

Despite the frameworks, research is often fragmented at the interface of supplier capability, risk management, decision-making, and supply chain performance. Supplier evaluation research has focused on selection criteria and multi-criteria decision-making methods, which often emphasize supplier scoring and resource allocation without linking capability assessment to risk management processes and measurable supply chain performance outcomes (Nguyen et al., 2024).

Supply chain risk management research, on the other hand, provides models and planning frameworks. Frameworks are provided for identifying, assessing, and mitigating risks at the supply chain level, but it does not typically create a supplier capability assessment as part of a unified supplier assessment model for strategic sourcing (Bandaly et al., 2012; Tang, 2006). A third stream focuses on supply chain performance measurement by proposing metrics and performance frameworks to assess efficiency and

effectiveness, while supplier capability inputs and risk-based decision logic are often treated as external to the performance measurement framework (Gunasekaran et al., 2004). Recent supplier-focused risk research further emphasizes the need for coherent conceptual guidance for supplier related risks, reinforcing the opportunity to integrate capability assessment, risk management, and decision support into one framework that is explicitly linked to performance goals (dos Santos et al., 2025).

This gap is visualized in Figure 3, where the overlap among the four dimensions highlights the need for a unified model for supplier evaluation and strategic sourcing.

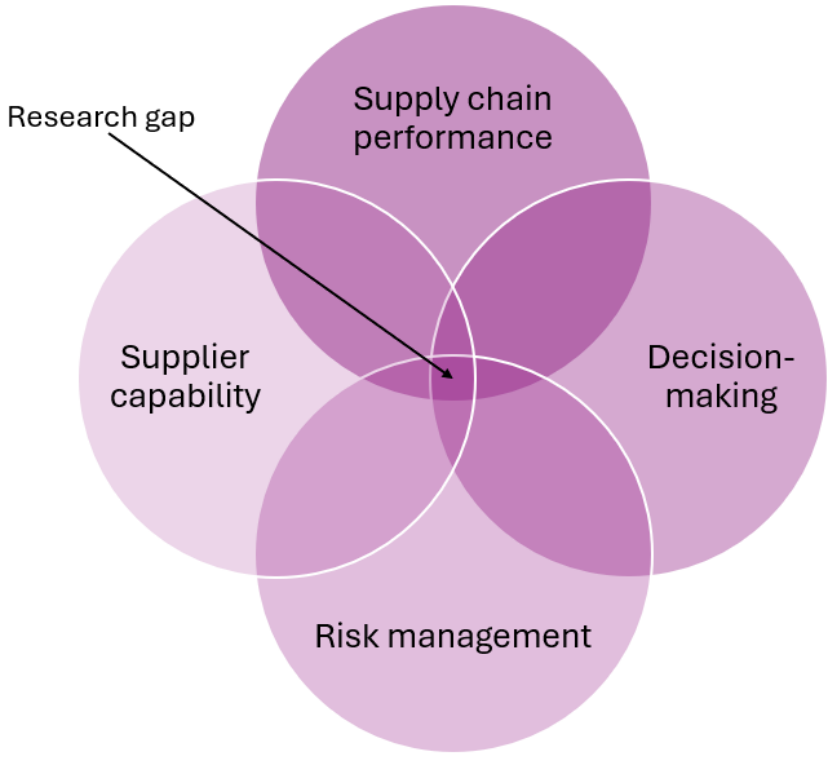


Figure 3. Venn diagram of the research gap.

1.2 Research questions, objectives and limitations

The main objective of this study is to develop a structured proposal for the case company on how to integrate multiple indicators related to supplier evaluation and selection. When indicators are combined into a unified framework, an organization can gain a

better understanding of its suppliers' capabilities. A unified framework could support supplier performance monitoring, help identify development needs and reduce supply chain risks. The purpose of the study is to provide a recommendation for the case company which addresses how an integrated framework can be used in supplier selection and comparison. In addition, the study contributes to existing literature, by combining the viewpoints of supplier capability assessment and risk management, which are supported by data-driven decision-making.

The purpose of the study is to develop a systematic approach for assessing the capabilities of suppliers. Its purpose is to improve supplier evaluation, risk management and comparison. The aim of the study is also to identify the key factors affecting the capabilities of suppliers and to analyse how these factors affect the performance of suppliers. At the end of the study, suggestions are also offered on how the supplier evaluation methods currently used by the case company could be integrated into the unified evaluation framework. The study also aims to support the company's supplier management strategy by introducing a data-driven approach.

The study aims to answer the following questions:

1. How can supplier capabilities be assessed to effectively manage risks in the supply chain?
2. What are the key factors influencing supplier capability, and how do they impact supply chain performance?
3. How can supplier capability data be used to improve decision-making in supplier selection and management?

The purpose of the study is to bring practical observations to one case company, which is why the study has limitations. The first limitation is that the empirical analysis of the study focuses on only four suppliers. The cropped sample allows for a more detailed examination of each case, it only provides a partial picture of the supplier base. If more

suppliers were involved in the study, it would enable more generalizable conclusions and a stronger analytical basis.

Another limitation of the study is that the research is carried out for a case company, which means that the selected suppliers reflect the needs and emphases of the organization in question. Companies with different delivery structures or goals could produce different outcomes. The third limitation of the study is related to the availability and accuracy of information. There may be variation in the information available about suppliers, as information may not always be available. Interviews are carried out in order to supplement the available data and strengthen the research results.

1.3 Thesis structure

The structure of the thesis consists of five different main chapters. The main chapters have been arranged logically, starting with the background of the study, and the last chapter presents the conclusions of the study. Figure 4 shows the whole structure of the study, and also the key components of the chapters.

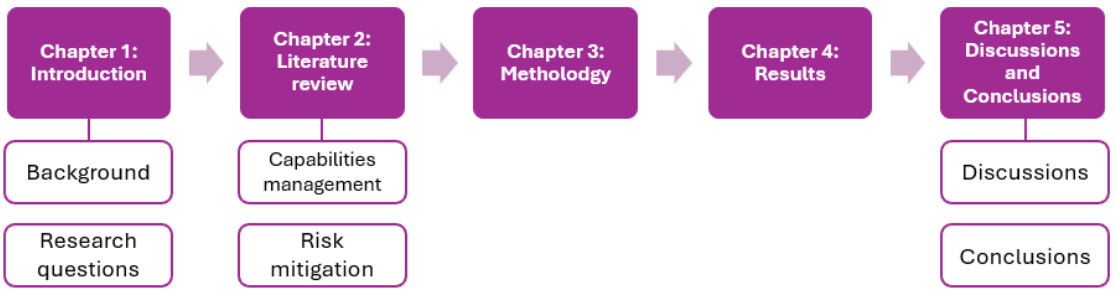


Figure 4. Thesis structure.

The first chapter of the thesis introduces the topic, the research problem, and defines the research questions. The next chapter discusses the research-supporting literature that focuses on supplier capabilities, risk management, and supply chain performance. The third chapter presents the research method, such as the research approach and data collection methods. The penultimate chapter discusses the empirical results and

analyses of the study. The last chapter presents discussions and conclusions. In the last chapter are discusses of theoretical and practical implications and it gives suggestions for future research.

1.4 Case company

The study examines the case company’s current supplier selection and evaluation. The case company is an international technology company. The case company has operations around the world, and its procurement organization manages a diverse network of suppliers selected according to predefined criteria. The case company has both European and non-European suppliers.

Case company's procurement organization currently monitors supplier performance by utilizing individual indicators. The indicators work independently and provide only a partial picture of performance in their respective regions. An integrated approach would improve the case company's supplier capability assessment by combining key performance indicators related to supplier selection. Developing a holistic view would support the company's ability to evaluate, compare and select suppliers based on consistent, data-driven criteria.

2 Literature review

Supplier management has started to evolve beyond operational issues to include strategic dimensions, such as risk and resilience (Tang & Nurmaya Musa, 2011; Ho et al., 2015). The researchers emphasize structural approaches to mitigate and classify risks, which include supply, demand, and operational disruptions.

The studies highlight that sustainability and resilience have also been integrated into the evaluation and selection of suppliers. By combining traditional metrics such as cost and quality with ESG considerations and technological readiness, organizations strengthen supply chain robustness (Onukwulu et al., 2025; Messaoudi et al., 2025; Machado et al., 2025). As a result, the importance of data-driven methods has been emphasized in improving decisions related to suppliers. According to Dubey et al. (2021) analytics capabilities and organizational flexibility increase resilience. On the other hand, Kusumawati (2025) explores the role of big data in enabling real-time decision-making and proactive insights.

The literature review aims to create a theoretical basis for assessing the capabilities of suppliers and to support informed decision-making in accordance with the research questions. The review discusses the principles and criteria related to the evaluation and selection of suppliers. At the same time, they are combined alongside resilience, sustainability, costs and quality. The review examines the ability of suppliers and its role in mitigating supply chain risks. The review highlights frameworks that take into account both ESG factors and technological readiness. At the end of the literature review, the contribution of data-driven methods to supplier-related decision-making is examined, with a focus on analytics and BI tools to support proactive insights and agile management.

2.1 Capability management

Capability refers to an organization's ability to utilize, integrate, and coordinate its resources, such as people, technology, and processes, to enable the organization to achieve desired outcomes and maintain a competitive advantage (Amit & Schoemaker, 1993; Teece, Pisano & Shuen, 1997). Capabilities and resources differ from each other, as resources describe what a company has. Ability, on the other hand, describes what a company can do with these resources. The difference between capability and resources creates a theoretical base for capability management.

When looking at capability management, it can be seen that it includes the systematic identification, development and renewal of an organisation's capabilities. They can be used to ensure alignment with both strategic goals and changing environmental conditions. Capability management is also associated with various theories, such as resource-based vision (RBV) and dynamic capability theory. From the perspective of RBV and the theory of dynamic capabilities, a sustainable competitive advantage arises not only from the possession of unique resources, but also from the ability to modify and adapt resources over time (Helfat & Peteraf, 2003; Eisenhardt & Martin, 2000). Based on this, it can be seen that capability management is a continuous and evolving process, not a static assessment of existing strengths.

Studies emphasizes that the management of supply chain capabilities is increasingly affected by digitalization and data-driven practices. According to a study by Ning and Yao (2023), digital transformation improves supply chain characteristics that are key to competitiveness, such as visibility and responsiveness. Based on their research, it can be seen that the current capability development is tied to the company's ability to utilize data analytics, digital platforms, and collaboration technologies in supply chain operations.

Digital and dynamic capabilities such as agility, collaboration and proactive sensing also have an important role in supply chain performance. According to Kareem and Kummitha (2020), dynamic supply chain capabilities help improve operational performance

in manufacturing environments by strengthening the company's ability to respond to disruptions and variability. The researchers' observation supports the link between capability development, resilience and performance outcomes.

Capability management can also be examined from the perspective of the supply network. From a supply network perspective, capability management extends beyond the focused company to include strategic stakeholders, including suppliers. According to Chin et al. (2025) the technological, operational and relational capabilities of suppliers affect the acquiring company's ability to achieve quality, delivery, innovation and sustainability objectives. Supplier capability management is becoming a strategic priority rather than a purely operational task, as supply chains become increasingly interconnected and data driven.

2.1.1 Supply chain management

Supply chain management (SCM) refers to cross-functional integration and management of key processes within an organizational network, with the goal of coordinating and optimizing material, information, and financial flows between internal functions and external partners (Enz & Lambert, 2023; Ashraf & Yalcin, 2024). A key part of SCM is the planning and continuous development of the supply chain structure. The purpose of SCM is to emphasize time, reliability and transparency, as its key factors are cooperation between chain partners and value creation for customers (Ritvanen et al., 2011, p. 23; World of Logistics, 2025).

When evaluating successful supply chain management, it is taken into account how well it achieves its goals in terms of delivery capability, efficiency and customer value (Ritvanen et al., 2011, p. 23). Figure 5 shows the key success factors of supply chain management. These key success factors include continuous improvement, focus on core functions, problem-solving, performance measurement, transparency and knowledge sharing. These factors can be used to promote the competitiveness and continuous improvement of the supply chain.

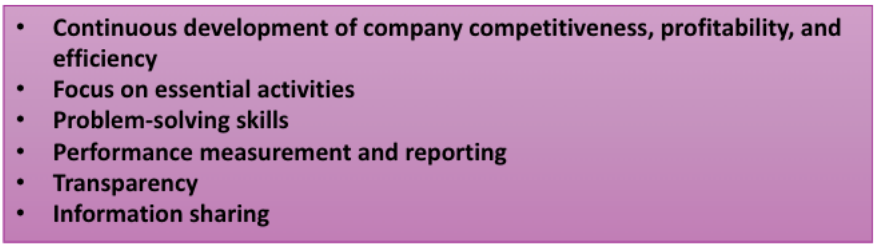


Figure 5. Key success factors in supply chain management (adapted from Ritvanen et al., 2011, p.23).

According to Habib (2011, pp. 1–14), SCM can be seen as a holistic management principle that aims to connect both internal processes and external networks through common goals and information exchange. This helps companies to improve the use of resources and strengthen the collaborative relationship. SCM also enables increased flexibility and competitiveness throughout the supply chain.

2.1.2 Supplier capability

Supplier capability refers to the set of resources, competencies and processes that enable the supplier to meet the purchaser's requirements. A supplier's capabilities cover both visible and subtle factors. These factors include production capacity, technological know-how, flexibility, quality performance and risk management practices. Based on Bag's (2025) study, it can be interpreted that supplier capability should be understood as the supplier's ability to utilize technology, information systems, and organizational routines to create value and ensure performance in the supply chain.

When assessing a company's ability to ensure risk management and the sustainability of the supply chain, the supplier's capability is a key factor. As the global environment becomes increasingly unstable, supplier capability is no longer seen as a mere operational feature, but as a strategic resource that has an impact on supply chain continuity and competitiveness (Ho, Zheng, Yildiz & Talluri, 2015; Tang & Nurmaya Musa, 2011).

When examining the capabilities of suppliers, it can be noted that they have been studied with the help of theoretical frameworks as the RBV and the dynamic capabilities theory. According to Kähkönen et al. (2012) in RBV, a supplier's intangible and intangible resources, such as technology, expertise, financial stability, and quality of relationships, together form the basis of a competitive advantage if they are valued and irreplaceable. The theory of dynamic abilities, on the other hand, emphasizes the ability of the supplier to adapt and renew these resources according to changing conditions (Wieland, 2021).

In their study, Han et al. (2024) emphasise that risk management capability is an essential dimension of a supplier's capability. Their research highlights suppliers' resilience, adaptability, and resilience to disruptions as key elements of the role of supply chain sustainability. A capable supplier is able to be efficient under normal conditions, but also maintain performance during times of uncertainty, which reduces the risks of the buyer's operations.

Although previous studies have examined numerous frameworks related to the evaluation and selection of suppliers, there are still challenges in combining fragmented indicators into a coherent and more data-driven framework (Patrucco, Frattini & Di Benedetto, 2022; Ho, Zheng, Yildiz and Talluri, 2015). Based on this, it can be seen that the supplier's capability is a multidimensional concept. The supplier's capabilities are able to extend beyond operational efficiency and include aspects such as sustainability, digital integration, strategic collaboration.

2.1.3 Supplier evaluation

Supplier assessment should play a key role in supply chain management, as it has a direct impact on risk reduction, cost-effectiveness and strategic alignment in buyer-supplier relationships (de Boer et al., 2001; Ho et al., 2010). Supplier evaluation is a broadly ongoing process that supports supplier qualification, performance monitoring, and development over time (de Boer et al., 2001; Ho et al., 2010). By conducting assessments in an orderly manner, companies can identify strengths and weaknesses, anticipate supply risks, and

ensure that suppliers' capabilities remain aligned with operational and long-term goals (de Boer et al., 2001; Ho et al., 2010).

Based on the study, it can be seen that of the traditional assessment methods, scoring cards, scoring systems and simple linear weighting, are common due to their practicality and transparency (Dickson, 1966; Weber et al., 1991). However, the suppliers' evaluation literature points out that traditional approaches may be subjective and may have difficulty describing the interdependencies of criteria as decision contexts become more complex (Ho et al., 2010; de Boer et al., 2001). To overcome the limitations of traditional assessment methods, advanced techniques built on multi-criteria decision-making (MCDM) have emerged, especially in environments where criteria are numerous, partly qualitative or conflicting (Ho et al., 2010; de Boer et al., 2001).

MCDM methods, such as fuzzy based methods, can be used to address the inaccuracy and uncertainty of expert assessments and incomplete information. Fuzzy logic represents evaluations using degrees of membership rather than binary true false values, which supports the use of linguistic assessments and partially defined criteria common in supplier evaluation (Ho et al., 2010; Tronnebati et al., 2024). In practice, fuzzy AHP is often used to derive criteria weights from expert input under uncertainty, while fuzzy TOPSIS is used to rank suppliers based on their distance from ideal and non-ideal solutions in a fuzzy environment (Ho et al., 2010; Althaqafi, 2023). Recent sustainable supplier selection studies illustrate how fuzzy hybrid approaches can combine conventional criteria with environmental and social criteria, producing rankings that remain consistent across methods and decision maker inputs (Tronnebati et al., 2024; Althaqafi, 2023).

From a risk management perspective, supplier evaluation models have evolved toward more integrated frameworks that combine objective and subjective inputs, and that connect supplier capability and risk indicators to operational performance measurement (Ho et al., 2010; de Boer et al., 2001). One way to support such integration is to anchor evaluation in reference models that standardize supply chain processes and metrics. The

SCOR (Supply Chain Operations Reference) model is widely used as a benchmarking and performance framework because it provides standardized process definitions and performance metrics that can be applied across supply chain functions (Nicoletti, 2023; Panudju et al., 2023). Studies combining SCOR based metrics with fuzzy MCDM techniques show how standardized performance structures can be paired with uncertainty handling methods to evaluate performance and support decision making under ambiguity (Panudju et al., 2023; Ho et al., 2010).

Table 1 summarizes commonly reported supplier evaluation criteria into three categories. The first two categories, attributes and performance, reflect a long-established distinction in supplier selection research. Early empirical and review studies repeatedly highlight quality, delivery, and price or cost as core criteria, often supplemented by capability and resource related attributes such as technical capability and financial position (Dickson, 1966; Weber et al., 1991). Based on other research, it can also be confirmed that suppliers' evaluation decisions are typically multi-criteria and increasingly combine quantitative and qualitative measures between these categories (Ho et al., 2010; de Boer et al., 2001).

Table 1. Supplier evaluation criteria, categories and example criterias (Adapted from Cheshmberah, 2020; Gegovska et al., 2020; Çalık, 2021; and supported by Dickson, 1966; Weber et al., 1991; de Boer et al., 2001; Ho et al., 2010; Althaqafi, 2023; Tronnebati et al., 2024).

Category	**Example Criteria**
Attributes	Technological capability, Quality systems, Financial stability, Environmental responsibility, Geographical location, Security
Performance	Cost performance, Delivery reliability, Flexibility, Innovation, Quality performance
Sustainability	Economic:Price, cost efficiency Environmental: Green packaging, ISO 14001 certification, waste reduction Social: Occupational health & safety, stakeholder rights

In the third category, it can be seen how sustainability reflects the increasing integration of environmental and social considerations in supplier evaluation. Sustainable supplier selection surveys can identify environmental criteria, such as ISO 14001 certification and green packaging, but also social criteria, alongside traditional criteria such as quality, delivery and costs (Tronnebati et al., 2024; Althaqafi, 2023). Based on the research results, sustainability criteria are increasingly being treated as a multidimensional entity that covers economic, environmental and social dimensions, rather than as an optional add-on (Lenarčič, 2024; Althaqafi, 2023).

The literature supports the use of the above-mentioned criteria. They combine the supplier's characteristics with perceived performance, while aiming to include sustainability criteria in both categories. The approach can improve comparability between suppliers, strengthen the transparency of trade-offs, and enable more defensible decisions when organizations are operating under uncertainty and supply risk exposure (Ho et al., 2010; de Boer et al., 2001).

2.1.4 Risk mitigation

One important aspect of supplier assessment is risk management. In supplier assessment, this means systematically identifying, assessing and mitigating uncertainties. Uncertainties can affect suppliers' performance and delivery continuity. According to Manuj et al. (2008), risk management is an essential part of procurement and deliveries and thus also part of supplier evaluation. Risk management enables organizations to anticipate disruptions, improve decision-making, and ensure supply chain resilience (Manuj & Mentzer, 2008).
In line with the International Organisation for Standardisation (ISO, 2018) risk management guidelines, supplier risk management should be integrated into governance and decision-making routines rather than being handled through separate, ad hoc activities (ISO, 2018). The structural nature of the approach also supports resilience, as it enables earlier detection of risk signals and more consistent prioritisation of mitigating measures (Ponomarov & Holcomb, 2009).

In practice, supplier risk management is divided into a four-step cycle, the first of which is the identification of risks. After that, risk analysis, risk management, and risk monitoring and assessment are repeated in the cycle. The four-step cycle of risk management reflects the core logic of structural risk management, in which the identified risks are assessed, dealt with with selected measures and continuously monitored as circumstances change (Kuusela & Ollikainen, 2005; ISO, 2018). The process orientation is also emphasized in applied logistics guidance, which treats risk management as ongoing work that aims to reduce both the probability and impact of adverse events while maintaining business continuity (Logistiikan maailma, 2024).

Risk identification focuses on detecting events or circumstances that may impair supplier performance or continuity of supply, such as supply unreliability, quality issues, capacity constraints, or external disruptions (ISO, 2018; Manuj & Mentzer, 2008). The likelihood and consequences of the identified risks are assessed using a risk analysis that supports

prioritisation and allocation of resources to the most critical exposures (ISO, 2018; Bandaly et al., 2012). Risk management seeks to translate prioritised risks into actions such as avoiding, reducing, allocating or transferring risk or maintaining risk based on risk criteria and resilience, while clarifying responsibilities and monitoring practices (ISO, 2018; Bandaly et al., 2012). Finally, risk monitoring and evaluation assess whether the solutions made remain effective over time and whether assessments and responses need to be updated in response to new risks (ISO, 2018; Hamir & Md. Sum, 2021).

When the cycle is iterative, the feedback from monitoring and evaluation will guide subsequent identification and analysis. Based on this, the feedback also supports a proactive and adaptive approach to supplier risk mitigation. Ilmonen, Kallio, Koskinen and Rajamäki (2010) emphasise that systematic risk management consists of practical actions that help value and support strategic objectives, as only identified risks can be actively managed (Ilmonen et al., 2010, pp. 30–34).

Figure 6 illustrates the four-step risk management cycle and the measures that are essentially related to it. Figure 6 aims to highlight how identification and analysis lead to treatment choices, while risk monitoring and assessment provide continuous feedback, confirming that supplier risk mitigation requires continuous communication, learning, and refinement (ISO, 2018; World of Logistics, 2024).

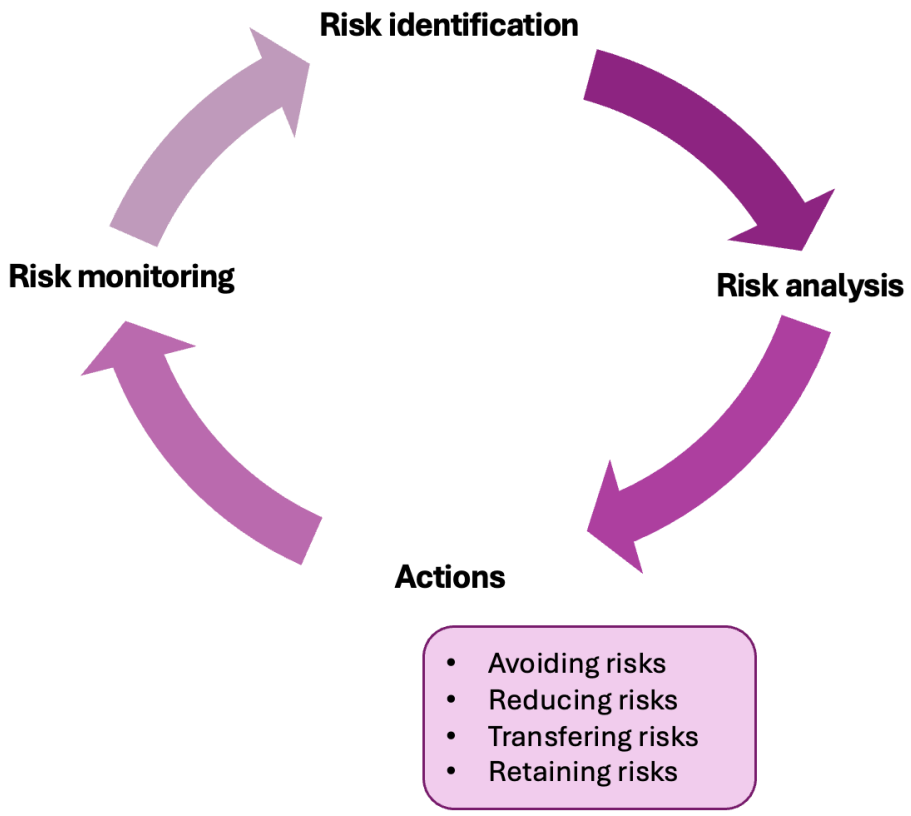


Figure 6. The four steps of the risk management process and actions (adapted from ISO 31000:2018 and Logistiikan maailma, 2024).

Supplier risks can also trigger capability development and innovation as they are not seen only external threats. Lintukangas et al. (2016) show that managing supply-related risks, particularly those linked to quality and reputation, can accelerate the adoption of sustainable and green supply management practices, positioning risk management as a strategic enabler rather than only a defensive mechanism.

The need for integrated risk management methodologies is growing as global supply chains become more complex and interdependent. According to Tang et al. (2011), operational, environmental and geopolitical risks are major challenges, highlighting the importance of combining supplier assessment with collaboration and knowledge sharing to strengthen stability. Sharma et al. (2023) emphasize that, expanding logic, recent resilience-focused frameworks propose systematic measures to assess and improve

resilience through the identification of sources of disruption, mapping of risk progression, resilience factor definition, metric development, and assessment mechanisms. According to Taghizadeh et al. (2024), dynamic approaches further argue that simulation-based assessment and optimization can support proactive mitigation strategies and improve deep-level visibility directly outside suppliers. They can also reduce disruption effects through earlier detection and targeted responses (Taghizadeh et al., 2024).

Disruptive supply chain management aims to shift the focus from static risk avoidance towards more adaptive and collaborative resilience. According to Wieland (2021), the view emphasizes organizational flexibility and continuous adaptation as key to volatility management, combining risk management with broader capability development, and long-term resilience.

2.2 Supply chain performance in the technology industry

In the technology industry, supply chain performance is affected by many things. Performance is shaped by short product life cycles, high innovation intensity, multi-level global supplier networks, and dependencies on critical components, which increase variability and risk at different levels (Aguilar-Hernandez et al., 2023; Xiong et al., 2025). Performance requirements consist of structural features that differ from more stable sectors and require performers to coordinate complex ecosystems (Ivanov et al., 2023; Ivanov, 2021). At the same time, they aim to balance responsiveness, costs, and continuity during design changes and fluctuations in demand (Ivanov et al., 2023; Ivanov, 2021).

Exposure to systemic shocks such as semiconductor shortages, geopolitical tensions, and logistics bottlenecks has shifted performance evaluation beyond traditional efficiency indicators toward resilience and viability, meaning the ability to sustain acceptable performance during prolonged crises (Ivanov, 2021; Katsaliaki et al., 2022). Ivanov (2021) has noticed four adaptation strategies which are intertwining, scalability, substitution and repurposing. It shows how they preserve supply chain viability under pandemic-like

disruptions, reframing performance as an outcome of adaptive design choices rather than steady-state productivity alone (Ivanov 2021). In technology-intensive chains such as semiconductors and electronics, small perturbations propagate as ripple effects, so resilience metrics must capture propagation, recovery time, and structural flexibility, not just cost or fill rates (Kravchenko et al., 2024; Xiong et al., 2025).

Digitalization is a primary lever for improving performance in high-tech supply chains because it enhances end-to-end visibility, collaborative planning, and fast, data-driven reconfiguration (Ning & Yao, 2023). The digital transformation has strengthen supply chain capabilities, but also competitive performance through better information processing and integration, while big-data and machine-learning forecasting reduce demand-supply mismatches and bullwhip effects (Seyedan & Mafakheri, 2020; Talwar et al., 2021). In the semiconductor channel specifically, AI-enabled risk inference and demand clustering improve planning accuracy and resilience at distributor OEM interfaces, which is key to mitigating long lead times and product migration (Fu et al., 2023). Collectively, these findings suggest that performance in technology supply networks is increasingly determined by analytics readiness as much as by physical capacity (Talwar et al., 2021).

Sustainability has become an integrated performance dimension rather than a parallel goal, particularly in electronics and semiconductor chains facing carbon pressure, e-waste growth, and critical material constraints (Bressanelli et al., 2021; Pollard et al., 2021). Circular-economy capabilities such as design for longevity, repairability, reuse, and recycling, together with reverse logistics, improve both environmental outcomes and long-term competitiveness by reducing input volatility and dependency on virgin critical materials (Bressanelli et al., 2021; Geng et al., 2023). Given geopolitical and environmental volatility around rare earth elements, strategies that combine supplier diversification with circularity through recycling and recovery are central to sustaining performance in high-tech value chains (Aguilar-Hernandez et al., 2023; Geng et al., 2023). Case evidence from industrial electronics indicates that managing internal, supply-chain,

and external complexity together enables companies to translate sustainability initiatives into resilience and innovation advantages (Cicerelli & Ravetti, 2024).

Bringing these strands together, the current performance frontier in the technology industry combines agility, meaning fast reconfiguration and time-to-response, resilience and viability, meaning the ability to withstand and adapt under systemic shocks, digital capability, meaning visibility, analytics, and decision-making, and sustainability and circularity, meaning reduced footprint and material exposure (Ivanov et al., 2023; Aguilar-Hernandez et al., 2023). Semiconductor-focused studies further underline the need for network-aware metrics such as disruption propagation, time-to-recover, and multi-sourcing optionality, as well as the codification of mitigation portfolios whose cost-effectiveness can be evaluated in advance (Xiong et al., 2025; Kravchenko et al., 2024). In practice, technology companies that institutionalize these capabilities, supported by governance, data infrastructure, and multi-tier collaboration, achieve more stable service and lower volatility despite frequent component and logistics shocks (Ning & Yao, 2023; Talwar et al., 2021).

2.2.1 Supply chain performance

Supply chain performance describes the ability of a supply chain to transform inputs into outputs that meet customer requirements while optimizing resources, minimizing costs, and ensuring quality and responsiveness. It is a multidimensional concept encompassing both process performance, which focuses on operational efficiency and coordination, and outcome performance, which reflects strategic and customer-oriented goals (Lehyani, Zouari, Ghorbel, & Tollenaere, 2021).

Evaluating performance requires a holistic approach that integrates operational, tactical, and strategic dimensions. Estampe (2014) emphasizes that assessment should include financial and other indicators as quality, innovation, and collaboration. Supply Chain Operations Reference (SCOR) model and the Balanced Scorecard are frameworks which are

link operational metrics to strategic objectives, providing a comprehensive view of effectiveness.

Recent research highlights resilience as a critical dimension of performance. Singh, Soni, and Badhotiya (2019) identify indicators such as agility, flexibility, redundancy, visibility, and IT capability that enable supply chains to anticipate disruptions and recover quickly. Similarly, Kochan and Nowicki (2018) argue that resilience capabilities such as adaptability, velocity, and redundancy complement traditional efficiency metrics, ensuring continuity during crises. From a risk management perspective, supplier capability acts as both a preventive and resilience enhancing mechanism. Ho, Shekarian, and Nekooie (2015) and Rezaei, Aghsami, and Rabbani (2021) show that supplier selection and evaluation are fundamental strategies for mitigating operational and disruption risks.

Digitalization further transforms performance evaluation by enabling real time visibility and predictive risk management. Fan and Stevenson (2018) note that integrating live data streams from logistics, procurement, and production systems allows organizations to assess risks holistically. Advanced analytics and machine learning enhance these capabilities by detecting anomalies and proposing corrective actions before failures occur (Ivanov, Dolgui, & Sokolov, 2019; Aljohani, 2023). Emerging technologies such as IoT sensors, digital twins, and blockchain strengthen adaptability and responsiveness, creating dynamic supply chains that adjust operations in real time (Portelinha, Carrara, Zanon, Esposto, & Anholon, 2025; Ivanov, 2024; Owusu-Berko, 2025). Big data analytics also improves agility and forecasting, supporting proactive decision-making (Dubey, Gunasekaran, & Childe, 2019). Furthermore, artificial intelligence enables predictive risk control and resilience-building strategies (Riad, Naimi, & Okar, 2024).

Finally, interpersonal relationships and dependence asymmetry influence supplier-initiated risk management behaviours, reinforcing supply-side resilience (Fan, Stevenson, & Li, 2020). Collectively, these developments demonstrate that supply chain performance

is no longer limited to efficiency metrics but increasingly depends on resilience and digital capabilities to sustain competitiveness under uncertainty.

2.2.2 Key factors in supplier evaluation and performance monitoring

Supplier evaluation involves two complementary dimensions: performance assessment, which reflects short-term operational results, and capability assessment, which captures longer-term potential and adaptability. Sarkar and Mohapatra (2006) emphasize that suppliers may show strong operational performance while still being vulnerable under volatile conditions. This distinction supports combining performance-based indicators with capability-oriented factors so that evaluation captures both efficiency and the capacity to cope with change.

Many commonly cited key factors, such as supplier reliability, financial stability, and collaboration quality, can be interpreted as resource-based determinants of performance. RBV suggests that differences in resource endowments and competences contribute to performance differentials (Barney, 1991), while the relational view emphasizes that inter-firm governance and knowledge-sharing routines can generate value beyond firm boundaries (Dyer & Singh, 1998). This provides a theoretical rationale for including both capability-related and relationship-related factors in performance explanations (Barney, 1991; Dyer & Singh, 1998).

Key Performance Indicators (KPIs) are widely used to monitor supplier performance in a consistent and comparable manner. Parmenter (2019, p. 45) notes that KPIs focus on areas critical to organizational success, while Nørreklit et al. (2023) describe them as tools for aligning operational activities with strategic objectives. Systematic KPI assessment also supports comparability across suppliers and time, enabling more transparent performance monitoring (Hester et al., 2017).

In project-based organizations, KPIs are commonly identified and applied through lean principles to enhance efficiency and goal alignment (Cruz Villazón et al., 2020). For

example, defect rate, defined as the proportion of products failing to meet quality standards, signals process reliability and operational risk. Beyond traditional metrics, sustainability-oriented KPIs have gained prominence. Bai and Sarkis (2014, p. 280) propose integrating environmental, economic, and social dimensions into KPI frameworks, linking performance measurement with corporate sustainability.

Technological advancements can further enhance performance monitoring by incorporating more timely data into KPI tracking and enabling more adaptive management. For instance, Kiron et al. (2024) show how AI-driven systems can integrate real-time data and sustainability metrics into KPI models to support more responsive monitoring.
While quantitative KPIs primarily reflect realized performance, qualitative factors such as leadership, responsiveness, and communication can offer predictive value by indicating agility and problem-solving capacity. Jääskeläinen et al. (2021) argue that collaborative relationship management and transparent performance information sharing strengthen capability monitoring and support risk mitigation.

Figure 7 presents the SMART principles, specific, measurable, attainable, relevant, and time-bound, which guide KPI design. Applying SMART helps translate strategic objectives into operationally meaningful indicators, thereby strengthening monitoring and supporting strategic decision making (Salesbook, 2025, p. 12; Parmenter, 2019, p. 46).

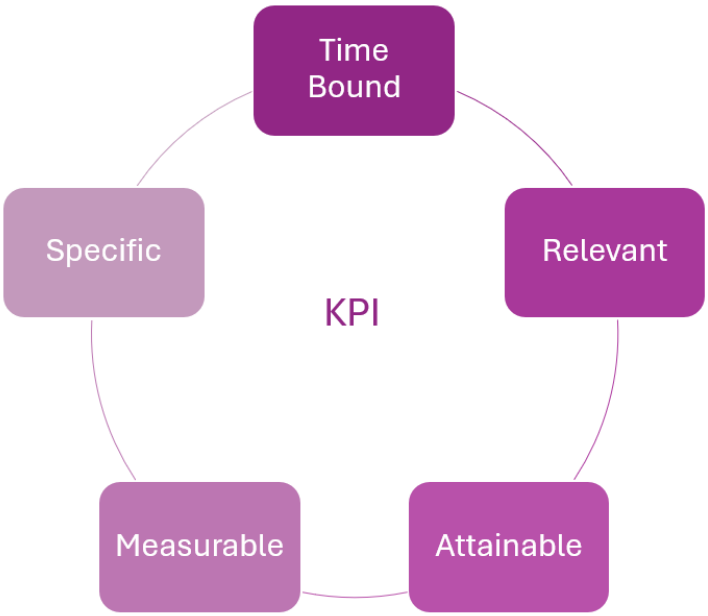


Figure 7. KPI definition based on SMART principles (Salesbook, 2025, p.12; Parmenter 2019, p.46).

2.2.3 Impact of the key factors

Researchers have emphasized the need for integrated perspectives that link supplier capability, performance measurement, and risk management in explaining performance outcomes (Abuzaid et al., 2024). Abuzaid et al. (2024) found that supplier selection criteria such as environmental friendliness, flexibility, price, and delivery reliability have a statistically significant relationship with manufacturers' operational performance. This supports the argument that capability-based assessments that include both traditional and sustainability-related dimensions can contribute to improved performance outcomes and strengthen resilience through better supplier-related decisions (Abuzaid et al., 2024; Ponomarov & Holcomb, 2009).

Beyond static associations between supplier criteria and performance, dynamic capabilities help explain why similar resource bases can yield different outcomes under volatility. Sensing, seizing, and transforming activities determine whether firms can interpret signals, allocate resources, and reconfigure supplier-related arrangements to protect performance when conditions change (Teece et al., 1997; Teece, 2007). This mechanism-

based view strengthens the argument that capability factors influence resilience and decision quality, not only routine performance (Teece, 2007; Ponomarov & Holcomb, 2009).

Digitalization can reinforce these effects by improving visibility and enabling more continuous monitoring of supplier-related performance and risk indicators. Business intelligence and analytics support earlier detection of weak signals and more proactive responses by transforming operational data into decision relevant information for performance and risk management (Chen et al., 2012; Trieu, 2017). In supply chain contexts, big data analytics and predictive approaches further strengthen risk awareness and response capabilities as conditions evolve, supporting resilience-oriented performance management (Gunasekaran et al., 2017; de Assis Santos & Marques, 2022; Kache & Seuring, 2017; Aljohani, 2023). In line with this, Parmenter (2019) notes that supplier performance dashboards can combine quantitative metrics with qualitative assessments to increase transparency and support fact-based decision making.

Recent studies expand the set of capability dimensions relevant for supplier evaluation and monitoring. Rodrigues dos Santos et al. (2025) propose a conceptual framework for supplier risk management that incorporates environmental, social, and technological dimensions, highlighting the growing relevance of ESG and IT-related factors. Rashid et al. (2025) similarly show that supplier trust combined with integrated technology and real-time data integration enhances supply chain resilience, reinforcing the value of integrating relational and technological factors in supplier monitoring and risk informed decision making (Rodrigues dos Santos et al., 2025; Rashid et al., 2025).

2.3 Decision making processes in supplier selection and evaluation

Digitalization has transformed the way organizations manage supplier relationships. Traditional evaluation methods have typically focused on past performance and manual assessments, which often provide a limited view of a supplier’s capabilities (Patrucco et al., 2022). With the adoption of digital technologies and networked systems, companies can

now collect and visualize supplier data in real time, enabling a more accurate understanding of performance and risk factors (Rauch et al., 2024; Wamba et al., 2020).

A significant part of this transformation is driven by Business Intelligence (BI) and Big Data Analytics (BDA). BI refers to a systematic process in which business data is collected, integrated, and analysed to support decision making and enhance competitiveness (Adewusi et al., 2024). BI systems not only gather performance data but also help managers identify patterns and predict risks (Margarido & Guimarães, 2024). While BI primarily focuses on diagnostic and descriptive analytics, BDA extends the approach to predictive analytics, identifying trends and forecasting future outcomes. Wamba et al. (2020) emphasize BDA's role in converting large volumes of structured and unstructured data into actionable insights that enhance agility, innovation, and flexibility. Dubey et al. (2019) describe BDA as leveraging advanced techniques such as machine learning and statistical modeling to extract business value from complex data sources.

This development has shifted supply chain management from reactive monitoring to proactive and predictive approaches. Tang and Nurmaya Musa (2011) argue that data-driven frameworks allow organizations to identify delivery risks before they escalate into disruptions. Nabil (2023) demonstrates that interactive dashboards, such as Microsoft Power BI, enhance responsiveness by consolidating multiple metrics into a single view. Recent studies reinforce this perspective by showing that adaptive, cloud-based BDA models can integrate BI lifecycle stages from data ingestion to machine learning, improving decision making and supplier quality oversight (Stefanovic et al., 2025). Similarly, strong data governance and analytics competency have been linked to better decision-making performance (Fattah, 2024). Interactive dashboards also improve usability and decision speed, although scalability challenges remain (Verma et al., 2025), and practical guides highlight how Power BI and DAX can significantly enhance decision accuracy and efficiency (Garudasu et al., 2024).

2.3.1 Decision making process in supplier selection and evaluation

A decision-making process can be defined as a structured sequence of steps through which organizations identify a problem or opportunity, develop and evaluate alternatives, and commit to a course of action, aiming to support systematic analysis rather than relying solely on intuition (Simon, 1960; Mintzberg et al., 1976). Simon (1960) introduced a foundational model consisting of three phases: intelligence, where relevant information is gathered and the decision situation is recognized; design, where alternative solutions are developed; and choice, where an alternative is selected (Simon, 1960). Empirical research on organizational decision processes further supports a phased logic that begins with recognizing a stimulus for action and ends with a commitment, while acknowledging that decision processes in practice include iterative elements and dynamic influences (Mintzberg et al., 1976).

In supplier selection and evaluation contexts, the process is often extended beyond the initial choice to include implementation, monitoring, and learning, where feedback informs adjustments to criteria, assumptions, and supplier related actions over time (Robinson & Fuller, 2017). The intelligence phase increasingly relies on data visibility and continuous monitoring, which supports earlier detection of weak signals in delivery, quality, or risk indicators. This aligns with the sensing dimension of dynamic capabilities, where firms interpret changes in the environment and supplier base to anticipate risks and opportunities (Teece, 2007; Kache & Seuring, 2017).

2.3.2 Processes decision making methods for supplier selection and evaluation

Decision making methods in supplier selection and evaluation aim to structure judgments and reduce reliance on intuition by making criteria, trade-offs, and assumptions explicit. Such structure becomes particularly important when decisions involve multiple objectives, including cost, delivery, quality, sustainability, and risk exposure, which require consistent weighting and comparison across alternatives (Mintzberg et al., 1976). From a governance perspective, explicit methods also support transparency and

organizational learning by enabling post decision review and adjustment (Mintzberg et al., 1976; ISO, 2018).

Supplier selection and evaluation are often treated as multicriteria decision problems, which has led to a wide range of structured methods for weighting criteria and ranking alternatives. Common approaches include simple scoring and weighted sum models, multicriteria decision making (MCDM) techniques such as AHP and TOPSIS and other outranking or preference-based methods, as well as optimization-based approaches and efficiency benchmarking methods such as data envelopment analysis (DEA) (de Boer et al., 2001; Ho et al., 2010). Because supplier information is frequently incomplete or imprecise, fuzzy set theory and hybrid combinations of methods are widely used to handle uncertainty while maintaining comparability across suppliers (Ho et al., 2010; Chakraborty et al., 2025). Method choice typically depends on the decision context, including the number of criteria and suppliers, data availability and quality, and whether the goal is transparent ranking, trade-off analysis, or performance benchmarking over time (de Boer et al., 2001; Dutta et al., 2021).

In supplier related decision making, methods are applied within core activities such as selecting suppliers, evaluating ongoing performance, and developing suppliers through improvement initiatives (Patrucco et al., 2022; Xu, 2023). Supplier selection focuses on identifying and choosing suppliers that can meet agreed requirements, whereas supplier evaluation emphasizes systematic monitoring against predefined criteria, and supplier development targets capability improvement through collaboration (Gabellini et al., 2025; Patrucco et al., 2022).

Methodologically, structured supplier decisions commonly combine quantitative indicators, such as cost, delivery reliability, and quality rates, with qualitative assessments, such as responsiveness and cooperation, to form a more comprehensive basis for comparison and prioritization (Wamba et al., 2020; Gabellini et al., 2025). Patrucco et al. (2022) emphasize that purchasing functions play a key role in ensuring that the outputs

of these assessments remain strategically relevant. This linkage supports more consistent resource allocation and risk aware supplier management, particularly when organizations need to balance efficiency goals with resilience considerations (Wieland, 2020; Xu, 2023).

2.3.3 Data impact on supplier related decision making

Data-driven decision making is enabled by business intelligence and analytics that integrate and transform operational data into decision-relevant information (Chen et al., 2012; Trieu, 2017). Research on embedded analytics in enterprise systems suggests that integrating analytics into core platforms shifts their role from routine reporting toward decision-oriented management and more timely action (Solano & Cruz, 2024; Trieu, 2017). In supply chain contexts, big data analytics and predictive approaches can support earlier risk awareness and more proactive responses by converting high volume data into actionable insights for monitoring and mitigation (Gunasekaran et al., 2017; de Assis Santos & Marques, 2022).

In supplier selection and evaluation, these capabilities are operationalized through increased data visibility and continuous monitoring of delivery, quality, and risk indicators. Integrating data across enterprise systems, including procurement and logistics, can improve the consistency and comparability of supplier assessments by providing a shared basis for evaluating performance and capability factors over time (Chen et al., 2012; Trieu, 2017). For example, dashboards and embedded analytics within enterprise environments, such as ERP systems and Power BI dashboards, can consolidate supplier related KPIs and risk signals into decision ready views, supporting faster interpretation and escalation of emerging issues (Solano & Cruz, 2024; Trieu, 2017).

Analytics also affects decision quality by supporting earlier detection of weak signals and enabling learning through feedback loops. Visibility depends on timely, accurate, and meaningful information, and when analytical outputs are integrated into decision routines, organizations are better positioned to update evaluations as conditions change (Kache & Seuring, 2017; Trieu, 2017). Predictive and prescriptive analytics can further

strengthen responsiveness by identifying patterns and potential disruptions that may not be evident through traditional reporting, thereby supporting more risk informed supplier management (Gunasekaran et al., 2017; de Assis Santos & Marques, 2022).

At the same time, the increased role of analytics highlights governance requirements related to transparency and fairness in data-driven decision support. Huang and Zaslavsky (2024) propose a contextual knowledge graph approach to detect and reduce bias factors during near real time decision support system operation, strengthening fairness and transparency of analytical decision support (Huang & Zaslavsky, 2024). Similarly, Teixeira et al. (2025) show that AI applications can support decision-making across strategic and operational supply chain phases, while challenges related to data governance and scalability remain important considerations for implementation (Teixeira et al., 2025).

2.4 Conceptual Framework

The literature on supplier management and supply chain resilience is extensive but often fragmented across separate streams. Studies on supplier capability and evaluation commonly focus on performance outcomes and selection criteria, whereas risk management research frequently emphasizes risk identification, assessment, and mitigation practices as distinct activities (Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2015). At the same time, supply chain resilience research highlights the importance of readiness, response, and recovery, yet it also notes that the relationships among key resilience elements and the mechanisms through which firms operationalize resilience remain insufficiently integrated and empirically understood (Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2015). As a result, prior research often explains parts of the phenomenon but lacks an integrated lens that simultaneously connects supplier resources and capabilities, structured risk management, and data-driven decision support into one coherent framework for resilience-oriented supplier evaluation and informed decision-making (Tukamuhabwa et al., 2015; de Assis Santos & Marques, 2022).

To address this gap, the conceptual framework of this study integrates three complementary theoretical perspectives RBV, Dynamic Capabilities Theory, and the ISO 31000 risk management guidelines, and positions digitalization and data-driven practices as an enabling layer across them (Figure 8). RBV explains why supplier related resources matter for performance and competitive advantage by emphasizing that valuable, rare, difficult to imitate, and non-substitutable resources underpin sustained advantages (Barney, 1991). This perspective aligns with the themes in the literature review under capability management and supplier capability, where supplier technological expertise, operational know how, and financial stability can be interpreted as strategically relevant resource bases that influence downstream supply chain performance (Barney, 1991; Abuzaid et al., 2024). In addition, because supplier relationships are a central mechanism through which capabilities are developed and leveraged, the framework treats relational capital as a strategic resource that can span organizational boundaries. According to Dyer et al. (1998) the view is consistent with research that conceptualises interorganisational relationships and governance as sources of value through relation-specific properties and routines of knowledge-sharing.

However, RBV alone provides a largely static explanation of why resources matter at a point in time. In volatile supply environments, firms and suppliers must also adapt, renew, and reconfigure resources to sustain performance. Dynamic Capabilities Theory complements RBV by explaining how organizations build and deploy higher-order capabilities to respond to change (Teece et al., 1997; Teece, 2007). In particular, sensing, seizing, and transforming activities provide a useful structure for linking your literature review headings to resilience and decision-making (Teece, 2007). Sensing relates to early identification of weak signals and emerging risks, which connects to your risk mitigation and data impact discussions (Teece, 2007; Kache & Seuring, 2017). Seizing relates to prioritizing actions and allocating resources, which connects to decision-making processes and supplier evaluation methods (Teece, 2007; Mintzberg et al., 1976). Transforming relates to reconfiguring processes, governance, and supplier portfolios, which connects to

capability management and longer-term supply chain performance improvement (Teece, 2007; Teece et al., 1997). This theoretical linkage is important because resilience literature emphasizes readiness, response, and recovery, and dynamic capabilities offer a mechanism-based explanation for how those outcomes are achieved through deliberate sensing and reconfiguration rather than ad hoc reactions (Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2015; Teece, 2007).

The third pillar of the framework, ISO 31000, provides a structured and organization-wide approach to risk management that supports systematic risk identification, analysis, evaluation, treatment, and monitoring (ISO, 2018). This risk management lens complements the supplier evaluation literature by ensuring that evaluation criteria do not remain limited to efficiency and historic performance but explicitly include risk exposure and continuity considerations (ISO, 2018; Ponomarov & Holcomb, 2009). ISO 31000 is also relevant to your literature review structure because it offers a process-oriented logic that can be aligned with supplier evaluation and risk mitigation practices discussed earlier (ISO, 2018). Importantly, resilience research has repeatedly noted that while resilience is widely discussed, the methodological integration of risk identification and mitigation with operational decision-making remains underdeveloped, which supports the need for an integrated conceptual framework rather than a set of isolated indicators (Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2015).

Digitalization and data-driven practices constitute the enabling layer of the framework because they connect resource and capability assessments with continuous monitoring and informed decision-making. Business intelligence and analytics research show that integrating analytics into enterprise systems supports more informed, decision-oriented management by transforming dispersed operational data into actionable information (Chen et al., 2012; Trieu, 2017; Solano & Cruz, 2024). In supply chain contexts, analytics and dashboards facilitate performance monitoring and decision support, and big data analytics literature emphasizes the conversion of high-volume and high-variety data into

actionable insights for improved agility and performance (Nabil et al., 2023; Gunasekaran et al., 2017).

This enabling layer connects directly to your literature review headings on decision-making and data impact, and it also supports the sensing component of dynamic capabilities by improving visibility and earlier detection of risk signals across the supplier base (Kache & Seuring, 2017; de Assis Santos & Marques, 2022; Teece, 2007). Evidence from predictive analytics research further suggests that continuous monitoring and data-driven models can strengthen risk awareness and enable more proactive responses as conditions evolve (Aljohani, 2023; Gunasekaran et al., 2017).

Figure 8 therefore synthesizes the reviewed literature into a single integrative model: RBV explains which supplier resources matter and why (Barney, 1991); Dynamic Capabilities explains how those resources are renewed and deployed under uncertainty through sensing, seizing, and transforming (Teece et al., 1997; Teece, 2007); ISO 31000 specifies how risks are managed systematically (ISO, 2018); and digitalization enables continuous measurement, monitoring, and evidence-based decision-making across these dimensions (Chen et al., 2012; Solano & Cruz, 2024).

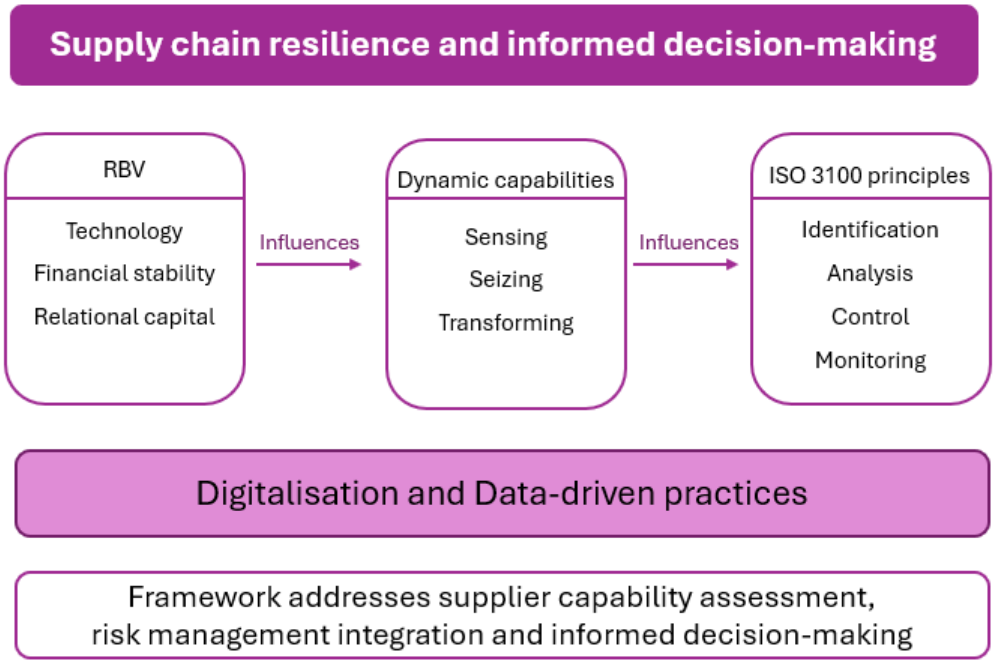


Figure 8. Framework for supply chain resilience and informed decision-making.

The research gap addressed by this study is that prior work typically examines these components separately, for example supplier performance metrics without a structured risk process, or risk frameworks without an explicit link to dynamic capability building and data-driven decision support (Tukamuhabwa et al., 2015; de Assis Santos & Marques, 2022). By integrating these perspectives, the framework clarifies how supplier capability evaluation can be linked to resilience outcomes and how decision makers can use data-driven tools to move from reactive monitoring to more proactive and informed supplier-related decisions (Ponomarov & Holcomb, 2009; Teece, 2007; Nabil et al., 2023).

3 Methodology

This chapter explains the research methodology and data collection methods. The aim is to find answers to research questions using these methods.

3.1 Research approach

The research has been conducted as a case study, as the aim of the research is to examine a case company and its phenomenon. The research assesses supplier capability and how it can be utilized in the risk management and decision-making of the purchasing organization. The phenomenon under study is diverse and linked to its own operating environment, and it cannot be separated from its environment without losing essential information. The research uses the mixed methods method, as both qualitative and quantitative information is needed when studying the phenomenon. The mixed methods method enables the phenomenon to be examined from different perspectives and the combination of different materials. The method also supports triangulation, i.e. quantitative observations can be compared and supplemented with qualitative material, which strengthens the validity, reliability and value of the research results (Creswell, 2014).

The mixed-methods literature clearly defines that a researcher can give equal weight to qualitative and quantitative data, in which case both methods affect the conclusions of the study equally (American Psychological Association, 2018; Creswell & Plano Clark, 2018; Creamer, 2018).

In mixed method research, the priority dimension can be defined so that qualitative and quantitative data contribute equally significantly to the key conclusions of the study. This corresponds to the equal-priority setting, which Creamer (2018) describes as a situation where the share of both methods is equal and neither method dominates the analysis or the formation of the results.

The mixed method research consists of a combination of quantitative and qualitative data. The study utilized an appropriate sampling strategy that is suitable for mixed-method studies when the participants are required to have special expertise and experiential knowledge of the process being studied (Palinkas et al., 2015; Etikan, Musa & Alkassim, 2016).

In the first phase, eight employees of the case company were selected as targets because they had operational and often strategic responsibility for their own suppliers, which allowed them to provide detailed and practical information on the effectiveness of the current supplier evaluation methodology. They were first interviewed and then surveyed, which partly included supplier-specific questions. The benefit of this two-stage sampling was that the observations that emerged in the interviews could be quantitatively tested with the same group of participants, which strengthened constructive validity and internal coherence of the data (Yin, 2018).

In the second phase, a separate Forms questionnaire was sent to four selected suppliers, which included questions related to the supplier's own operations and capabilities. The selection of these suppliers was based on their strategic importance in the supply chain of the case company and the fact that they had the best expertise in their own processes, certifications and performance factors. The separate perspectives of internal experts and external suppliers formed a complementary whole, which is a key strength of mixed method research (Creswell & Plano Clark, 2018).

The third data source was the case company's Power Bi data, which provided an objective, quantitative view of the suppliers' delivery reliability, quality and performance. Combining these three datasets made the sample particularly valuable for the study: internal experts brought operational understanding, suppliers brought a self-assessment of their own capabilities, and performance system data provided an independent, measurable perspective. In this way, targeted sampling enabled a deep understanding of the

phenomenon from several perspectives and produced insights that the aim of the master's thesis was to achieve to develop the framework for assessing suppliers' capabilities.

The research method aims to answer the preset research questions. The first research question is answered through interviews, as the interviews gathered an understanding of current supplier assessment practices and risk management. The second research question is answered by analysing the results of both the interviews and the Forms surveys, which help to identify the key factors affecting supplier capability.

The third question is answered through both interviews and surveys, which provide a combined view of the experiences of buyers and supplier development engineers, data needs, and the utilization of reporting tools in decision-making. The data obtained from Forms complements the development needs and expectations raised in the interview.

3.2 Data collection and delamination

The quantitative data of the study consists of closed questions from two different forms surveys and Power BI reports managed by the case company, which display numerical performance indicators. These produce objective and measurable data on suppliers' delivery reliability, risk level, quality and other trends. The qualitative data, on the other hand, consists of semi-structured interviews conducted with the company's employees and open-ended answers to forms surveys. Qualitative data forms a view of the key factors of suppliers' capability and development needs. The interviews discussed supplier-specific themes and employees' views on current assessment methods and how they could be developed to support their own work.

From figure 9 can be seen that the data for the study was collected by combining four different sources: interviews with employees of the case company's procurement organisation, two different Microsoft Forms surveys, and data from the case company's Power Bi reports. The aim of combining the data sources was to form an entity for the study

that supports the mixed methods method, consisting of both quantitative and qualitative data.

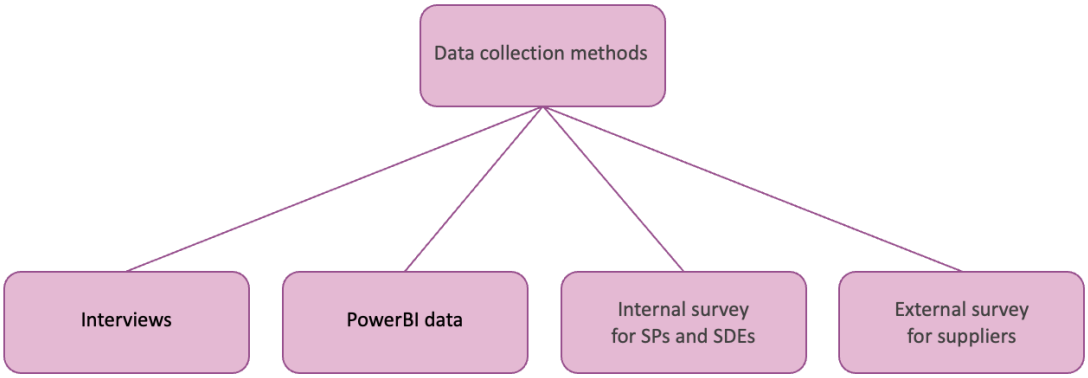


Figure 9. Data collection methods.

The data collection was carried out in stages, and the interviews carried out as the first phase of the study were based on the recommendations of the mixed methods methodological literature that qualitative data serves as an effective tool for structuring the research problem, clarifying concepts and preliminarily defining the indicators before collecting quantitative data (Hurmerinta Peltomäki and Nummela, 2006; Jick, 1979). The qualitative initial phase is particularly justified when the research phenomenon is complex and there is no ready-made measurement tradition of its key variables, which is why the research first requires an in-depth explanation of the research context (Hurmerinta Peltomäki and Nummela, 2006). This was also the case in this study: the case company did not have a uniform view of the key areas of supplier capabilities or what kind of data is required for the assessment. Therefore, the aim of the first interviews was to produce a contextual understanding of current assessment practices and to identify the experts' views on key capability factors. This approach corresponds to the exploratory sequential research design described in the mixed methods literature, where qualitative knowledge guides the construction of a later quantitative stage (Creswell and Plano Clark, 2018).

The analysis of the interviews produced ten repeatedly mentioned evaluation factors, which formed the basis for the structure of the Microsoft Forms survey aimed at the employees of the case company. The research design was clearly qualitative dominant sequential mixed method design, in which the qualitative phase had a guiding role in the research and not just a supporting function for the preliminary phase (Piekkari and Nummela, 2011). Piekkari and colleagues emphasize that in such sequential implementation models, qualitative data builds an interpretative basis for the research, without which quantitative indicators cannot be meaningfully planned or interpreted (Piekkari and Nummela, 2011). The primacy of the interviews was also methodologically justified because it made it possible to examine the research phenomenon from the participants' own perceptions, avoiding too early categorization that a structured survey could cause.

The survey conducted after the interviews provided a quantitative way to test whether the themes identified in the qualitative phase are consistent in the views of several experts. In addition, a separate Forms survey sent to four suppliers provided an external perspective in the form of suppliers' self-assessments, which complemented the internal review. This is in line with the aggregated mixed method strategy described by Piekkari, in which several data sources are used to examine the same case in depth (Piekkari and Nummela, 2011). Finally, the case company's Power Bi data provided objective performance data for triangulation, which strengthened the validity of the results. The combination of these three data sources, qualitative, quantitative and system data, provided the study with a deep and valid understanding for the development of a method for assessing supplier capabilities.

The interviews were conducted as themed interviews in the case company's procurement organization in 2026. The aim of the interviews was to produce answers to the research questions and to collect the participants' experiences of daily work with suppliers, capability assessment, and data utilization. The interviews were organised Microsoft Teams, and the interviews were recorded, and permission was requested for their recording. The interviews were conducted either in Finnish or English, depending on the

interviewee's own preference. The interviews in Finnish were translated into English using Microsoft Word's built-in translator. After translation, the translations were manually checked to ensure that the meaning or context of the response did not change with the translation, but that they corresponded to the original content. The reliability of the translation was assessed by comparing the text back to the original Finnish version and it was ensured that no changes were made to the text. The interview had 17 questions, which were divided into three themes. First, background questions were discussed, secondly, supplier-specific capability and risk issues, and finally, general questions related to the development of capability assessment and reporting were asked in the interview.

There was a total of 8 interviewees, four of whom were strategic buyers and four were supplier development engineers. The study dealt with four suppliers selected by Case company: A, B, C, and D. For each supplier, one SP and one SDE were interviewed, which made it possible to examine the supplier from both a commercial and a technical perspective. The interviewees and their suppliers' responses are presented in Table 2. Each interviewee works with their own supplier daily and is responsible for them on supplier. Length of each interview is also presented in Table 2.

Table 2. Interviewees by role and responsibility.

Interviewee	**Role**	**Supplier responsibility**	**Interview length**
SP1	Strategic purchaser (SP)	Supplier A	32min 15s
SDE1	Supplier development engineer (SDE)	Supplier A	45min 37s
SP2	Strategic purchaser (SP)	Supplier B	50min 54s
SDE2	Supplier development engineer (SDE)	Supplier B	15min 51s
SP3	Strategic purchaser (SP)	Supplier C	27min 40s
SDE3	Supplier development engineer (SDE)	Supplier C	23min 46s

Interviewee	Role	Supplier responsibility	Interview length
SP4	Strategic purchaser (SP)	Supplier D	49min 7s
SDE4	Supplier development engineer (SDE)	Supplier D	28min 13s

After the interviews, a Microsoft forms survey was created, which was targeted at the same eight interviewed people, because the survey followed a sequential exploratory mixed methods setup. In the method, the qualitative phase serves as the basis, the observations of which are confirmed and structured in a later, more quantitative phase (Creswell and Plano Clark 2018; Saunders et al. 2019). Using the same people improved constructive validity, as the survey tested whether the themes that emerged from the interviews were consistent among the respondents (Yin 2018).

Interviews and surveys differ from each other as a method and in the nature of the information they produce. The interviews are a flexible qualitative method that enables the participants' experiences, justifications and perspectives to be presented. In the interviews, more detailed questions can be asked, and new themes can be brought up that could not have been foreseen in advance (Kvale and Brinkmann 2015). The questionnaire, on the other hand, is a structured and standardized method that produces comparable responses and enables the measurement of observed factors on uniform scales (Dillman et al. 2014). The survey is particularly suitable for situations which were wanted to evaluate or prioritize previously identified factors quantitatively.

The combination of these two methods was necessary because they complement each other. With the help of the interviews, it was possible to identify how the participants understand the suppliers' capabilities, risks and the relationships between them, as well as to highlight case company’s views and experiences. The survey, on the other hand, made it possible to structure and confirm these observations quantitatively, assess their importance and compare the participants' views systematically. This improved the

reliability of the data and supported the construction of the framework to be developed in the study by providing both qualitative understanding and quantitatively analysable data (Ketokivi and Choi 2014).

The interviewees were selected since they are responsible for the suppliers appointed by the case company. Each SP and SDE act as the lead with the main responsibility for their own responsible supplier, which is why they have the most practical and up-to-date information about the suppliers selected for the study among the employees of the case company. They are familiar with supplier performance, cooperation history and operational development targets. With the help of the survey, their expertise also provided measurable answers to supplier-specific sub-areas that Power Bi data does not provide an answer to. Their job description includes the selection, evaluation and development of suppliers, which requires dynamic capabilities such as sensing, seizing and transforming. With these capabilities, the organization's experts can detect changes and risks, make decisions and seize the identified opportunities, as well as renew collaboration, processes and the supplier network. Not all of these can be seen in quantitative data, which is why these people are able to identify silent signals and assess the development of suppliers' capabilities comprehensively (Teece, 2007). This made them the most appropriate and justified group of interviewees for the study.

Forms were chosen as the tool because it allows responses to be collected and transferred to Microsoft's Excel for further analysis. The survey was conducted in 2026 and was open for 19 days. The survey link was distributed to each respondent personally. 8/8 responses were received, with a response rate of 100 %. The structure of the survey supported the analysis of the data and included both Likert scale statements and open-ended questions. The survey assessed the clarity of the current supplier capability assessment method and the usability of the data with the help of statements. Two different five-point Likert scales were used in the survey, depending on the purpose of the question. In the statements that measured the respondent's agreement or disagreement, a scale of 1 = completely disagree – 5 = completely agree was used. The questions that

evaluated the usefulness or general functionality of the method used a scale of 1 = very unclear or very weak – 5 = very clear or very strong. The use of uniform scales enabled the comparability of responses and supported the implementation of systematic quantitative analysis.

In addition, the respondents assessed the order of importance of the selected capability factors based on the interview, assessed their own supplier's performance in relation to the defined capability factors, and answered open-ended questions that mapped the most important indicators for the capability dashboard and its benefits in supplier management. The key factors to be ranked in order of importance of the survey were derived from interview data, from which 10 factors were selected for the survey. Which were mentioned most often in the interviews and were emphasized in terms of evaluation and risk management.

A separate Microsoft Forms survey was created for the four suppliers selected for the study, the purpose of which was to collect the suppliers' own views on their current situation, capabilities, capacity, development plans and cooperation needs. The survey contained 13 questions and was open for 19 days. The survey link was sent to the suppliers by email to one email address per supplier. 4/4 of the responses were received, which resulted in a response rate of 100 %. The survey was divided into four sections. The first part dealt with the supplier's self-assessment of the current capability, the second part dealt with capacity and flexibility, the third with development plans, and the fourth with the case company.

The supplier survey included both multiple choice and scale questions as well as open-ended questions, which made it possible to analyse the supplier's own perspective and compare it with internal assessments. The survey included several scale questions, but their scales were functional in content and not traditional statement type Likert-scales.
In the questions that assessed the suppliers’ current capabilities, a five-step scale was used, the extremes of which were descriptively defined. In the question "How would you

rate your current capability to meet our requirements?" the answer options were 1 = Poor – 5 = Excellent.

Correspondingly, the questions measuring the flexibility of processes or capacity used a scale of 1 = No flexibility – 5 = Very high flexibility, where each level was clearly named. The question on the response speed of the delivery capability used a scale of 1 = Very slowly (>4 weeks) – 5 = Very quickly (< 3 days) based on concrete time periods, which made it possible to evaluate performance from the perspective of practical practices.

In addition to these scales, the survey also included multiple-choice questions, such as "Which areas are your top priorities for improvement?", where the respondents could choose several development targets, such as Quality, Lead time, Flexibility, Risk management and Cost Efficiency. This complemented the scale questions and provided insight into which areas the suppliers themselves would target with their development measures.

The third source of data for the study was the case company's Power Bi reports, which are used by the procurement organization to monitor supplier performance. The reports provide vendor-specific numerical data over a long period of time. In this study, the review period was limited to 1/2025–12/2025 to obtain a uniform and comparable overall picture of the situation in 2025. The following KPIs were used from the Power Bi reports: delivery reliability, lead time, quality deviations, price, and supplier risk assessment.

To improve the reliability of the interpretation of Power Bi data, the following preprocessing and calculation principles were applied. When processing price data, zero-value order rows were removed, as they distort the material price analysis. Lines with a zero value are related to return orders, work orders, and other special cases, and don't represent the normal material price. Security of supply was examined using each supplier's average for 2025 to offset the impact of monthly fluctuations. Quality was reviewed at the 2025 level and the target set for each supplier was utilised in the assessment. In the

lead time review, the average lead time in the category was used as a comparison criterion, which makes it possible to identify supplier-specific deviations in relation to the normal level.

The study was narrowed down as follows to keep the analysis focused on the research questions:

1. The study was carried out as a case study in one case company, and it was limited to four suppliers (A-D)
2. In the internal data, the respondent group was limited to two key roles in the procurement organisation (SP and SDE), i.e. a total of 8 people.
3. The quantitative review of performance data was limited to 2025 (1/2025–12/2025) to ensure comparability.
4. Not all the key factors identified in the interviews were available in the Power BI reports, which is why qualitative data was used to complement and explain the numerical observations.

3.3 Data analysis

This is a mixed-methods study, so the analysis includes both qualitative and quantitative data. This chapter presents in detail the steps involved in analysing both quantitative and qualitative data.

3.3.1 Qualitative analysis

The qualitative data of the study consisted of interviews and open-ended responses to Microsoft Forms questionnaires. The purpose of the qualitative data was to produce an in depth understanding of suppliers' capability and the risks associated with it, as well as the use of information in decision-making. Because of the interviews, the phenomenon was examined from the case company's internal perspective, while the open answers to the forms surveys provided suppliers views.

In the interviews conducted in Teams, experience-based information was collected on the assessment of supplier capabilities, development needs, risk identification, and the use of reporting and indicators. The interview framework was divided into themes. The interviews were recorded in Teams, after which they were transcribed using the Microsoft Word transcription tool.

The open-ended questions of the internal Forms survey were used to gather insight into which indicators the company's employees would choose to describe their capabilities and how the report could support their work in the procurement organization. The answers were intended to complement the ranking and likert data, as the employees were able to justify their choices.

The external supplier survey also included open questions related to the supplier's strengths, limitations and goals. The supplier's view of one's own capabilities can be compared to the view of a case company.

The qualitative material was analysed using the principles of theming and partly content analysis. The aim of the analysis was to identify recurring concepts and meanings in the data, which could be used to determine the key factors to be included in the Power Bi report. As the study was a mixed method study, qualitative analysis was used to support the quantitative results. Figure 10 presents a data structure table that illustrates the progress of the analysis from the raw data to the results. The first column contains key quotes from the interviews, 1st order concepts. In the second column, these observations are grouped and interpreted as second-level themes, 2nd order themes. In the third column, the themes are combined into a single aggregated entity, aggregate dimensions, which describes the outcome of the study.

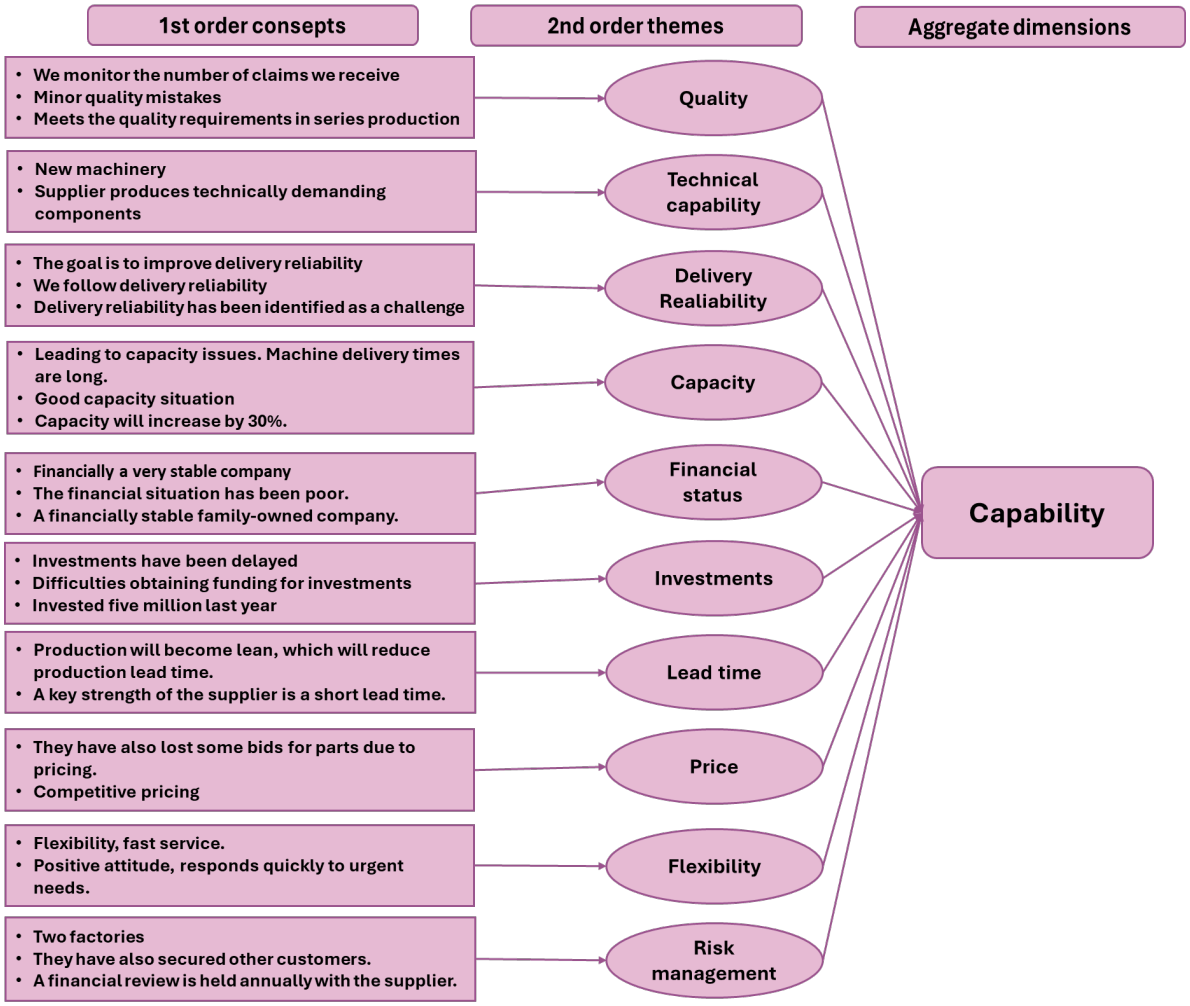


Figure 10. Data structure table.

The recorded interviews were transcribed into text format for analysis using the Microsoft Word transcription tool. The open-ended responses to the Forms surveys were compiled into a single analysis table. The open-ended questions of the internal survey were particularly related to metrics and the support of the report for the user, while the open-ended answers to the supplier survey focused on the current state of capability and the factors affecting it. The data was reviewed several times to make it ready for use for analysis.

The qualitative data served as the basis for the later collection of quantitative data. In accordance with the exploratory sequential research designs described in the mixed methods literature, the aim of the qualitative interviews was not only to provide an in

depth understanding of the phenomenon, but also to identify those areas of suppliers' capability that required quantitative structuring (Creswell et al., 2018).

Recurring themes and capability dimensions were identified from the interview material, which described the key strengths, challenges and information needs of supplier cooperation in practical work. Based on these observations, the themes were operationalized into measurable statements suitable for the survey phase, as well as evaluation and prioritization options, so that the quantitative phase would be based on empirically identified phenomena and not on predefined assumptions. This corresponds to the logic presented by Hurmerinta et. al (2006), according to which the qualitative phase can serve as the initial phase of mixed methods research and support the development of relevant indicators and questions. In this study, qualitative observations guided the selection of key factors, the formulation of Likert statements, and the definition of subareas for which Power Bi data did not provide a sufficient numerical knowledge base. Thus, the qualitative phase created both a conceptual and empirical basis for quantitative analysis and strengthened the logical and methodological coherence between the research phases.

3.3.2 Quantitative data

The quantitative data was collected with two different Microsoft surveys and from the case company's Power BI reports. The internal survey was targeted at strategic buyers (SP) and supplier development engineers (SDE) who participated in the interviews, and included Likert scale statements, a ranking task and a supplier-specific evaluation matrix. The survey aimed at suppliers, on the other hand, included both numerical estimates and quantitative information on production capacity and utilisation rate.

The quantitative analysis of the surveys began by examining the response distributions of each question. Microsoft Forms provides summaries of responses, but to ensure transparency and further processing of the analysis, the survey data was exported to Excel. The averages of the answers were calculated in Excel.

The survey data included three different types of quantitative measurements:

1. Likert scale (1–5): the internal survey assessed, among other things, the clarity of the current assessment method, the reliability and comparability of the data, and the objectivity of the assessment.
2. Order of importance (1–10): Respondents prioritise key factors in order of importance (1 = most important, 10 = least important).
3. Supplier-specific assessment matrix (1–5): respondents assessed their own supplier's performance in several capability dimensions

A key part of the quantitative analysis was to identify the ten key factors of supplier capability and quantify their importance. The analysis began with identifying key factors from the interviews. Capability factors were coded from the interview data, and the number of times for each factor was mentioned. The ten most frequently mentioned factors were selected as options for the priority task in the internal Forms survey. Next, the respondents of the Internal Survey ranked ten key factors in order of importance on a scale of 1 to 10, after which the ranking responses were converted into points and added together to obtain a complete picture of the importance of each factor. In practice, ranking variables were treated as weighted scoring, in which the higher ranked factor gets more points. After this, the scores of each key factor were summed up over all respondents.

The interview and questionnaire data were collected as two complementary datasets. For this reason, the aim was to give equal weight to the data. The data were combined using the equal-status mixed-methods approach.

To ensure that the intolerant sample size of the data would not cause methodological bias or dominance of a single data type, the results were normalised by method, the relative proportions of the interviews and questionnaires within the total mentions. Normalisation is a basic statistical method that aims to make data of different sizes

comparable with each other by proportioning observations to percentages or relative frequencies.

The normalized proportions were combined by giving the methods equal weights (0.5/0.5). This reflects a methodological solution in which both data types were given equal influence in the analysis. The literature on the emphasis on mixed methods emphasizes that the researcher can consciously assign methods to an equal status setting, which is an established and justified practice in mixed-methods research (Creswell & Plano Clark, 2018; Creamer, 2018).

The qualitative data, i.e. the interviews and the open answers to the SP and SDE Forms questionnaires, were quantified by converting the observations into numerical form. Key factors related to capability were identified from the transcribed interviews, and their occurrences were calculated according to the number of times each key factor was mentioned in the interview responses. After this, the mentions were compiled and the results are presented in Figure 11. Next, the answers given to the open questions of the SP and SDE Forms questionnaire were reviewed on the same principle. The key factors related to capability were identified from the responses and the number of mentions was calculated, after which the observations were compiled for further analysis.

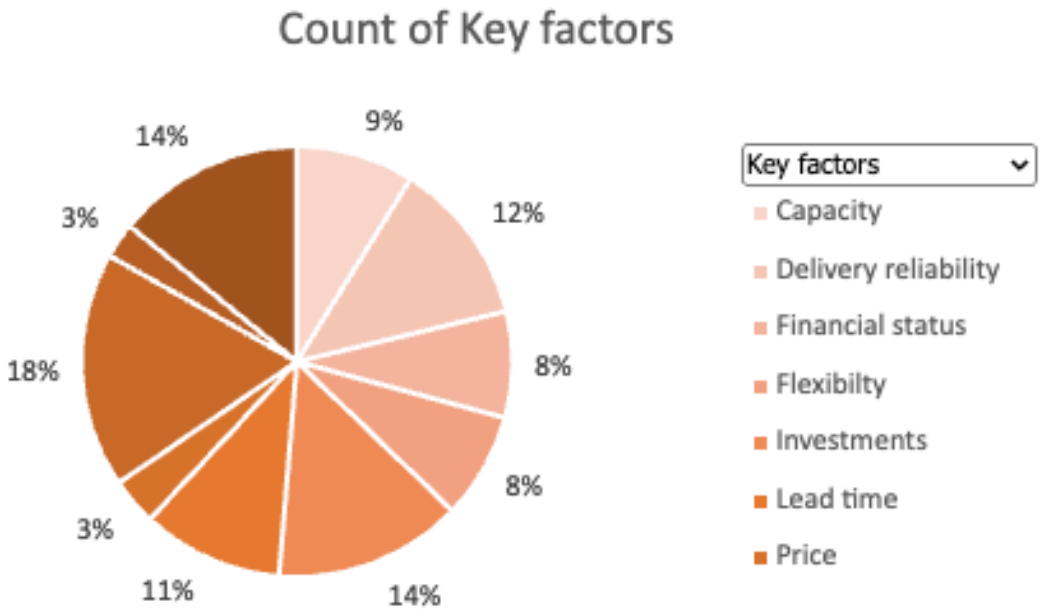


Figure 11. Count of key factors.

The combined distribution formed by this procedure reflects the equal weight of the two datasets, not the effect of a larger amount of data. This follows the equal-priority logic presented by Creamer (2018), in which the analytical weight of the methods is determined by the researcher's design decision.

Next, the weight values of the key factors were analysed. The final weights of the key factors were derived by combining the frequency of the interviews and open-ended questions, i.e. how often the factor was mentioned, and the scoring of the forms ranking, i.e. how important the factor was prioritized. This was done by normalizing both datasets into proportions and combining them with equal weights of 50/50. The calculation of weights proceeded as follows.

For each factor, i was calculated separately for its share in the interview data and the questionnaire material. Normalization was performed as follows:

where

$x_i^{(I)}$ = Key factor's i number of mentions in interviews and open-ended questions

$x_i^{(F)}$ = Key factor's i number of mentions in form submissions

N_I = Total number of all interviews and open-ended questions mentions

N_F= Total number of all form configurations

The purpose of normalisation is to convert the number of mentions into relative proportions, so that the interview and questionnaire data are comparable with each other.

Since both data sources were methodologically equally significant, their weights were combined using a balanced 50/50 method:

$$p_i = 0{,}5 \cdot p_i^{(I)} + 0{,}5 \cdot p_i^{(F)}$$

The combined weight thus formed describes the overall significance of factor i from the perspective of both the interviews and the questionnaire.

Finally, the weights were changed to percentage format to clarify the presentation and interpretation of the results. The obtained percentage value describes the relative importance of the factor in the total data.

$$Score_i = 100 \cdot p_i$$

As a result, a percentage weight was obtained for each key factor, the sum of which is 100%. These weights were used to build the supplier capability KPI (KPI) and to prioritize the dashboard in the Power BI dashboard.

Table 3. Key factors and their weights.

Key factors	**KPI metric weights**
Quality	17,08 %
Technical capability	13,33 %
Delivery reliability	12,50 %
Capacity	9,58 %
Financial status	9,58 %
Investments	9,17 %
Lead time	8,75 %
Price	7,50 %
Flexibility	7,08 %
Risk management	5,42 %
TOTAL	**100,00 %**

In addition to the survey data, supplier-specific performance was examined with the help of the case company's Power Bi reports. The analysis was limited to the period 1/2025-12/2025 so that the metrics are representative of a full year's performance. Supplier-specific comparison figures were formed from the Power BI data, which were used to assess the capability.

Once the weights of the key factors had been determined, the next step was to apply them to the vendor-specific metrics. The performance of each supplier was proportioned to the weight of the factor in question, which made it possible to form an overall picture of the capability. To do this, the number of each key factor was determined in Excel for each supplier as a percentage.

The first to be defined was Delivery Reliability, which was obtained directly from the case company's Power Bi data. Directly from the Power Bi data, the average of the supplier's delivery value 1/2025-12/2025.

$$= AVERAGE(Delivery\ reliablity[\text{Supplier A}])$$

From the above formula, delivery reliability was calculated by calculating the average of the supplier's annual delivery reliability.

Next, the quality was determined, which was calculated from 1/2025 to 12/2025 by the number of notifications divided by the annual target set for the supplier. How many notifications a supplier can receive and how many notifications the suppliers received.

$$= IF(1 - (SUM(Quality[Notifications])/Notifications\ Max) < 0; 0; 1 - (SUM(Quality[Notifications])/Notifications\ Max))$$

The formula shows that if the number of notifications in 2025 was higher than the set target, the supplier received a percentage of 0. If the number was smaller, the supplier received a percentage.

The next key factor, or lead time, was calculated as follows. From the case company's Power Bi report, the monthly lead times for 2025 were narrowed down and their average was calculated. It has been compared to the average lead time of the category.

$$= IF(Lead\ Time\ Max[Supplier\ A] - C6 > 0; ((Lead\ Time\ Max[Supplier\ A] - C6))/(Lead\ Time\ Max[Supplier\ A]\ ); 0)$$

Based on the interviews, price was chosen as one of the key factors. For price weight data analysis, following table 4 is formed with headers only, where blue headers are from ERP and yellow headers calculated with data process:

Table 4. Price weight data analysis.

Material	PO Qty	PO Value	Unit price	Min € material	Difference	Price%

The percentage, which describes the price level of each supplier, is started by forming the unit price by dividing the value of the order line by the number of pieces to get the unit price for one material. A pivot table is made of the unit prices to find out the lowest actual unit price recorded for the material for 2025, which is excluded from the public version.

$$Unit\ price = \frac{\left[\ @[PO\ Value]\right]}{\left[@[PO\ Qty]\right]}$$

Vlookup was used to find out the lowest unit price per material from the pivot and move it back to the original table.

$$Min\ €\ material\ = VLOOKUP([@Material]; PivotMIN!\ A{:}\ R; 16; FALSE)$$

The unit price is compared to the calculated unit price of the order row and the lowest actual material-specific unit price for 2025 obtained from the pivot table. The focus is on how much the unit price of an order line differs from the cheapest material in the same category. The comparison uses the material-specific prices of delivery batches in the same category in 2025.

If the result of the comparison is 0, the unit price of the order line is the lowest unit price per order line in the category. A zero price can also mean that the material has only one supplier, in which case this supplier is automatically the cheapest. If the benchmark is greater than 0, another vendor has had a lower unit price on the corresponding order line.

$$Difference\ = [@Unit\ price] - \left[@[Min\ €\ material]\right]$$

First, the difference between the price of the order line and the cheapest unit prices per material in 2025 is calculated by proportioning the difference to the lowest actual unit price in the category. This creates a comparison figure that describes the ratio of the price per order row to the lowest price in the same category. If the comparison figure exceeds 1, the function returns a value of 0, which means that the unit price of the order line is at least double the price of the cheapest delivery batch. If the comparison number is equal to or less than 1, the function produces a percentage value (Price%), which represents the relative level of the price on the order line between the lowest and double the price. A Price% value of 100% means that the price of the order line is the cheapest in the category, while a value of 0% indicates that the price is at least double that of the lowest. If the price% figures are between 0–100%, the unit price of the order line is between the cheapest and at least double the unit prices.

Price% =IF(1-([@Difference]/[@[Min € material]])<0;0;1-([@Difference]/[@[Min € material]]))

The vendor-specific average pivot for the whole year, the percentage of which is exported to the KPI.

Next, key factor is flexibility which is not obtained from the case company's Power BI system, so it was evaluated using an internal survey in which employees were asked to evaluate the key factors of each supplier. Eight people responded to the survey, and two respondents always rated the same supplier. In question 8 of Appendix 3, SP answered x1 and SDE x2.

In addition, the suppliers were asked to assess their own flexibility, and this material was also used in the calculation (Appendix 1, question 6: value given by the supplier x3). Suppliers were also asked how quickly they were able to react to changes in orders, and this information was included in the flexibility assessment (value provided by the supplier x4).

In both the internal and external surveys, respondents rated on a scale of 1 to 5, which was converted to 0%, 25%, 50%, 75%, and 100%.

The final flexibility value was calculated as follows:

$$= AVERAGE(x_1; x_2; x_3; x_4)/100$$

Risk management, financial situation, investments and technical capability assessments were taken from the responses to the internal Forms survey. The response scale of the SDE/SP-Forms questionnaire was 0, 25, 50, 75 and 100. There were two respondents for each supplier, and an average was calculated from their answers.

Question 8 of Appendix 3 used the following values: SP = x1 and SDE = x2.

$$= \frac{AVERAGE(x_1; x_2)}{100}$$

The suppliers' capacity is calculated in several stages, which form the final percentage. First, the supplier's Average Monthly Output is determined, which is obtained by adding up the total number of orders for 2025 and dividing it by twelve.

The suppliers' capacity is calculated in several stages, which form the final percentage. First, the supplier's Average Monthly Output is determined, which is obtained by adding up the total number of orders for 2025 and dividing it by twelve.

$$Average\ Monthly\ Output\ = \frac{Sum\ of\ Yearly\ Po\ Qty}{12}$$

The formula forms a capacity index that describes the supplier's ability to meet order volumes, deliver as agreed, and maintain a predictable lead time. It is primarily designed to describe the supplier's capacity capability, which is reflected in the fact that capacity sufficiency is clearly the most important component of the model. It has been given 50% weight.

The capacity ratio Average Monthly Output / Peak Required Output indicates whether a supplier's production capacity meets the company's peak demand, which is a basic requirement for delivery capability. Although the formula also includes delivery of reliability and variation in lead times, these serve as aspects that complement capacity. In this way, the formula emphasizes that a supplier's overall capability is built above all on sufficient capacity.

The calculation proceeds in such a way that the Average Monthly Output is divided by the Peak Required Output, i.e. the month when the order volume has been the highest. The resulting value is multiplied by a weighting factor of 0,5. After this, the average security of supply for 2025 obtained from Power BI is converted to a decimal number, and the result is multiplied by the security of supply weighting of 0,3. Finally, the Lead Time Variation for 2025 is divided by the Average Lead Time for the same year and multiplied by a weighting factor of 0,2. The combined result of these components forms the capacity index.

$$(Average\ Monthly\ Output\ /Peak\ Required\ Output) \cdot 0{,}5 + (Delivery\ Reliability\ /\ 100) \cdot 0{,}3 + \left(1 - \frac{Lead\ Time\ Variation}{Average\ Lead\ Time}\right) \cdot 0{,}2$$

When the weights of the key factors and the capability percentage of each key factor were clear. Numbers were multiplied by a hundred, which gave the weighted capability for each of the ten key factors.

$$Key\ \ factor\ weight \cdot key\ factor\ cabability \cdot 100$$

The percentages of the key factors are added together to form a percentage describing the supplier's overall capability on a scale of 0 to 100.

3.4 Validity and reliability

In this mixed methods case study, validity and reliability were strengthened by using multiple data sources and by combining quantitative and qualitative data according to the principle of triangulation. This allowed the findings to be compared and complemented across different sources (Creswell, 2014).

The material used in the literature review consists of peer-reviewed scientific articles retrieved from databases and search engines such as Google Scholar and Finna. In the methodology chapter, the research stages are described transparently, which supports the traceability and replicability of the research process, insofar as the necessary data is available (Yin, 2018). In addition, the survey questionnaires are included as appendices to the thesis, enabling the instruments to be used and evaluated in future studies as well. The research questions are addressed through both the literature review and the empirical data. The following subsections examine the validity and reliability of the quantitative and qualitative data separately.

3.4.1 Qualitative data

The qualitative data of the study consisted of interviews and open-ended responses to internal and external Forms questionnaires.

The supplier survey included several open-ended questions, but due to the research design, the answers could not be completely anonymous, as they had to be targeted at a specific supplier This can increase the risk that respondents will give more socially desirable answers or be wary of critical comments. (Krumpal, 2013). However, in research

reporting, suppliers are presented anonymously, and the results are reported as aggregates so that individual respondents or individual responses are not identifiable. This supports the protection of respondents and reduces the pressure on response behaviour. (Lincoln & Guba, 1985). All questions in the supplier survey were mandatory and all respondents answered them.

The internal Forms survey had open questions that were answered by the employees of the case company. The respondents are presented anonymously in the survey, but it is possible to deduce within the organization who works with which supplier. The possibility of recognisability can affect the tone of the answers, which was considered a possible source of bias in the interpretation. (Krumpal, 2013). The response rate of the survey was 8/8 (100%) and all questions were mandatory, which reduces the problem of missing information. In addition, the respondents were experts in the procurement organization who work with suppliers daily, which supports the relevance and credibility of the material.

The same group of people participated in the interviews as in the internal Forms survey. The advantage of this setup is that the qualitative data can be examined through a uniform group of participants and the themes that appear in the open-ended responses of the interviews and surveys can be compared. Reliability was further strengthened by triangulation, when qualitative observations were compared with quantitative survey data and system-based KPIs.

3.4.2 Quantitative data

The quantitative data consisted of internal and external surveys and the case company's Power BI-based KPI data. The use of several data sources supports the constructive validity of the case study, because the same phenomenon is examined from several perspectives and a clear chain of evidence is formed (Yin, 2018). In the mixed methods setting, combining quantitative and qualitative data strengthens the interpretation and overall understanding of the results. (Creswell, 2014).

Due to the research design, the surveys were not anonymous, as targeting the responses to a specific supplier was essential in the supplier-specific analysis. (Yin, 2018). The external supplier survey was limited to four suppliers to enable an in-depth comparison typical of a case study. (Yin, 2018). The response rate was 100% (4/4), which reduces the nonresponse error, although the small sample limits statistical generalizability. (Fowler, 2013).

The content validity of the internal survey was improved so that the key factors in the ranking section were first derived from interviews and then operationalized to quantitative measurement, which is the recommended method in a mixed methods setting. (Creswell, 2014). The non-anonymity of surveys may increase the risk of socially desirable responses, which is a known factor that distorts survey data. (Krumpal, 2013). This risk was mitigated by comparing survey responses to system-based KPIs and leveraging multiple sources which included surveys and Power BI, which strengthens the credibility of the results in the case study. (Yin, 2018; Creswell, 2014).

The reliability of quantitative analysis was strengthened by documenting the analysis process, i.e. transferring the forms to Excel, defining KPIs, ranking scoring, KPI data limitations and pre-processing. As documenting the analysis process improves repeatability and reduces sources of error in the analysis phase. (Fowler, 2013; Dillman, Smyth & Christian, 2014)

4 Results and analysis

In this section, the results of the empirical study are presented. Chapters 4.1, 4.2, and 4.3 outline the analysis and findings from the interviews, surveys, and Power BI data. Chapter 4.4 presents the summary.

4.1 Interviews results and analysis

For the study, eight employees from the procurement organization were interviewed to gather their perspectives. All interviewees were asked the same questions, and some of the questions were answered from the perspective of their own responsible supplier. In addition, several questions were more general themes related to supplier evaluation.

4.1.1 Background questions

All eight interviewees are experienced procurement professionals and have worked in the same procurement organization for a long time. Their daily work involves supplier evaluation and development. In the case company, supplier evaluation is conducted particularly when onboarding a new supplier, but existing suppliers are also regularly monitored and audited.

4.1.2 Supplier related questions

Four suppliers were selected for the study, and each interviewee works with at least one of them, as shown in Table 2. The suppliers manufacture various complex components or assemblies required in the case company's production. The selected suppliers are not single-source suppliers, meaning they can be replaced if necessary. However, depending on the component, substitution can take several weeks or even months. The key strengths of suppliers were mapped with interview question 5. The following quotes illustrate the strengths identified by the respondents from the perspective of capacity and capability.

> *"Service-minded, many employees handling different processes, problems are solved quickly, they invest a lot, purchase new machines, train personnel, and hire additional staff. They are expanding the welding department. They also have other major customers. Active, not just waiting around. Financially a very stable company." Strategic Purchaser 2, describing Supplier B*

> *"Good capacity situation, machines with a high utilization rate, invested five million last year, hiring more employees. Aim to increase capacity, have strong technological capability, and a development-oriented supplier. Able to calculate their capacity accurately." Strategic Purchaser 4, describing Supplier D*

> *"Manual machines, able to easily produce small batches. They can do everything themselves: welding, machining, cutting sheets, bending, even surface treatment. Good attitude, respond quickly to urgent matters." Strategic Purchaser 3, describing Supplier C*

Each supplier has its own expertise and strengths related to capacity and capability. All respondents stated that the suppliers' service attitude is at a good level. The suppliers' financial situation is considered important, as it enables them to make necessary investments. Suppliers A, B, and D invest significantly, which is reflected in their extensive machine base. During the interviews, the importance of supplier self-sufficiency was emphasized, as the ability to perform work phases in-house reduces bottlenecks.

The main development needs or risks of suppliers were mapped with interview question 6. The following quotes illustrate the development needs identified by the respondents from the perspective of capacity and capability.

> *"Investments have been delayed, leading to capacity issues. Machine delivery times are long." Strategic Purchaser 4, Supplier D*

> *"The financial situation has been poor, but things are improving. Difficulties obtaining funding for investments. The goal is to improve delivery reliability, and the root cause of the issue has been that the supplier has been unable to purchase materials and has confirmed orders too optimistically." Supplier Development Engineer 3, Supplier C*

The interviewees also recognized development needs and potential risks among the suppliers. They noted that suppliers struggle to increase their capability quickly. Some

suppliers have been late with their investments, resulting in insufficient capacity due to long machine delivery times. Supplier C's weak financial situation has hindered both investments and material purchases, which is reflected in their delivery reliability.

All interviewees stated that suppliers have faced quality issues, although some of the errors were due to carelessness. Interviewees highlighted that the severity or scope of errors is not considered in the case company's statistical reporting, meaning all notifications are valued equally in the supplier's statistics.

Regarding capacity, interviewees raised the risk that different categories within the company purchase from the same suppliers, and communication about this is not always clear. Capacity risks may therefore originate not only from external demand but also internally when another category consumes the supplier's available capacity for the same factory's needs.

Two suppliers also struggle to calculate their own capacity accurately, resulting in an unclear overall picture of workload. Suppliers do not leave free space in their production schedules but instead aim to plan their production very precisely. At present, all suppliers are operating at full capacity, with little to no free capacity available.

4.1.3 Supplier development

In the interviews, the interviewees were also asked: "How do you expect this supplier's capability to develop over the next 12–24 months? " The following quotes illustrate the suppliers' upcoming development by the respondents from the perspective of capacity and capability.

> *"Capacity will increase by 30%. New salaried employees in addition to factory workers, labour force has grown by 20 persons in a year." Strategic Purchaser 4, Supplier D*

”Capability grows. For current needs, it's okay. Sufficient for the needs of category A, but the other categories cannot use the capacity. Technical capability increases with the acquisition of new machinery. ” Strategic Purchaser 1, Supplier A

All respondents expect supplier capability to improve over the next 12–24 months. Suppliers are increasing their capacity, recruiting new employees as well as additional white-collar staff. The interviewees noted that the investments being made now will only become visible in one to two years, as machine delivery times are long and new employees must be trained for their tasks. All suppliers also have investment plans in place.

The interviewees believe that the cooperation between the case company and its suppliers will develop positively over the next two years. At present, the trend is positive, and suppliers need to invest to keep up with the increasing order volumes. Development areas have been identified together with the suppliers, and efforts are being made to address them to ensure growth. All interviewees expect suppliers to enhance their capabilities by investing or by completing the investments that have already been initiated. Suppliers are expected to improve delivery reliability and to recruit additional personnel.

4.1.4 Supplier evaluation data

All interviewees stated that they monitor supplier performance by tracking delivery reliability, the number of quality notifications, and the defect rate through KPI metrics.

“We monitor the number of claims we receive and follow delivery reliability. Of course, the baseline assumption is that if a supplier offers something, they are also capable of doing it.” Strategic Purchaser 3

“Interaction with suppliers, monthly meetings, calling and staying in contact. Design review meetings for new parts, and if there are problems, we discuss them openly.” Supplier Development Engineer 3

When respondents were asked how they ensure that a supplier’s capability is under control, all stated that they maintain regular communication with the supplier and make use of available KPI metrics. For new materials and changes, they remain in closer contact

with the supplier to be able to react to challenges in a timely manner. All interviewees emphasized that they have good and open communication with their suppliers.

4.1.5 Suppliers' capability evaluation

When the interviewees were asked about the most important factors in capability assessment, they responded:

> *"Is it possible for a supplier to carry out processes in-house? Reduces bottlenecks outside the house. Measuring instruments and capacity are also important." Strategic Purchaser 3*

> *"The suppliers must have the technical ability to understand why there are certain technical requirement. An understanding of what is made and why. The level of quality is also important from the end customer's point of view. Often, price also correlates with quality, which means that customers are not lost." Supplier Development Engineer 1*

Interviewees also responded that they consider capacity to be a key factor. Another important factor was technical capability, as the supplier is expected to understand why certain requirements are necessary, as well as to know their own manufacturing techniques. The interviewees also stated that quality and delivery reliability are important parts of capability. Visiting the supplier is also considered an important part of the assessment, since discussions with employees and the cleanliness of the factory provide insights into the supplier's situation. It would also be important to see the supply chain down to tier-2 suppliers to identify root causes more accurately.

The interviewees believe that a Power BI report describing capability could support their decision-making. Some, however, feel that the currently available data is already sufficient. The interviewees think it is important that the report serves as a tool, but that it cannot replace discussion and communication. Some interviewees believe that it is impossible to create such a report because not all the required data is available. One interviewee noted that the monitoring of suppliers' financial situations varies and that financial status should be followed more closely, especially for high-risk suppliers.

The report could show where problems originate. Suppliers' financial information could be considered more effectively. The report could be used to support the distribution of delivery responsibilities among suppliers. It could also be utilized in new product development, cost awareness, quality performance, and capability risk management.

All respondents see challenges in maintaining the report. They believe challenges will arise in keeping the report up to date and in dealing with potential incorrect data. Some interviewees pointed out that Power BI would be a suitable environment for the report since it is already familiar. Others noted that even with current reports, it can be difficult to trust whether the data is up to date. Suppliers could also update their responses themselves via the existing portal.

Interviewees' opinions were divided regarding the update frequency of the report. Most respondents would like the report to be updated monthly. One respondent preferred weekly updates. For one respondent, updating the report a couple of times a year would be sufficient.

4.2 Internal survey results and analysis

In this chapter, the results of the survey conducted among the case company's employees are reviewed.

4.2.1 Background information

Eight people responded to the survey. Respondents are the same individuals who were also interviewed for the thesis. The survey was sent to them after the interviews.

Figure 12 shows how the respondents perceive the current way of working. Based on the survey results, supplier evaluation is generally viewed as functional and clear. A total of 28,6% of respondents strongly agree that assessing supplier capability is clear and

carried out regularly. Respondents consider the structure of the evaluation model to be consistent, and the metrics used are seen as objective and comparable. This indicates that the foundation of the method supports uniform decision-making.

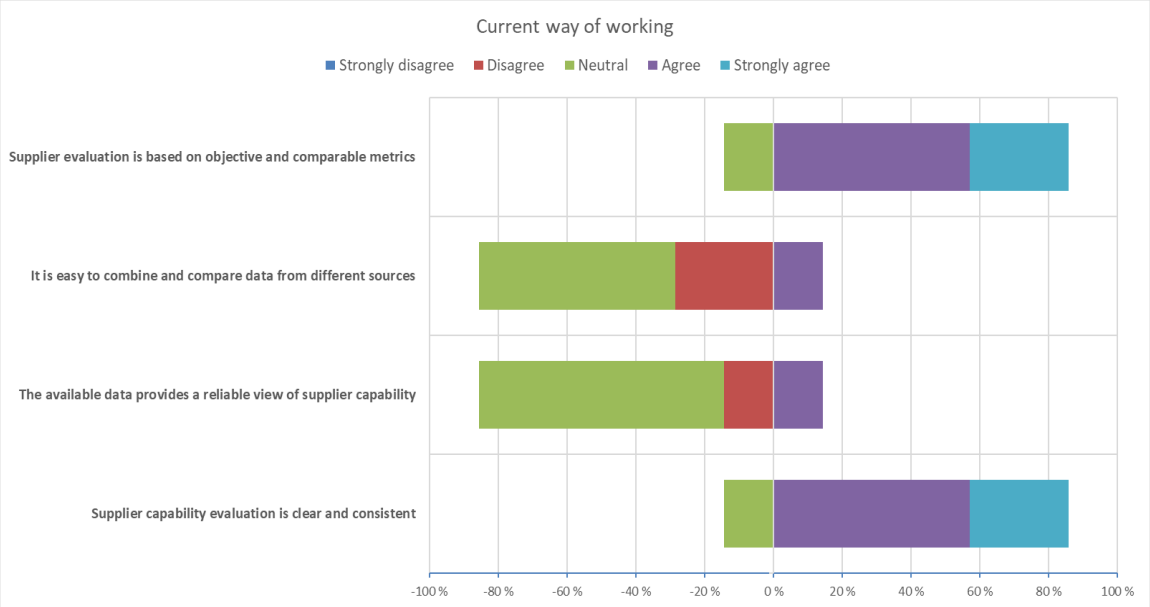


Figure 12. Current way of working.

However, the biggest challenges relate to data availability and usability. Another 28.6% of respondents disagree with the statement that it is easy to combine and compare data from different sources. Integrating and comparing information collected from various source systems is considered difficult, and as a result, the data does not form a sufficiently comprehensive or reliable overall picture of supplier performance.

Based on the results, it can be concluded that the evaluation itself works well, but its effectiveness suffers from fragmented data layers and insufficient integrations. Reliability and the usefulness of the evaluations would improve if data from different systems were standardized, combined, and systematically quality assured.

From Figure 13 can be seen that the respondents ranked the key factors identified during the interviews on a scale from 1 to 10. As shown in the table below, quality emerged as

the most important factor, with 29% of the eight respondents selecting it as their top priority. Delivery reliability was ranked as the second most important factor, followed by technical capability in third place. Price was considered the fourth most important factor, followed by the supplier's financial situation. After these, respondents highlighted capacity and risk management as the next most important factors. Lead time ranked eighth, flexibility ninth, and future investments was considered the least important of the ten factors.

Figure 13. Key factors.

4.2.2 Supplier related questions

There was one question about suppliers in the survey. The question was mandatory for the respondents and 8 responses were received. The purpose of the question was to collect measurable data from the views of the employees of the procurement organization, which could be used to replace the missing data in the final Power Bi report.

The answers to the question supported the answers received from the interviews. In the interviews, the respondents highlighted the strengths and weaknesses of suppliers. The same trend can be seen in survey responses. In the interview, both SP3 and SDE3 brought up the poor financial situation of supplier C. In the survey, both respondents chose the financial status of supplier to be 2, on a scale of 1 to 5.

In the interviews, both SP2 and SDE2 highlighted that supplier B invests a lot. In the survey, both respondents chose 5 on a scale of 1-5, i.e. the best grade, as a future investment.

4.2.3 Open questions

At the end of the survey, there were two open-ended questions related to the capability report. Answering these questions was not mandatory. Seven respondents answered the first open-ended question, and six respondents answered the second. The first question was: “Which three metrics would you choose to represent supplier capability in a Power BI report?” All eight respondents answered this question. Delivery reliability, quality, price, and capacity were mentioned in several responses. Financial situations and lead times were also frequently noted. One respondent questioned whether capacity can be calculated reliably. Respondents also wished for the report to show the audit execution date and result.

In the second question, respondents were asked: “How could the capability report best support your role in supplier management?” According to the responses, visibility and predictability of supplier capacity would help avoid capacity issues in the coming months and enable timely actions. Responses also highlighted that all metrics and information that support developing supplier capabilities would also help in creating a development plan with the supplier. Audit data would be useful to have systematically available. In the evaluation of new suppliers, the report would provide significant added value. At present, the report would support certain decisions, but respondents felt they already know the situation well about themselves. The report was also seen as offering early warning signs of declining performance and helping to understand the supplier’s current situation.

4.3 External survey results and analysis

This chapter looks at the results of a Microsoft Forms survey. Four suppliers selected by Case Company responded to the survey.

4.3.1 Current state

The suppliers' own views on their current ability to respond to the needs of the case company were charged with a Likert question on a scale of 1 to 5. 75% of suppliers rated their own capabilities with a rating of 4. One supplier chose a grade of 5.

In the open-ended question "What are your main strengths in working with us?", the editors describe their strengths as collaboration with your R&D and purchasing, quick reaction and flexibility. The suppliers' own answers support the comments received from the employees of the case company, as it was also noted in the interviews that the suppliers react quickly and that the cooperation works well.

In the open-ended question, "What are your current limitations or bottlenecks?" the answers of the suppliers vary. Both internal and external challenges were mentioned as limiting factors. One supplier has problems with the availability of material. Another supplier states that recruiting employees is difficult. In addition, some of the responses highlighted the slowdowns caused by the cleaning of products.

In the following open-ended question, the suppliers are asked: "What is your calculated production capacity (e.g., units/month) and current utilization (%)?" Already in the interviews, it was identified that some suppliers have challenges in calculating their own capacity. 25% of the responses provide information about weekly production hours. In addition, they report that the occupancy rate for the next four weeks will be 80%.

The other answers do not include numeric capacity information. One supplier does not want to answer the question because they have updates to both the machinery and the measurement method coming up. Another supplier, on the other hand, says that their capacity cannot yet be fully measured, but the capacity calculation is currently being developed.

The flexibility of suppliers' production capacity was assessed on a Likert scale, with response options ranging from 1 to 5. Figure 14 shows that 75% of suppliers chose a value of 4, while one supplier rated their flexibility as excellent and chose a value of 5.

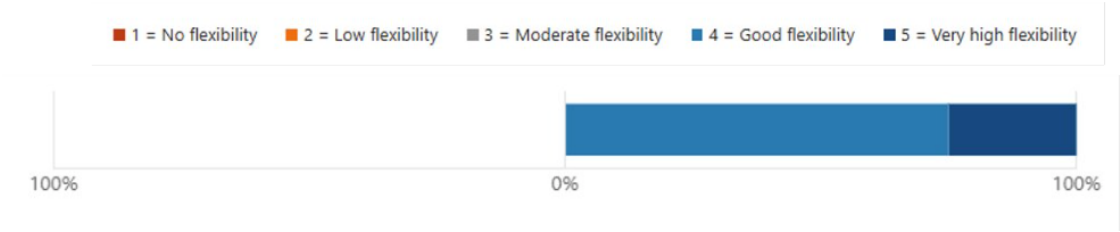


Figure 14. Suppliers' views on the flexibility of their production capacity.

Another Likert question on the same topic was about the speed of reaction to sudden order changes ("How quickly can you respond to sudden order changes?"). Figure 15 shows that 50% of respondents chose 4, which means a response within 2-7 days. The remaining 50% chose a value of 5, which means that the supplier can react to changes in less than three days.

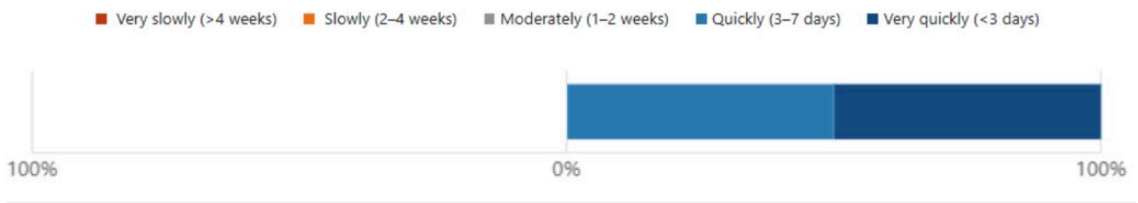


Figure 15. Suppliers' ability to react sudden order changes.

In the survey, suppliers were asked to evaluate with an open-ended question: "Which three KPIs best represent your current performance (e.g., on-time delivery%, defect rate, lead time)?"

All respondents said that delivery reliability, defect rate and order volume best describe their current performance. In addition to these, the respondents also mentioned success in urgent deliveries.

4.3.2 Development

In the survey, suppliers were asked to assess future developments with an open-ended question: "What actions are you planning in the next 12–24 months to improve your capability?". All respondents stated that they intend to invest in new machines and recruit more staff. This also supports the responses to the interviews, in which the case company's employees said that suppliers invest a lot in enhancing capabilities.

Next, the survey asked a question in which the suppliers had to choose their most important areas for development from the alternatives formed based on the interviews. From figure 16 can be seen that 29% of respondents chose quality as the most important area for development and 29% chose price. The remaining options, i.e. lead time, capacity and flexibility, each received 14% of the responses. The suppliers' answers are in line with the interview data, which highlighted the quality challenges experienced by the suppliers and negligence errors in production, which are also reflected in the notification statistics. The second most common choice, price, may indicate the suppliers' desire to remain competitive in relation to other players in the industry.

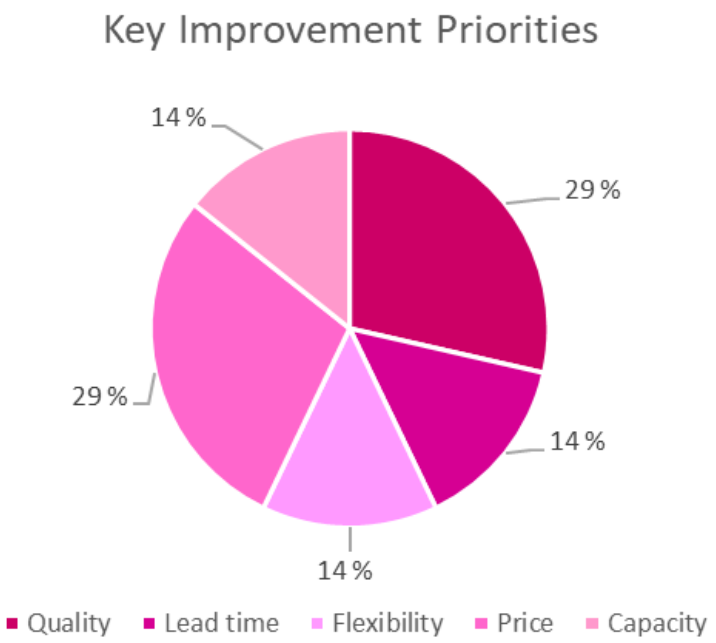


Figure 16. Suppliers' key improvement priorities.

4.3.3 Influencing factors

The next open question in the survey is "What factors most influence your ability to deliver (positively or negatively)?". The question was mandatory and answered by 100% of the respondents. The suppliers' responses show that sudden changes cause problems with security of supply. Some of the changes may also come from the case company, as the case company may modify the drawings of the material. Sub suppliers may also have delivery difficulties, which also affects the supplier's delivery reliability. Suppliers' capabilities, on the other hand, are improved by accurate forecasts, technological advances, and suppliers' quick reactions.

The next open question is: "How do you manage risks that could impact your delivery capability?". There is a variation in the answers of suppliers.

> *"Multiskilling, factories on two cities, sharing the know how with the other factory, good outsourcing, good know how in international purchasing, long term relationship with our customers and suppliers" Supplier D*

Supplier D emphasizes long-term relationships and know-how. The risk can also be shared through two different locations. The responses of other suppliers' state that risks are being mapped and flexibility is being developed continuously.

4.3.4 Collaboration

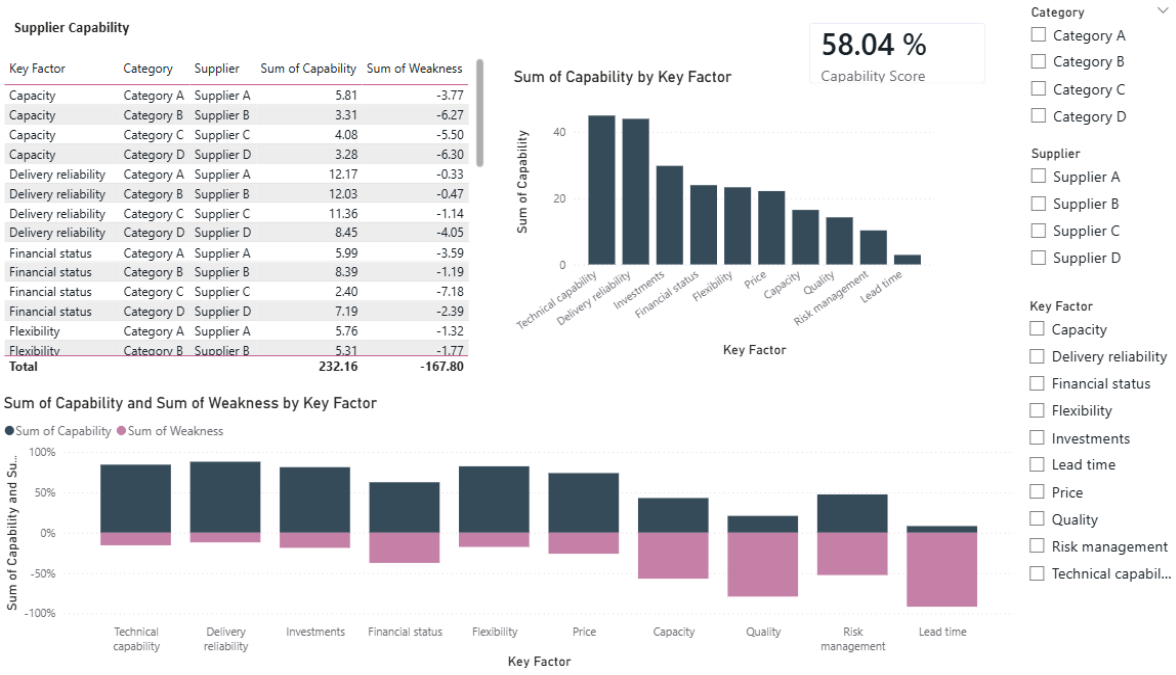
As the last question of the survey, suppliers are asked an open-ended question "What support or actions from us would help you improve your capability?", which can be answered voluntarily. Three out of four suppliers answer the question, which means that the response rate is 75%.

All respondents state that they would like to see more reliable and accurate forecasts from Case Company. One of the respondents would also like to have a longer lead time.

4.4 PowerBI data results and analysis

The Power BI report was created using the Power BI Desktop app. According to Arnold (2022, p. 2), Microsoft Power BI is a data analysis and visualization tool that can be used to produce interactive reports from data.

The data was first processed in Excel and then transferred to Power BI. As shown in Picture 1, the data is visualized on a single page. The page summarizes capability and weakness results by key factors. The table on the left displays the aggregate values "Sum of Capability" and "Sum of Weakness" for each supplier within a category and key factor. The bar chart "Sum of Capability by Key Factor" highlights which key factors contribute most to the overall capability score, while the lower chart shows both capability and weakness by key factor, where weakness is displayed as negative values



Picture 1. Power Bi visualization.

Power BI calculates a capability score for each supplier on a scale from 0 to 100%, where 100% represents the best performance. This study is limited to the year 2025; therefore, Picture 1 presents result only for 2025. If more extensive data were available, a time-range filter could be added to the report to enable analysis across multiple years.

4.5 Summary of the key results

This chapter presents the key results of the analysis of the empirical data and examines the similarities and differences between the data through systematic comparison.

An internal survey shows that the basis for assessing supplier capability is in order. The process is mainly perceived as clear, the assessment model is consistent, and the indicators used are objective and comparable. The biggest area for development is related to data. It is considered difficult to combine and compare information from different source systems, which leaves the overall picture of the supplier's performance fragmented and reliability suffers. Based on this, the effectiveness of the assessment would be

significantly improved if the data were standardised, integrated and quality assured systematically.

The survey also confirms that the most important key factors of an organisation's supplier capability are quality, delivery reliability and technical capability, while price is only ranked fourth and the financial situation is fifth. In the supplier-specific assessments, the respondents' views support the interviews, such as the poor financial situation of supplier C and the strong investments of supplier B are consistently reflected in both datasets. Above all, the Power BI report is expected to provide visibility that supports practical decision-making. The key reporting indicators are delivery reliability, quality, price and capacity. The report is felt to bring the most value to foresight, building development plans with suppliers, as well as evaluating new suppliers and identifying early warning signals.

In a survey targeted at supplier, suppliers rated their ability to serve Case Company as high, with an average rating of 4.25/5. The strengths of the suppliers were good cooperation with R&D and procurement, quick reaction and flexibility. The bottlenecks varied from supplier to supplier and were related to the availability of materials, recruitment challenges and, in some cases, production slowdowns.

Regarding capacity data, the inconsistency of measurement and reporting can be seen. Only some suppliers were able to provide numerical figures, and some reported that capacity calculations were incomplete or changing. Despite this, suppliers felt that flexibility was good and responsiveness was strong. The key KPIs were delivery reliability, number of notifications and order volume.

In the future, all suppliers are planning to invest in machinery and increase the number of employees. The development priorities focused on quality and price, and sudden changes and challenges in supply chain were mentioned as factors affecting delivery

capacity. The clearest request from suppliers to Case Company was for more accurate and reliable forecasts.

Based on the interviews, the assessment of the supplier capability of the procurement organisation is largely established, as suppliers are monitored with KPIs and guided through active dialogue. Capacity, technical expertise, quality and delivery reliability were identified as key components of capability, but at the same time, it was emphasised that the overall picture is complemented by observations, such as supplier visits and the general impression of the production environment. The service attitude of the suppliers was mainly seen as good and the willingness to invest was significant, which is directly linked to financial stability and the ability to maintain and increase performance.

The biggest development needs and risks are related to capacity management and data reliability. Suppliers are operating almost at full capacity, the impact of investments can be seen with a delay due to long machine delivery times and induction, and some suppliers are unable to calculate their capacity accurately enough. In addition, capacity risks also arise internally if different categories buy from the same supplier without common visibility. In terms of quality, it was found that there are deviations, but the current reporting does not distinguish between the severity of errors, which can distort the prioritization of the supplier image and development activities. The Power BI report was seen as a useful support for decision-making, but its success requires consistent and up-to-date data. The report can support cooperation, but it is not a substitute for continuous supplier communication.

Based on the data obtained, a Power Bi report was created, which compiles the examination of supplier capabilities into one clear view. The report presents capabilities and weaknesses by key players and suppliers. A single-page structure aggregated "Sum of Capability" and "Sum of Weakness" values, and graphs that break down capability drivers at the key factor level support quick situational awareness and comparison. Showing weaknesses as negative values improves interpretability and helps to identify which

factors should be targeted with development measures and in which suppliers the risks or shortcomings are highlighted.

However, a key limitation is related to the temporal coverage of the data, as the analysis is limited to 2025, the report describes the performance of suppliers primarily as a cross-sectional view and does not allow for a reliable assessment of trends or the impact of development actions in the longer term. The analytical value of the report would increase significantly if data were accumulated over several years and a time limit was added to the view, so that changes could be monitored, permanent problems could be separated from individual deviations, and decision-making could be supported in a more long-term manner. In addition, the usefulness of the report in practical guidance depends on keeping Excel preprocessing and the Power BI model maintainable and the data up to date.

5 Discussions and Conclusions

This chapter presents the key results of the study and evaluates how they answer the research questions posed at the beginning of the study. In addition, the chapter presents conclusions based on both the findings of the literature review and the analysis of empirical data. The last section of the chapter highlights the key limitations of research and makes recommendations for future research.

5.1 Discussions

RQ1: How can supplier capabilities be assessed to effectively manage risks in the supply chain?

The results of the study support the literature on supplier evaluation, according to which the supplier's capability should be assessed through several dimensions and not rely on just one indicator. The classic supplier selection survey and subsequent reviews repeatedly identify quality, delivery reliability and capacity as key criteria, often supplemented by technical capability and financial position, as these dimensions together determine whether a supplier can meet requirements consistently and at an acceptable level of risk (Dickson, 1966; Weber et al., 1991; de Boer et al., 2001; Ho et al., 2010). From the perspective of risk management, this multidimensional logic is in line with the ISO 31000 framework, where risk management is seen as a structured and iterative process: risks are identified, analysed, assessed, processed and monitored instead of decision-making based on individual ad hoc assessments (ISO, 2018). In addition, the theory of dynamic capabilities justifies the inclusion of predictive indicators in the assessment, because decision-making in uncertain operating environments should also take into account signals describing future readiness, such as investment capacity, availability of capacity and the supplier's own risk management practices and not rely solely on historical performance (Teece et al., 1997; Teece, 2007).

Empirically, the results largely confirm these theoretical expectations. Based on interviews, an internal survey, supplier surveys and Power BI-based KPIs, quality, delivery reliability and capacity emerged as the most critical capability dimensions in terms of risk management. In practice, weaknesses in these areas manifested themselves as delivery delays, quality variability, resource shortages and an increased likelihood of production interruptions, which suggests that operational risk is closely linked to the supplier's capabilities. The results also highlight the importance of financial stability and investment readiness, as differences in suppliers' financial situation and investment activity were related to differences in capacity development and security of supply. This is in line with the literature, which emphasizes the importance of capability development and resilience in conditions of uncertainty (Manuj & Mentzer, 2008; Tang, 2006).

The key added value of this study is that it specifies how risk-relevant capability assessment becomes more reliable when information is combined from multiple sources. KPI data mainly produces lagging, historical performance indicators, while interviews and surveys reveal qualitative risk information about collaboration practices, processes, and constraints that may not be reflected in system data. This supports the ISO 31000 view that effective risk management requires systematic identification and monitoring, but at the same time, the results show that the practical challenge is often the fragmentation of data between different systems and roles. From the perspective of the theoretical framework, this is directly related to the sensing and monitoring dimensions: integrated reporting improves the ability to detect weak signals and emerging risks at an early stage. The Power BI-based capability view illustrates how weighted metrics and visual vendor-specific comparisons can support earlier risk detection and more consistent assessment, which is in line with BI and analytics research, which emphasizes the role of analytics as an enabler of evidence-based decision-making (Chen et al., 2012; Trieu, 2017).

Finally, the results show that data-driven assessment supports, but does not replace, relational capital in supplier risk management. The interviewees emphasized that continuous dialogue, supplier visits and regular interaction are still essential in interpreting

signals, verifying the situation behind the indicators and implementing corrective actions. This is in line with the relational perspective, which emphasizes that routines and control mechanisms between organizations complement analytical evaluation in performance and risk management. Overall, the results suggest that supplier capability assessment serves as an effective risk management tool when it is structured, multi-sourced, and linked to continuous monitoring practices and collaboration routines, combining systematic risk logic (ISO 31000), dynamic capability development, and digitalized decision-making support.

These results confirm previous research that the assessment of supplier capability should be multidimensional and systematic to reduce subjectivity and improve the comparability of suppliers (de Boer et al., 2001; Ho et al., 2010). The results also complement the previous literature by showing that the key practical obstacle is not the lack of metrics but the fragmentation of information into different systems and roles, and that a compiled BI view can strengthen early risk identification and consistent supplier comparison (Chen et al., 2012; Trieu, 2017). The results do not contradict the previous literature, but elaborate on it by showing that risk-relevant capability assessment improves when quantitative KPIs and qualitative data are combined and the assessment is linked to continuous collaboration routines (ISO, 2018; Teece, 2007)

RQ2: What are the key factors influencing supplier capability, and how do they impact supply chain performance?

The results show that a supplier's capabilities consist of several interconnected operational, financial, technical and relational factors, which together determine the performance, stability and risk of the supply chain. This is in line with the literature, which understands supplier capability as a multidimensional entity and emphasizes that performance and risk levels are determined by both capability characteristics and actual operational performance (de Boer et al., 2001; Ho et al., 2010). Quality and process capability became key factors, as quality variation increases process variability and

weakens the reliability of material flows. Such quality-related instability reduces predictability and increases operational risk, which is in line with the study, which emphasizes the spread of disruptions and reliability issues in the network and impairing overall performance (Christopher & Peck, 2004; Tang, 2006).

Another critical factor is security of supply and the reliability of deliveries, which the literature links to resilience and continuity. Empirical data supports this, as delivery deviations and delays were key risk factors between suppliers and they were described as having a direct impact on production planning, inventory level management, and the reliability of customer deliveries. This is in line with supply chain risk management research, where delivery capability and continuity are seen as key exposure points, especially in uncertainty and disruption risks (Manuj & Mentzer, 2008; Tang, 2006). Capacity and the availability of resources were highlighted as particularly important drivers of capability. The results suggest that suppliers operating at almost full load react less to changes and are more likely to experience delivery delays. Capacity-related constraints, such as long machine delivery times, material shortages and a shortage of skilled labour, weakened supplier performance. This finding supports previous research linking capacity constraints to significant supply risk and susceptibility to disruptions (Manuj & Mentzer, 2008; Ho et al., 2015).

Financial stability and investment ability also had a strong impact on the supplier's capabilities. Empirical observations showed that the weaker economic situation was related to delays in investments, challenges in the availability of materials and weaker security of supply, which increased susceptibility to disruptions. This supports a capability-driven logic in which financially stable suppliers can maintain and develop processes, capacity and technology, which strengthens long-term continuity. From the perspective of the theoretical framework, this is in line with the resource-based view, in which economic stability and technological capability can be interpreted as strategic resources that affect performance and resilience (Barney, 1991). Technical expertise and the ability to develop processes also distinguished suppliers: differences in machinery, measurement practices

and development capabilities were reflected in quality and delivery reliability. This is in line with the RBV view, which sees technology and competence as key resource bases for performance, and at the same time supports the view that capability development strengthens resilience in the face of uncertainty (Barney, 1991; Tang, 2006).

Risk management practices also formed an important capability dimension. Supplier inquiries highlighted deficiencies, such as material dependencies and weak capacity calculation practices, which increased the overall risk level. This complements the structured risk management view by demonstrating that supplier capability is not only about operational execution, but also about practices and routines for anticipating and mitigating risks. This is in line with the logic of systematic risk management, where identifying, analysing and monitoring risks are necessary to reduce both probability and impact (ISO, 2018).

Finally, both the theory and the data emphasize the importance of cooperation and communication in terms of capability and performance. Open and proactive communication and regular interaction enabled faster problem solving and reduced operational disruptions. This supports a relational perspective in which relational capital, control routines, and information sharing across company boundaries complement analytical evaluation and shape performance and risk (Dyer & Singh, 1998; Jääskeläinen et al., 2021). In addition, the dynamic capabilities perspective helps explain the importance of these factors in uncertainty: the ability to interpret signals, prioritize actions, and modify routines and resources supports maintaining performance in the face of changing circumstances (Teece et al., 1997; Teece, 2007).

In summary, the study suggests that a supplier's capabilities are primarily determined by quality, delivery reliability, capacity, financial stability and investment readiness, technical expertise, risk management practices and relational capability. These factors affect supply chain performance through operational stability, responsiveness, continuity and resilience. The results strengthen the previous literature and support the framework of

the thesis by showing that the capability of a supplier cannot be understood on the basis of historical KPIs alone, but in addition to operational indicators, proactive capability signals and relational routines are needed to support early detection and effective response.

The results reinforce the previous literature by showing that supplier capability is a multidimensional entity in which quality, delivery reliability, capacity, and economic and technical factors are directly linked to supply chain performance and risk level (de Boer et al., 2001; Ho et al., 2010; Tang, 2006). The results also complement previous research by prominently highlighting that relational factors such as interaction, information sharing, and collaborative routines are not mere supporting factors, but in practice affect the ability to detect, interpret, and solve problems and manage risks (Dyer & Singh, 1998; Jääskeläinen et al., 2021; Teece, 2007). The results do not contradict previous literature but elaborate on it by showing that supply chain resilience and susceptibility to disruptions consist of both performance factors and systematic risk management practices and continuous monitoring (Manuj & Mentzer, 2008; ISO, 2018).

RQ3: How can supplier capability data be used to improve decision-making in supplier selection and management?

The results of the study show that supplier capability information can support decision-making in both supplier selection and supplier management, especially by increasing comparability, transparency and predictability. This is in line with the literature on vendor evaluation, which emphasizes that decision-making benefits from a structured and multi-criteria approach, as vendor evaluation involves multiple concurrent criteria and trade-offs (de Boer et al., 2001; Ho et al., 2010). At the same time, data-driven assessment reduces subjectivity when criteria and their weights are made visible and systematically monitored (de Boer et al., 2001; Ho et al., 2010).

The empirical data concretized this: the Power BI-based dashboard enabled the comparison of suppliers with the help of weighted KPIs, and both the internal respondents and

the interviewed experts felt that the visualized data increased the transparency and reliability of decision-making. Comparable metrics, such as security of supply, quality, capacity, and financial situation, help identify differences between suppliers and detect risky suppliers at an early stage. This supports the idea that capability information can be used in supplier selection both to highlight the development needs of suppliers and to justify the position of selected suppliers in decision-making.

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The results also show that suppliers perform differently in different areas, and capability data helps identify which suppliers are critical and require closer monitoring, and which are better suited for lower-risk materials or volumes. This is in line with the literature, which emphasizes the role of capability data in risk-based supplier segmentation and monitoring targeting (Manuj & Mentzer, 2008; Ho et al., 2015). In addition, this supports the risk management perspective, where monitoring and prioritisation are key practices in continuous risk management (ISO, 2018).

A significant observation is that the information obtained from suppliers' self-assessments complements quantitative KPI data and improves decision-making by highlighting constraints and risks that are not visible in the system data. The suppliers' responses revealed, for example, material shortages, personnel challenges and uncertain capacity calculation methods that could not have been identified from KPIs alone. This supports the view that the most effective decision-making is based on a combined knowledge

base, where quantitative monitoring is complemented by interactive evaluation and contextual insight from suppliers.

The results also highlight the importance of visualisation and accessibility for the effectiveness of decision-making. Gathering capability information into a single reporting view speeds up the formation of a situational picture, facilitates the identification of differences, and especially supports the early identification of risks, the assessment of new suppliers and the prioritisation of development measures. This is in line with the BI and analytics literature, which emphasizes that the value of analytics comes from transforming distributed data into a format that is usable and understandable for decision-making (Chen et al., 2012; Trieu, 2017).

From the perspective of the theoretical framework, the utilisation of capability data is particularly related to dynamic capabilities. Integrated and visualized data supports the sensing dimension by improving the detection of weak signals and the early identification of risks, and the seizing dimension by supporting the prioritization of decisions and the allocation of resources based on visible capability gaps (Teece, 2007). The transformation dimension is reflected in the fact that the recommendations of the study are aimed at redesigning operating methods and reporting: harmonising indicators, combining data and establishing evaluation as part of continuous supplier management. In this way, capability data does not remain just reporting but is linked to process development and risk management routines (Teece et al., 1997; ISO, 2018).

Finally, the results show that data-driven assessment supports, but does not replace, relational capital. The interviewees emphasised the importance of continuous dialogue, supplier visits and regular interaction, as they help to interpret the situation behind the indicators and ensure that the measures are correctly targeted. This is in line with the relational perspective, which emphasizes the role of routines and control mechanisms that extend across company boundaries in the management of performance and risk (Dyer & Singh, 1998; Jääskeläinen et al., 2021).

In summary, supplier capability information improves decision-making by providing a more objective, comparable and up-to-date basis for supplier evaluation and development. It enables risk-based segmentation, identification of critical suppliers, targeting of development measures and the building of strategic partnerships. The results support the view of both the literature and the work framework that effective decision-making requires a combined knowledge base in which operational indicators, predictive capability signals and relational collaboration routines work together to strengthen supply chain performance and resilience.

The results can be interpreted through a frame of reference through four mechanisms. First, sensing is reflected in the fact that weak signals that anticipate risks are better detected when KPI monitoring, supplier self-assessments, and observations from internal experts are combined into the same view (Teece, 2007; Chen et al., 2012; Trieu, 2017). Secondly, seizing manifests itself in practice as prioritization of decisions: weighted, comparable indicators help to make trade-offs visible and to target supplier selection, segmentation and development measures based on capability gaps (Teece, 2007; Ho et al., 2010; ISO, 2018). Thirdly, transformation is related to the fact that assessment and reporting are proposed to be standardised as part of operations, for example through the harmonisation of indicators and monitoring practices, in which case decision-making routines and supplier management practices are modified more permanently (Teece et al., 1997; ISO, 2018). Finally, relational capital is reflected in the fact that indicators alone are not enough, but dialogue, supplier visits and routines between organisations are necessary for successful interpretation and implementation (Dyer & Singh, 1998; Jäskeläinen et al., 2021).

5.2 Conclusions

This study examined how supplier capability assessment can be developed into a more structured and data-driven approach that supports risk management and decision-making in supplier selection and management. Firstly, the study shows that the capabilities

of suppliers should be assessed as a multidimensional entity that combines operational, technical, financial and risk management dimensions. Based on the empirical results, quality, security of supply and capacity are the most critical capability dimensions for supply continuity and operational risk management, while financial stability and investment readiness explain the differences between suppliers in the development of long-term capabilities. This supports the study of supplier evaluation, which emphasizes multi-criteria evaluation and structured comparison of suppliers (Dickson, 1966; Weber et al., 1991; de Boer et al., 2001; Ho et al., 2010). At the same time, the observation is in line with the logic of systematic risk management, in which the identification, analysis, processing and monitoring of risks require an iterative and transparent assessment process instead of individual ad hoc assessments (ISO, 2018).

Secondly, the study shows that the key challenge of capability-based risk management is not the lack of indicators, but the fragmentation of information between different systems and roles. In the case company, information on suppliers' performance and capability signals was scattered in several places, which weakened comparability and made it difficult to form an overall picture of risk exposure. Based on the results, decision-making improves when capability information is compiled into a common view that supports continuous monitoring and helps detect early warning signals. The Power BI-based capability view developed in this study illustrates how weighted indicators and visual comparisons can increase transparency and support the early identification of vendor-related weaknesses. This is in line with the BI and analytics literature, which emphasizes that the value of analytics is created when distributed operational data is transformed into information that is relevant, easily accessible and interpretable for decision-making (Chen et al., 2012; Trieu, 2017).

Thirdly, the study shows that data-driven assessment supports decision-making most effectively when it complements supplier cooperation and expert judgement and does not seek to replace them. Empirical findings show that supplier self-assessments and insights from internal experts highlighted risks and constraints that KPI data alone did not make

visible, such as material dependencies, staffing constraints, and challenges in capacity calculation. At the same time, the interviews emphasised that continuous dialogue, supplier visits and regular interaction are essential for interpreting the situation behind the indicators and for implementing development and corrective measures. This supports the view that effective supplier management is built on both analytical monitoring and cooperation routines that enable interaction and joint development.

The study provides a practical example of how fragmented supplier indicators can be integrated into a structured capability assessment that supports risk-informed decision-making. The results suggest that supplier capability assessment strengthens supply chain performance and resilience when it is multi-sourced, systematic, and linked to continuous monitoring and collaboration routines. From a practical point of view, the study emphasizes that unified metrics, shared visibility through reporting, and proactive interaction with suppliers together form a more reliable basis for supplier selection, risk-based segmentation, and targeted supplier development.

5.3 Managerial implications

The results of the study provide several practical conclusions that can be utilized. Case company's current challenges in supplier management and strategic decision-making focus on a few different things.

The results of the study show that an organization should prioritize data-driven supplier management. Leveraging Power BI reporting and visualization allows you to benchmark vendors, track performance trends, and identify risks early. From a case company's point of view, this means that decision-making, such as supplier selection, volume allocation or targeting development measures, can be based on objective data instead of subjective assessment. Visual tools also support collaboration within the organization, as they facilitate the sharing of information between different units and stakeholders.

The study also highlights a clear need to strengthen supplier segmentation. Capability data enables supplier classification based on risk and performance, which supports both resource allocation and the building of strategic partnerships. Segmentation helps to identify suppliers with whom cooperation should be intensified, but also those whose risk level requires the development of alternative suppliers or a change in procurement strategy. From the case company's point of view, this improves the long-term stability of the supply chain and reduces dependence on poorly performing suppliers.

Finally, the study emphasizes the need to develop the case company's internal processes and data availability. The empirical data showed that dispersed data and hard-to-access information sources slowed down the identification of risks and weakened the quality of the assessment. The case company should therefore promote data integration and ensure that information on supplier performance is easily accessible and up to date. A clear process model in which data is collected, updated, and reported systematically improves operational efficiency and supports management's ability to make consistent and well-founded decisions.

5.4 Limitations and future research

The main limitations of the study are that the study was carried out in the context of a single case company, and the review was limited to four suppliers. In addition, quantitative performance data analysis will only cover one-year 2025, which is why no development or historical trends can be estimated. In addition, not all the capability factors identified in the interviews were available from numerical data, but some of the observations are based on interview and survey data.

The credibility of data is particularly affected by factors related to measurement and comparability. If all quality deviations are weighted equally in the statistics, regardless of the severity of the deviation, the indicator does not describe the actual quality situation, but the measurement may be distorted, because of which small and critical errors are treated as equal. As a result, the supplier's "quality" may appear better or worse than

reality. In addition, in single-source situations where the supplier is the sole supplier of the material, KPI comparison can reward the supplier because there is no comparison setting. In this case, the scoring can give full marks without a real competitive benchmark, which weakens the validity of the comparison.

In further research, the generalizability of the study can be strengthened by expanding the sample to several suppliers and by implementing a comparison setting in several case companies. This would make it possible to assess whether the identified capability factors and risks are company- and industry-specific or more generally applicable. In addition, the review period should be extended to several years so that the development of supplier capabilities and the effects of development measures can be analysed through trends and not just as a one-year cross-sectional view.

From the perspective of reporting and data utilisation, further research could focus on the development of data integration, indicators and scoring logic. The value of a Power BI report in operational management would increase if the data could be filtered to a monthly level and if the data model supported automatic refresh. In addition, the persistent identifiers SupplierID, FactorID, and composite key, such as SUP001KF1 that appear in Table 5 can be used to promote the unification of the data in the data model, so that the data in the report can be combined with other databases and systems that use the same IDs. The interpretability of the scoring can be improved by considering single-source situations separately and by developing quality metrics so that the severity and impact of the deviations are distinguished. In addition, regarding capacity, further research could develop a standardised calculation method and validation practices to make supplier capacity information comparable and supportive of forecasting.

Table 5. Persistent identifiers from supplier capability Power BI report.

SupplierID	FactorID	SupplierID FactorID
SUP001	KF1	SUP001KF1
SUP001	KF2	SUP001KF2

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Appendices

Appendix 1. Survey questions and responses from suppliers

1. Company name
2. How would you rate your current capability to meet our requirements? (Poor / Fair / Good / Very good / Excellent)
3. What are your main strengths in working with us?
4. What are your current limitations or bottlenecks?
5. What is your calculated production capacity (e.g., units/month) and current utilization (%)?
6. How flexible is your production capacity? (1 = No flexibility … 5 = Very high flexibility)
7. How quickly can you respond to sudden order changes? (Very slowly >4 weeks … Very quickly < 3 days)
8. Which three KPIs best represent your current performance (e.g., on-time delivery %, defect rate, lead time)?
9. What actions are you planning in the next 12–24 months to improve your capability? (Quality / Lead time / Flexibility / Risk management / Cost efficiency / Sustainability / Other)
10. Which areas are your top priorities for improvement?
11. What factors most influence your ability to deliver (positively or negatively)?
12. How do you manage risks that could impact your delivery capability?
13. What support or actions from us would help you improve your capability?

Appendix 2. Interview questions for strategic purchasers and supplier development engineers

1. What is your role in supply management?
2. How closely are you involved in supplier evaluation or development?
3. Which supplier are you working with?
4. Please briefly describe the supplier's products and their role in your company.
5. What are the key strengths of this supplier in terms of capacity and capability?
6. What are the main development needs or risks (e.g., quality, delivery reliability, financial issues)?
7. How do you expect this supplier's capability to develop over the next 12–24 months?
8. How do you expect the collaboration with this supplier to develop over the next two years?
9. What metrics or data are available for this supplier, and how up-to-date are they?
10. What actions do you expect the supplier to take to improve their capability?
11. How do you determine whether the supplier's capability is under control?
12. Has there been discussion with the supplier regarding their potential flex capability?
13. In your opinion, what factors are the most important when assessing a supplier's capability?

14. How could a Power BI–based report support decision-making and risk management?
15. What challenges do you foresee in implementing or maintaining such a report?
16. How frequently should the report be updated to remain useful?
17. For what types of decisions would a capability dashboard provide the most support?

Appendix 3. Survey questions and responses for SPs and SDEs'

1. Role (Strategic purchaser / Supplier development engineer)
2. Which supplier do you work with? (A, B, C, D)
3. Please rate the current way of working (Supplier capability evaluation is clear and consistent).
4. Please rate: The available data provides a reliable view of supplier capability.
5. Please rate: It is easy to combine and compare data from different sources.
6. Please rate: Supplier evaluation is based on objective and comparable metrics.
7. Rank the following factors in importance when assessing supplier capability (1=Most important, 10=Least important): Technical capability, Delivery reliability, financial status, Quality, Flexibility, Lead time, Future investments, Risk management, Capacity, Price.
8. Rate the following aspects for your supplier (1 = Poor, 5 = Excellent): Quality, Risk management, Delivery reliability, Price, Lead time, Response speed, Service attitude, PCPA result, Documentation, Capacity, Flexibility, Technical Capability, Financial status, Dependency (how dependent case company X is on supplier Y), Location, Future investments.
9. Which three metrics would you choose to represent supplier capability in a Power BI report?
10. How could the capability report best support your role in supplier management?
11. How useful would you consider a Power BI report that monitors supplier capability? (1–5 scale)