Designing a System for Supplier Performance Evaluation: Bridging Organizational Needs, External Demands, and Literature Insights

A case study of a distributing company

By

Matilda Ahl

Nora Hedin

Supervisor: Eva Berg

Examinator: Louise Bildsten

Master Thesis

Department of Mechanical Engineering Sciences

Division of Engineering Logistics

Faculty of Engineering - LTH

Lund University

June 2024

Abstract

Title: Designing a System for Supplier Performance Evaluation: Bridging Organizational Needs, External Demands, and Literature Insights

Authors: Matilda Ahl and Nora Hedin

Contribution: This thesis has been a complete elaboration between the two authors. Each author has been involved in every part of the process and contributed equally.

Supervisor: Eva Berg, Faculty of Engineering - Lund University

Examiner: Louise Bildsten, Faculty of Engineering - Lund University

Background: Purchasing and Supplier Relationship Management are becoming increasingly important as companies' competitiveness increases. One part in this is Supplier Performance Evaluation (SPE), which is part of the final step in the purchasing process and can be performed in many different ways. SPE can ensure that suppliers are performing as expected and when not, actions can be taken. When measuring the suppliers' performance the buying company will understand what areas can be improved and what is working well in the cooperation with the supplier. This study aims to explore how different options of SPE could apply to the case company and how they should best design their SPE process.

Purpose: This thesis aims to design an SPE system that aligns with external demands, insights from literature, and the goals, limitations, and requirements set by the Company.

Methodology: This is a holistic, single case study using an abductive research approach.

Findings: The findings in this thesis include a recommendation for how the Company's SPE system should be designed. The Company is recommended to implement a supplier scorecard with incorporated weights based on the importance of the specific metrics. The metrics that should be included in the supplier scorecard are; service level - delivery date, service level - quantity, percent complaints, number of product deviations, percent non-conformance, cassations, and spend per supplier. The suppliers should be divided into groups based on their performance, and actions should be taken based on the group the supplier belongs to. The supplier scorecard should be created in Power BI and follow numerous specifications, for example, the possibility to filter the results per supplier and translate the pre-defined threshold values to a score between 1 and 5.

Key words: Supplier Performance Evaluation, Supplier Performance Evaluation Approach, Supplier Performance Evaluation Metrics, Strategic Purchasing

Sammanfattning

Titel: Design av ett system för leverantörsuppföljning: Överbrygger organisationsbehov, externa krav och insikter från litteraturen.

Författare: Matilda Ahl and Nora Hedin

Bidrag: Detta examensarbete är resultatet av ett samarbete mellan författarna. Båda författarna har varit med i alla delar i processen och bidragit till lika delar.

Handledare: Eva Berg, avdelningen för teknisk logistik, LTH - Lunds universitet

Examinator: Louise Bildsten, avdelningen för teknisk logistik, LTH - Lund University

Bakgrund: Inköp och hantering av leverantörsrelationer blir allt viktigare i takt med att företags konkurrenskraft ökar. Leverantörsuppföljning utgör en del av det sista steget i inköpsprocessen och kan utföras på flera olika sätt. Leverantörsuppföljning säkerställer att leverantörer presterar som förväntat, och att korrekta åtgärder vidtas när de inte gör det. Genom att följa upp leverantörers prestation kan det inköpande företaget förstå vilka områden som kan förbättras, och vad som fungerar bra i samarbetet med leverantören. Denna studie ämnar att utforska hur olika alternativ för leverantörsuppföljning kan tillämpas på det aktuella företaget och hur de bäst ska utforma sin leverantörsuppföljningsprocess.

Syfte: Syftet med detta examensarbete är att designa en process för leverantörsuppföljning som uppfyller externa krav, insikter från litteraturen, och företagets mål, krav och begränsningar.

Metod: Detta är en holistisk fallstudie där en abduktiv forskningsmetod har använts.

Resultat: Resultaten i denna rapport inkluderar rekommendationer för hur företagets leverantörsuppföljningssystem bör utformas. Företaget rekommenderas att införa ett "scorecard" som inkluderar vikter som speglar viktigheten av de olika mätvärdena. De mätvärden som bör ingå i "scorecardet" är; servicegrad - leveransdatum, servicegrad - kvantitet, procent reklamationer, antal produktavvikelser, procent mindre avvikelser, kassationer och pengar spenderade per leverantör. Leverantörerna bör delas in i grupper baserat på deras prestation, och lämpliga åtgärder bör vidtas baserat på vilken grupp leverantören placerats i. "Scorecardet" bör skapas i Power BI och följa fördefinierade specifikationer, exempelvis möjligheten att filtrera resultaten per leverantör samt att översätta de fördefinierade tröskelvärdena till en poäng mellan 1 och 5.

Acknowledgements

Contents

List of Figures

List of Tables

Acronyms

AHP Analytical Hierarchy Process. 15, 16

BRCGS British Retail Consortium Global Standards. 2, 3, 31, 45, 51–53, 56, 57, 67, 86, 92–95, 102

CEO Chief Executive Officer. 56

COO Chief Operating Officer. 3, 18, 51, 54, 56, 57

CRM Customer Relationship Management. 55, 59, 89

FMCDM Fuzzy Multi-Criteria Decision Making. 35

KPI Key Performance Indicator. 51

MCDM Multi Criteria Decision Making Model. 35

MCPM Multi-Criteria Performance Measurement. 31

PMO Project Management Office. 3, 5

SCM Supply Chain Management. 1, 36

SMART Simple Multi-Attribute Rating Technique. 14, 31, 34, 44, 73, 74

SPE Supplier Performance Evaluation. i, ix–xi, 1–6, 10–21, 26, 27, 29–32, 34–48, 50, 52–56, 58–60, 62–73, 75, 76, 78–84, 86, 87, 89–99, 101–103

SPM Supplier Performance Measurement. 36

SRM Supplier Relationship Management. 1, 30, 101

TOPSIS Technique for Order of Preference by Similarity to Ideal Solution. 14, 26, 31, 35, 44, 46, 69, 71, 74

UoA Unit of Analysis. 10, 11

Chapter 1

Introduction

This chapter covers the background of the master thesis, as well as an introduction to the case company. The research objectives, the purpose, the delimitations, and the target group will also be stated. It ends with an overview of the report structure.

1.1 Background

According to Van Weele (2014), purchasing and Supply Chain Management (SCM) are becoming increasingly important as companies' competitiveness increases. One part of this is Supplier Relationship Management (SRM), which O'Brien (2022) highlights as essential for organizations to ensure competitiveness and success. SRM is a broad term used to describe the relationship between a supplier and buyer, in terms of for example evaluation of service delivered and cooperation between the parties. The term includes, for example, supplier performance measurement, supply chain management, and strategic collaborative relationships.

The purchasing process can be described in six steps: determining specifications, selecting suppliers, contracting, ordering, expediting and evaluation, and follow-up and evaluation (Van Weele 2014). The sixth and final step includes, for example, supplier rating and supplier evaluation, which can be performed in different ways. (Van Weele 2014)

O'Brien (2022) describes Supplier Performance Evaluation (SPE) as an important business measure impacting many functions in a company. Therefore, it is important to analyze how the suppliers' performance aligns with internal goals and take actions where they are not performing as expected (O'Brien 2022). According to Gordon (2008) some companies tend to focus only on measuring the cost of the goods purchased in their SPE, though there are several other important factors to consider as well. When measuring the suppliers' performance the buying company will understand what areas can be improved and what is working well in the cooperation with the

supplier. (Gordon 2008)

Businesses selling food and food-related products have high pressure from governments and consumers to ensure their products are safe. This has led to increased use of quality assurance systems, which control the quality of the products and ensure their safety. (Trienekens & Zuurbire 2008) One company conducting quality assurance standards issuing certifications is British Retail Consortium Global Standards (BRCGS) that provides standards in nine different categories. (BRCGS n.d.*a*) One of the categories is called Storage and Distribution and has companies certified in over 50 countries operating in everything from retail to primary production. The standard is applicable to companies with supply chain operations handling food, packaging, and consumer products. The Storage and Distribution standard contains, among other terms, requirements of the companies performing and documenting regular evaluation of their suppliers and taking action when the established criteria are not met by the suppliers. (BRCGS n.d.*b*)

According to the BRCGS standard there are no directions on how the SPE system should be designed, and since there are many ways of performing an SPE there is no one way of doing it. In this thesis, the authors aim to explore how different options of SPE could apply to the case company and how they should best design their SPE process.

In conclusion, SPE is important both to ensure that suppliers perform as expected and to receive several certificates. There is literature available describing how SPE can be performed, as well as how different evaluation approaches can be combined. At the same time, there are very few use cases to rely on when studying the problem, especially applied to distributing companies, or companies in the food industry. This thesis aims to bridge the knowledge gap by applying theoretical knowledge to a real-life problem.

1.2 Case Company

This master thesis will be a case study of a company, which is a part of a large conglomerate. Due to privacy policies, the real name of the company studied in this master thesis can not be revealed. Therefore, the authors will refer to the case company as "the Company" and the group it is a part of as "the Group" in this report.

1.2.1 Company Presentation

The master thesis will be written in cooperation with the Company, a distributor of food and food-related products. The Company is part of a group that consists of companies within different industries.

The Company is a mid-size company whose operations area is led by the Chief Operating Officer (COO) and includes Strategic Purchasing, Supply Chain, Innovation, Quality and Environment, Market, Warehouse, and the Project Management Office (PMO). The PMO consists of four employees who work with both short- and long-term projects aimed to increase the Company's strategic position on the market and to meet their strategic goals. Their main focus is to improve the daily operations of the Company.

1.2.2   Problem Description

The Company and the Group are certified according to the BRCGS Storage and Distribution standard, which requires the Company to have a process documented for an ongoing assessment of approved suppliers. Previously the Company has had an SPE system designed as a supplier scorecard, but when the business system was changed a couple of years ago this routine was lost. During a recent audit, conducted yearly by an external party, the Company received a deviation due to them missing a clear routine for evaluation of their suppliers of food and non-food articles. Since they need to meet this standard, the Company has created a temporary system that technically fulfills the requirements but does not take advantage of all the data they have and the possibilities a well-developed SPE system could give.

The current system is an Excel sheet where information about suppliers is filled in by the Head of Strategic Purchasing. The information collected in the Excel sheet is the quality (deviations and complaints), delivery security, and amount of non-conformities at delivery. Two subjective scores are also included, consisting of a qualitative assessment conducted by the operational and strategic purchasers. The Excel sheet is filled in once per year and this makes it impossible to follow up supplier performance on a regular basis.

The need for an enhanced system for SPE is an issue that the Company wants to prioritize and they therefore want to support the authors in writing this master thesis.

1.3   Purpose

The purpose of this thesis is to design a system for how the Company should evaluate the performance of its suppliers of direct material to align with company preferences, literature insights, and external requirements.

1.4   Research Questions

RQ1. How does the Company currently evaluate its suppliers?

    (a) What evaluation approach is used?

    (b) What metrics are included?

    (c) How are the results used to follow up on supplier performance?

RQ2. What requirements and preferences should the system meet?

    (a) What do the employees request?

    (b) What does the literature say?

    (c) What external requirements need to be fulfilled?

RQ3. How could the Supplier Performance Evaluation system be designed to align with the identified requirements and preferences?

    (a) What evaluation approach should be used?

    (b) What metrics should be included?

    (c) How should the system be implemented in the organization?

1.5   Delimitations

The key delimitations for the thesis' scope are:

1. The BRCGS standard that the Company is certified according to does not include purchasing of indirect material. This thesis only covers the evaluation of suppliers delivering material covered in the BRCGS Storage and Distribution standard chapters 10.2 and 10.3.

2. The thesis focuses on the evaluation of current suppliers and does not consider the initial supplier selection or a comparison between potential suppliers, i.e. step 6 in Van Weeles purchasing model, see Figure 1.1

3. The implementation part in RO3 only covers two areas: An illustrative description of what the technical layout of the SPE system could look like and an example of how actions on supplier performance should be prioritized.
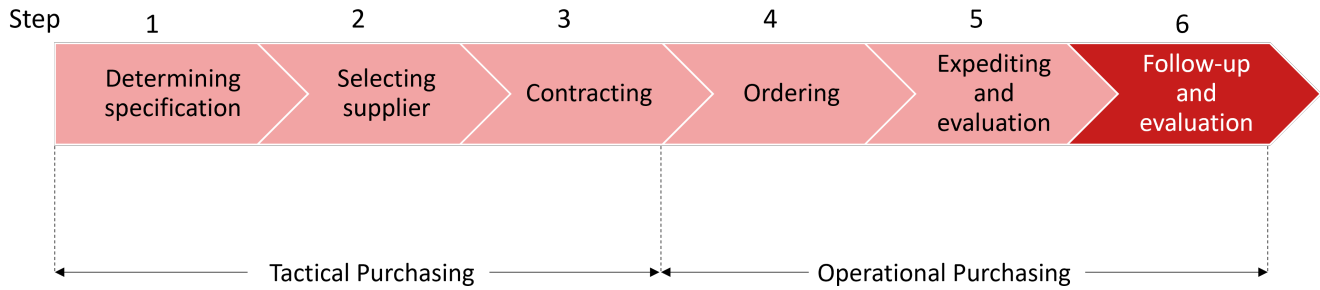
Figure 1.1: Van Weele's purchasing process. Adapted from (Van Weele 2014, p.8).

1.6 Target Group

This thesis primarily targets the Project Management Office and the Purchasing Department at the Company, aiming to offer valuable insights into the proper methods of conducting SPE. Additionally, the thesis addresses Lund University, specifically the Faculty of Engineering Logistics which is the faculty the authors are completing their Master's degree within. Finally, it is intended for anyone seeking to enhance their SPE practices or engage in further research on the topic.

1.7 Report Structure

Chapter 1: Introduction
Covers the background of the master thesis, as well as an introduction to the case company. The research objectives, the purpose, the delimitations, and the target group will also be stated. It ends with an overview of the report structure.

Chapter 2: Methodology
Outlines the research methodology used to conduct the study. It begins with an introduction of the research approach and philosophy, followed by the selection of the research strategy. Furthermore, it presents the different techniques and procedures used to gather information and how the information should be analyzed. Afterward, the quality of the research is discussed, and the measures taken to improve the quality are stated. The chapter ends with a discussion about research ethics and presents how the thought process has evolved during the project.

Chapter 3: Literature review
Presents the theoretical base the thesis is built upon. It begins with an introduction to purchasing- and company strategy, followed by information about SPE in general and different evaluation approaches. Thereafter, requirements and examples of metrics are presented. Some case studies are

also included for the reader to receive more context. The chapter ends with a summary of the literature review.

Chapter 4: Empirical study
Presents information about the Company and thoughts about its operations and current work with SPE. It also presents the wishes and requirements for the new SPE from the interview objects, and how the Procurement Company within the Group works with SPE today.

Chapter 5: Findings and analysis
Presents an analysis based on the findings presented in chapter 4 and the theory presented in chapter 3. The analysis is guided by the steps presented in the framework created in Concluding the Literature Review, see Figure 5.1. First, the Company's performance goals and objectives are identified. Next, the appropriate evaluation approach is discussed, based on external requirements and internal wishes and needs. Further, suitable metrics to include in the SPE system are considered, followed by an analysis of important aspects to consider in the implementation phase. Finally, additional aspects related to the scope of the thesis are briefly presented, as well as the advantages of implementing the SPE system.

Chapter 6: Conclusion
Presents a review of the thesis's purpose and the process of writing the thesis followed by a description of how the research questions have been answered, including a description of how the SPE system should be designed and implemented. The generalizability of the content in the thesis as well as the thesis' contribution to theory and practice are also discussed. Lastly, suggestions for future research are provided.

Chapter 2

Methodology

This chapter outlines the research methodology used to conduct the study. It begins with an introduction of the research approach and philosophy, followed by the selection of the research strategy. Furthermore, it presents the different techniques and procedures used to gather information and how the information should be analyzed. Afterward, the quality of the research is discussed, and the measures taken to improve the quality are stated. The chapter ends with a discussion about research ethics and presents how the hypothesis has evolved during the project.

2.1 Design of the Study

Saunders et al. (2007) highlight the importance of understanding the levels in the research structure. The layers are structured as a "research onion", see Figure 2.1. This means that before choosing the data collection techniques and analysis procedures, the outer layers should be peeled away.
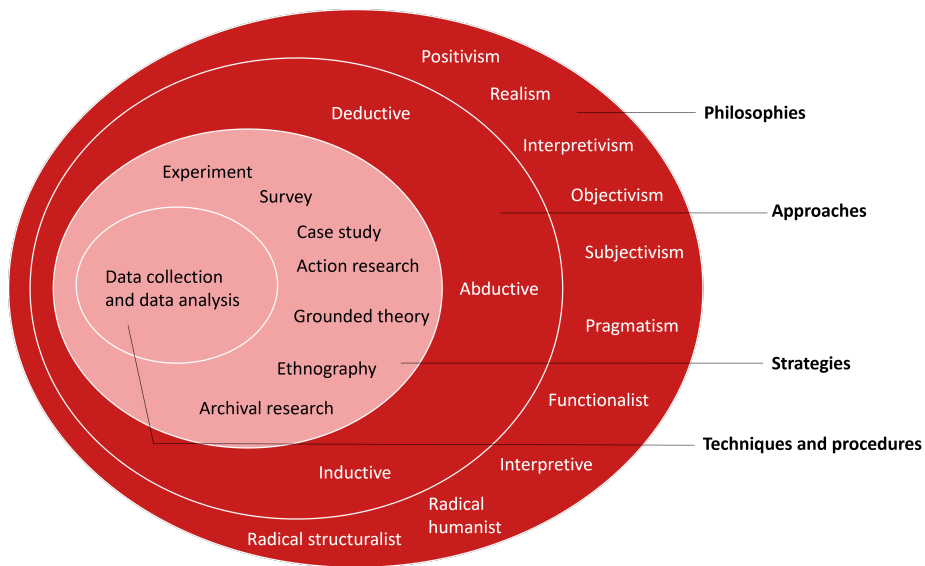
Figure 2.1: The Research Onion. Adapted from (Saunders et al. 2007, p. 102).

2.2 Research Philosophy

According to Saunders et al. (2007), the research philosophy refers to the development of knowledge and the nature of that knowledge. Various research philosophies exist, each grounded in different assumptions. Researchers may adopt a single research philosophy or combine elements from different philosophies, and according to Saunders et al. (2007), it is important to understand differences that will influence how one thinks of a research process to reduce the risk that personal values affect the conclusions in an unethical manner.

Positivism is a philosophy often adopted by natural scientists and prefers generalizable research. The positivist approach also emphasizes the importance of the research being conducted in a value-free way. (Saunders et al. 2007) Due to the authors' engineering background, they are used to approaching problems with a solution-oriented and practical mindset, and they value objectiveness. They are therefore likely to lean towards a positivistic research philosophy.

However, positivism advocates highly structured data collection and methods of analysis (Saunders et al. 2009). Considering the nature of the problem statement and the fact that many different methods have been used, a pragmatic research philosophy has also been adopted. Pragmatism highlights the research question as the most important factor when adopting a research philosophy (Saunders et al. 2007). Furthermore, pragmatism emphasizes practical solutions and outcomes and focuses on problem-solving and relevance (Saunders et al. 2009). This philosophy aligns well with the thesis' objective of developing a method suitable for the Company.

2.3 Research Approach

Saunders et al. (2009) present two main research approaches: Inductive and deductive. A third approach called abductive is also described, which is a combination of the two first. An inductive research approach aims to understand the phenomenon in its own terms. This means that the phenomenon is first studied in its natural setting, and then the researcher develops theory to describe the phenomenon. A deductive approach, on the other hand, starts with theory that explains, predicts, and controls the phenomenon. Data is later collected to verify the formal theory.

An abductive approach moves back and forth between theory and data (Saunders et al. 2007). The abductive approach was adopted in this project since surprises and the need for new theory have occurred multiple times, where it has not been obvious how the study would proceed. The collection of theory and data was therefore performed iteratively. This means that the literature review and information gathering from the company have occurred simultaneously, allowing for a dynamic and adaptive research process. By adopting this approach, the project aimed to capture and respond effectively to emerging insights and challenges throughout its course, ensuring a robust and adaptive research methodology.

2.4 Research Strategies

There are several types of research methods aimed to fit different types of research studies. What type of method the study will use is determined in the strategy layer of the research onion. The suitable type of research method is decided by answering a few questions regarding the research question, see Table 2.1. The first thing to decide is the form of the research question, if it should answer *how* and *why* or *who, what, where, how many* or *how much*. The second step is to determine if the research question requires control of behavioral events or not. Lastly, the researcher should think about if the focus is on contemporary events or not.

Table 2.1: Relevant Situations for Different Research Methods. Adapted from (Yin 2014, p. 9)

Method	Form of research question	Requires control of behavioral events?	Focus on contemporary events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/no
History	How, why?	No	No
Case Study	How, why?	No	Yes

.

2.4.1 Choice of Strategy

This study aimed to figure out *how* the Company should design their system for SPE. The study did not require control of behavioral events. The primary goal was to gain insights into complex phenomena within their real-life contexts, and not to manipulate variables and control conditions to establish causality, which would be the case for an experimental study. Furthermore, the focus of the study was on contemporary events, as the authors aimed to observe the current state of the Company, to understand how the SPE was working today. Due to the nature of the project, a case study was the most suitable research method. See Figure 2.2 to get an overview of the determination process.
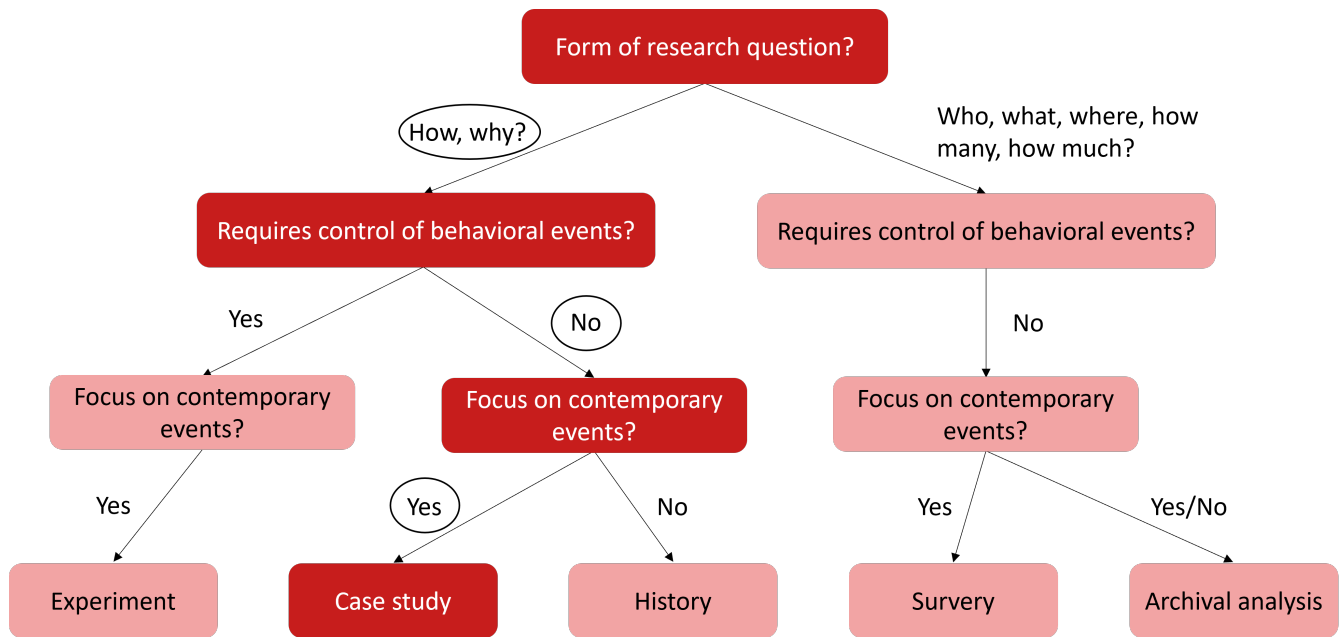
Figure 2.2: Process of deciding the suitable research method.

Yin (2014) describes four types of case studies. The classification of the specific case into one of the case study categories depends on two factors: whether it is a single- or multiple case study, and whether it consists of one or multiple units of analysis, see Figure 2.3. A study consisting of one single Unit of Analysis (UoA) is considered a holistic case study. If the case study involves more than one UoA, it is called an embedded study. Figure 2.3 also highlights that all types of case study designs require analysis of contextual conditions concerning the case.
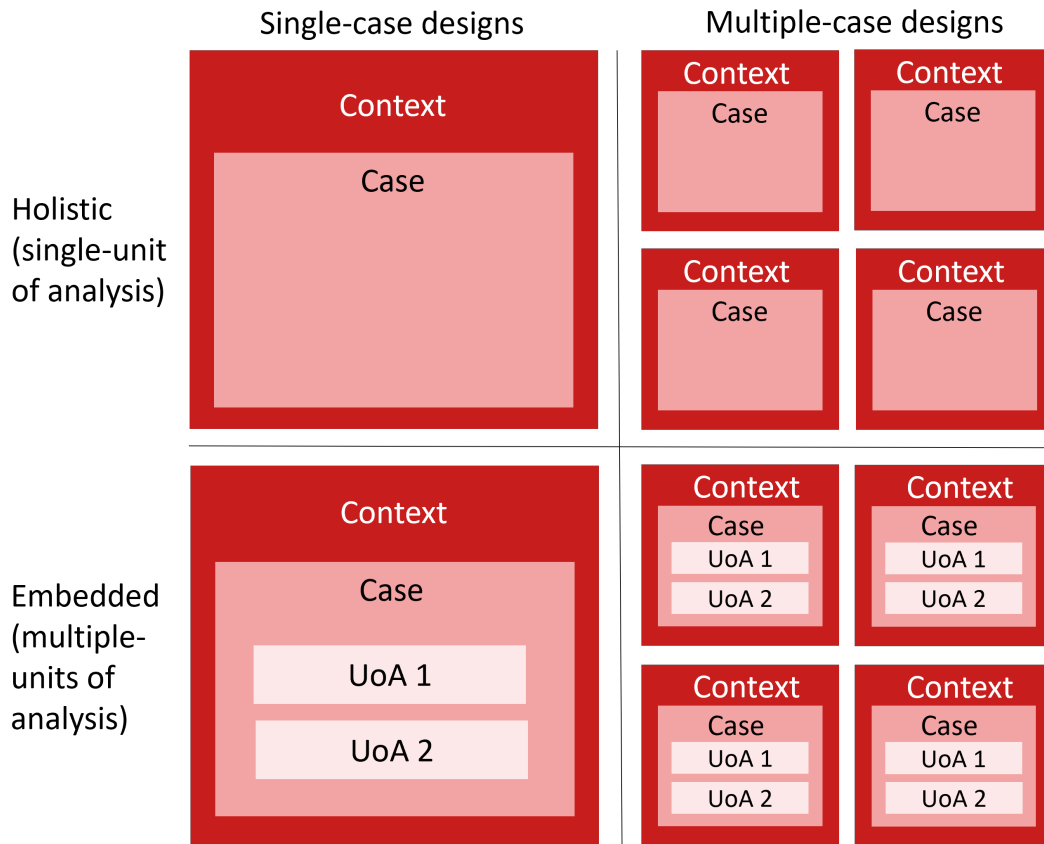
Figure 2.3: Four types of case study designs. Adapted from (Yin 2014, p. 50).

Although other companies were studied to deepen the understanding of the research question, the goal was to develop a contextual understanding of the Company. Therefore, the study is a single case study. Single case studies are useful in several different situations. They can be suitable due to the extreme or unique nature of the case. On the other hand, it may also be suitable because few people have gotten the chance to study the phenomenon before. (Saunders et al. 2007) A majority of the conclusions drawn in this report can be applied to other distributing companies to improve their SPE system. The rejection and confirmation of certain theories can also be applied to the study of similar organizations. Therefore, this case can be considered a common case. Hence, a single study is suitable.

According to Yin (2014), the UoA relates to the research questions and defines what should be studied in the case. Examples of UoA are individuals, small groups, organizations, partnerships, decisions, and projects. (Yin 2014) This study focused on one single organization, and within the organization, only the purchasing function was studied. More specifically, the thesis focused on the Company's SPE process in step 6 of Van Weele's purchasing process (Figure 1.1). Thus, only one UoA was studied and the research project can be considered a holistic study. Hence, this research

project is of a single-case design and a holistic type. It therefore falls within the second quadrant of Figure 2.3. See Figure 2.4 for a closer look at the case study design.
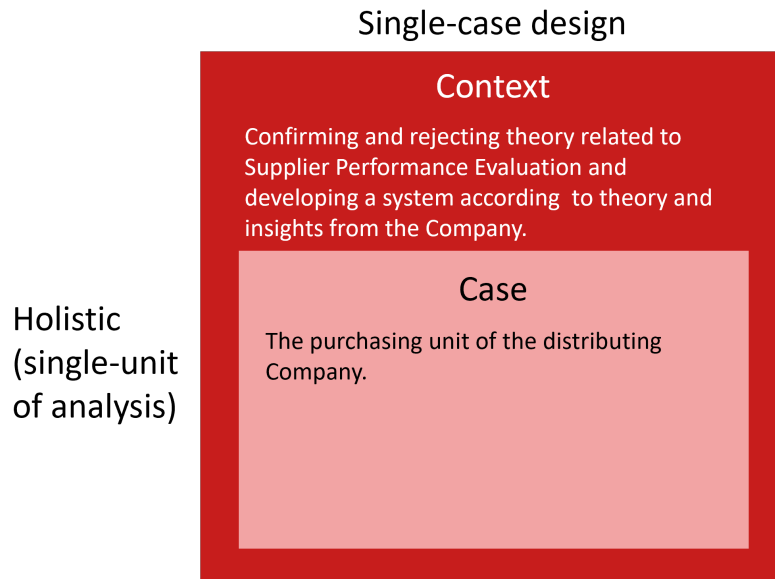
Single-case design

Figure 2.4: The single-case holistic case study design. Adapted from (Yin 2014, p. 50).

2.5   Research Techniques and Procedures

Research techniques and procedures refer to the data collection and data analysis part of the project, which is the inner layer of the research onion, see Figure 2.1, and a part of the research design of the project. The data collection and analysis contribute to answering the research questions and it is therefore important to have a plan for this part of the project. (Saunders et al. 2007)

Saunders et al. (2007) states that when doing case studies, multiple sources of data could be used and triangulated. To triangulate information, two or more data collection techniques are used to make sure the conclusions are correct. An example of triangulation could be to use group interviews to triangulate quantitative data gathered from questionnaires. To triangulate findings, collected data can also be compared to secondary data. (Saunders et al. 2007) This is one of the reasons why as many data collection techniques as possible were used in this project. Data has, for example, been triangulated when insights regarding the current SPE system have been gathered from both interviews and documentation. Another example is that information collected during the early parts of the study was cross-referenced and confirmed during a focus group arranged at the end of the project.

Yin (2014) highlights the importance of identifying and addressing rival explanations for the findings. The findings are stronger the more rivals that are addressed. Extensive literature concerning potential solutions and use cases were thoroughly reviewed and incorporated into this report. Moreover, during interviews, various potential solutions and findings were presented to the interviewees without disclosing initial propositions. This approach facilitated the addressing of potential rival explanations throughout the research process.

The research project consists of three main parts: a study of how the company currently performs its SPE, requirements on the new system, and design of the new system. All of these areas require different research techniques and procedures. Therefore, this research study has used a mix of existing literature, documentation, interviews, and a focus group. A compilation of the data sources used can be seen in Figure 2.5.
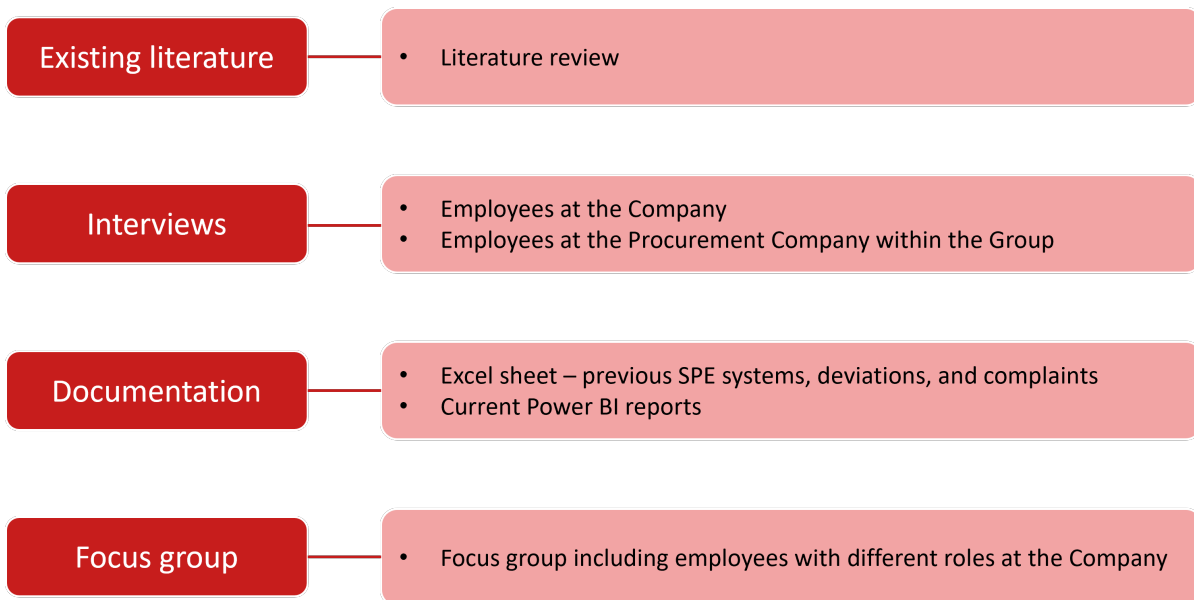
Figure 2.5: A compilation of the data collection methods and their related source of data used in the research study.

2.5.1 Literature Review

A literature review was conducted to help exploring potential solutions for the Company's new SPE system. The literature review followed the five steps described by Rowley & Slack (2004). The first step is called "scanning documents" which means that the authors familiarized themselves with the theory provided on the topic to get a broad sense of what themes should be explored in the thesis. The next step was conducted both during and after the first step, where the authors took notes to help identify the key themes and concepts found in the scanning step. The third

step involves structuring the literature review and was when the authors structured the documents according to key themes. When the literature review was structured, the actual writing of the literature review commenced and followed the structure. Building a bibliography was the final step in the literature review process, which included the authors referencing the literature used in a correct way using the Harvard system. (Rowley & Slack 2004)

In the literature review, research papers provided information about SPE concepts and methods in general. Use cases described how different theories apply to practice and theoretical models and reports on new trends were also used. The main search engines used were "Google Scholar", "LUBSearch" and "Scopus", where books and articles used in the literature review were found. Synonyms were often used to find relevant papers. For example, both *Supplier Performance Evaluation, Supplier Performance Measurement,* and *Supplier Performance Evaluation Methods* were used as search words. Other keywords used were connected to the specific methods, for example, *Weighted Point Evaluation System, Fuzzy TOPSIS, Simple Multi-Attribute Rating Technique* and *Supplier Audit.* The words for the methods were often combined with different versions of terms related to SPE to gather literature more suitable for the specific situation. When an interesting paper was found, the keywords and later the abstract were studied more in detail to determine if it was worth reading it deeply or not. In total, approximately 80 abstracts were read. The key sources of information can be found in Table 2.2

Table 2.2: The key sources used in the literature review.

Key source	Topic
The concept of Supplier Performance Evaluation, strategies and examples	
Supplier evaluation and performance excellence: a guide to meaningful metrics and successful results by Sherry R Gordon.	Focus on how to develop and design a supplier performance evaluation system and its importance for companies.
Supplier Relationship Management: Unlocking the Value in Your Supply Base by Jonathan O'Brien.	How to utilize a supplier performance evaluation system and what value it can bring to companies.
Purchasing and Supply Chain Management. Analysis, Strategy, Planning and Practice by Arjan J Van Weele.	Insights into the purchasing process and where supplier performance evaluation fits in.
BRCGS Storage and Distribution Standard	
Issue 4 Storage and Distribution by BRCGS.	Detailed description of the Storage and Distribution standard.
Methods for Supplier Performance Evaluation	
Using Scorecards for Supplier Performance Improvement: Case Application in a Lean Manufacturing Organization by Toni Doolen Mike MAJ Traxler Ken McBride.	Information about supplier scorecards.
Purchasing and Supply Chain Management. Analysis, Strategy, Planning and Practice by Arjan J Van Weele.	Information about the supplier audit method.
Study of the Simple Multi-Attribute Rating Technique For Decision Support by Robbi Rahim and Risawandi.	Information about the weighted point evaluation method.
An Evaluation of Supplier Performance based on a Three-Dimensional Fuzzy TOPSIS Framework by Nithima Boonsong and Pisit Jarumaneeroj.	Information about the Fuzzy TOPSIS method.

Different techniques and strategies were used to find relevant and reliable research papers. To narrow the number of search results, filters regarding publication dates and source type were used. To refine the search further, the boolean operators "AND", "OR, and "NOT" were used, often combined with an asterisk or citation mark. The asterisk was used to represent a group of characters or words and allow for different endings of the phrases, while the citation marks were used to search for an exact phrase or sequence of words.

Rowley & Slack (2004) suggests citation pearl growing as an effective search strategy. Citation pearl growing refers to a method where the starting point is only one or a few documents that are used to retrieve more documents through citations. This strategy was widely used to find new information and primary sources.

There are many different evaluation approaches for SPE and it would not be possible to consider all as potential solutions for the Company. An initial search was made to select what evaluation approaches should be studied more deeply. During the initial search, several potential approaches were excluded, and not even mentioned in the theory section of the report. The reasons for exclusions mainly descended from the fact that the application areas were not in line with the goals of this thesis, or the Company's preferences. For example, Analytical Hierarchy Process

(AHP) was excluded due to that it is mainly used for the initial supplier selection. Therefore, the article by Jayant (2018) was not used further. Some approaches were also excluded due to their sole focus on costs, and it was initially stated that the Company wants more perspectives than costs since cost leadership is not their only focus. The categorical system approach was excluded since it solely relies on an individual's perception of performance and therefore not on quantitative data. The Company wants the new system to mainly focus on quantitative data and the categorical system was therefore not relevant. Table 2.3 presents a summarized review of SPE approaches found in the literature, including those later excluded.

Table 2.3: Summary of approaches for Supplier Performance Evaluation.

Single method	Author (year)	Scope	Journal/Source
Fuzzy set theory	Osiro, Lauro and Lima-Junior, Fransisco R and Carpinetti, Luiz Cesar R (2014)	A fuzzy logic approach to supplier evaluation for development.	Peer-reviewed journal article, International Journal of Production Economics
Supplier Audit	Saunders, Andrew G (1994)	Supplier audits as part of a supplier partnership.	Peer-reviewed journal article, The TQM Journal
Fuzzy TOPSIS	Boonsong, Nithima and Jarumaneeroj, Pisit (2021)	An evaluation of supplier performance based on a three-dimensional fuzzy TOPSIS framework.	Peer-reviewed journal article, Institute of Electrical and Electronics Engineers
Fuzzy set theory	Zimmermann, Hans J (2010)	Fuzzy set theory is described, as well as the most important applications of this theory to other theories and techniques.	Peer-reviewed journal article, Wires Computational Statistics
Supplier Scorecard	Doolen, Toni and Traxler, Mike MAJ and McBride, Ken (2006)	Using scorecards for supplier performance improvement. Application in a lean manufacturing organization.	Peer-reviewed journal article, Engineering Mangement Journal
Balanced Scorecard	Kaplan, Robert S (2009)	Balanced scorecard for performance measurement.	Chapter in a textbook, Handbooks of Management Accounting Research
Categorical System, Weighted Point Method, Cost-Based System, Total Cost of Ownership Approach	NC State university (2011)	Performance measurements and metrics to evaluate suppliers and measure performance.	University website, NC State University
Weighted Point Evaluation system	Wuttke, Marcus (2020)	Supplier evaluation system in the food industry.	Master thesis, Lund University
Analytical Hierarchy Process	Jayant, Arvind (2018)	Analytical Hierarchy Process (AHP) based approach for supplier selection.	Peer-reviewed journal article, International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS)
Multi method	Author (year)	Scope	Journal/Source
SCOR + Fuzzy TOPSIS	Rodrigues Lima-Junior, Fransisco and Ribeiro Campinetti, Luiz C (2016)	Combines SCOR metrics and fuzzy TOPSIS to aid supplier evaluation and management. Categorizes the suppliers and proposes directives depending on their evaluation.	Peer-reviewed journal article, International Journal of Production Economics
Fuzzy + AHP	Stević, Zeljko and Tanackovb, Ilija and Vasiljevića, Marko and Novarlićc, Boris and Stojićb, Gordan (2016)	An integrated fuzzy AHP and TOPSIS model for supplier evaluation	Peer-reviewed journal article, Serbian Journal of Management
Supplier Scorecard + Weighted Point	Cao, Yang and Umberger, Geanie and Shelton, Aubery and Butts, Tami (2022)	Development of a supplier scorecard for a medical device company.	Peer-reviewed journal article, Journal of Pharmaceutical Innovation

2.5.2 Interviews

According to Yin (2014), interviews are one of the most important sources of information when it comes to case studies. Since this thesis delves deep into the Company's current operations, interviews were a crucial source for the as-is analysis as well as further analysis and recommendation. Interviews were used to gather information on how the current SPE system works, what data they have, and what the empolyees' wishes are for the new system. Representatives from the Procurement Company within the Group were also interviewed to broad the perspective on how SPE can be performed. Interview guides can be found in Appendix A.

According to Saunders et al. (2007) interviews can be categorized into three types called structured, semi-structured and unstructured interviews. In a structured interview, the interviewer uses standardized questions that are predetermined and asked in the same order and same way in the interviews. On the contrary, in an unstructured interview, the interviewer has a more informal approach and explores a topic without having standardized questions to use. A semi-structured interview is a mix between the two where there are key themes and questions that the interviewer wants to explore, but they and their order can vary in different interviews. Additional questions can also be added during the interview. (Saunders et al. 2007)

In this study, the interviews were all semi-structured. Interview guides with potential questions were sent out to the interviewees beforehand for them to be able to prepare for the topics discussed, and when additional interesting themes came up during the interviews the interviewers added questions to the previously determined example question guide. Due to the nature of the case, the semi-structured interviews were well working since this allowed the researchers to gain input on their pre-determined questions as well as new information they did not know to ask for beforehand. It gave the authors valuable insights that they would have missed if they had not added questions throughout the interview. However, using unstructured interviews would have been too unorganized for the authors to get specifically needed information for the case.

The interviewees were mainly selected by consulting the supervisor at the Company, who gave input on potentially suitable employees to interview for the case study. Some of the interviewees were on the other hand selected due to them being mentioned in another interview. The interviewees had broad experience from different functions related to purchasing and data collection in the Company as well as the Group, and each of them brought a new perspective to the topic studied. In Table 2.4 the interviewees, the purpose of the interview, and what type of interview it was is described.

Table 2.4: Interviews conducted in this project, their type and purpose.

Interviewee	Company	Type of interview	Purpose of interview
Head of Strategic Purchasing	The Company	Semi-structured	Understanding the current SPE system, what data is used and how it could be improved.
Supply and Demand Manager	The Company	Semi-structured	How the operational purchasing department could be involved in the SPE process.
Business Controller Sales	The Company	Semi-structured	How data collection and Power BI is utilized today at the Company and how it could be utilized in the future.
Chief Operating Officer	The Company	Semi-structured	How the company strategy, purchasing strategy and SPE system aligns and how it could be improved to increase its alignment.
Business Controller Purchasing	The Company	Semi-structured	How data collection and Power BI is utilized today at the Company and how it could be utilized in the future.
Head of a Product Group	Procurement Company within the Group	Semi-structured	What metrics are tracked and how the SPE system benefits the central purchasing function.
Director for Digital Procurement and Development	Procurement Company within the Group	Semi-structured	How data collection for the SPE system is built up and how the system for SPE works.

The first interviewee was the Head of Strategic Purchasing, responsible for the current SPE system. She could provide thorough information on how the current system functions, what could be improved with the current system, and what data they use.

The Supply and Demand Manager was selected due to his role related to operational purchasing which is a department not currently very involved in the SPE process, but that could bring value by being more involved. He provided insights into how the operational purchasing department works, what possibilities they see with an improved SPE process as well as how they could be included in the process.

The next interviewee was the Business Controller for Sales, who was chosen since she could provide insight into how the Company currently works with data collection and Power BI. She also brought knowledge about metrics that are not currently measured but that could be implemented into the measuring system. She also gave input on what is and is not possible related to the design of a new SPE system.

The Chief Operating Officer has experience working with strategic purchasing and as director of purchasing. He has a broad knowledge of the purchasing organization at the Company as well as

insight into how the overall company strategy and purchasing strategy are designed and aligned. He was chosen due to his ability to provide the authors with information about both strategy and purchasing, and brought a deeper perspective on the alignment between the SPE system and the company strategy.

The Business Controller for Purchasing works with similar topics as the Business Controller for Sales, but with a more purchasing-oriented focus. He also has knowledge about data collection and Power BI. Additionally, he provided information about how the Company previously worked with SPE, when Movex was still the business system. This provided valuable information about work that had already been done.

Additionally, two employees from the Procurement Company within the Group were interviewed. The Head of Product Group at the Group and the Director for Digital Procurement and Development participated in the same interview and contributed with two perspectives on how they work with SPE and how their system is built up. They had knowledge both about the technical functions of the system and the strategic value in using an SPE system.

Yin (2014) argues that throughout the interview process, it is important to ask the questions in a predetermined order and phrase them to prevent misunderstandings, ensuring that the goals associated with each question are effectively fulfilled. This was kept in mind, when applicable, both when preparing the interviews and during the interview process. The interviews were recorded to verify that the notes taken throughout the interviews were correct and that the quotes used in the case study were accurate. To increase validity, a summary of the interviews was sent to the interviewees after each interview to verify that the information was accurately understood, urging the interviewees to give feedback if something was incorrect.

Yin (2014) also highlights several attributes that are desired during the interview process. The attributes are:

1. Ask good questions - To create a rich dialogue.

2. Be a good listener - Receive the information without bias.

3. Be adaptive - See new information and situations as opportunities and not threats.

4. Develop a thorough understanding of the issues being studied - To not miss important clues and be aware of deviations.

5. Avoid biases and know how to conduct research ethically.

All these attributes were adapted, both when preparing the interviews and during the execution.

2.5.3 Documentation

Primary data was collected through the Company's current systems. The Excel file where they currently conduct their SPE emerged as a primary source of evidence, providing insights into the Company's existing SPE practices and serving as the foundation for identifying strengths, weaknesses, and areas of improvement. The Excel sheet with the previously used supplier scorecard was also used in the case study as a primary source of evidence. It provided insights into how the Company has previously worked with SPE and what metrics they have valued to follow up. Excel sheets with information about deviations and complaints were studied to see what data the Company currently has access to, and some Power BI reports were studied offering insight into how the Company uses its data. Power BI is an interactive data visualization software product. Its primary focus is on business intelligence.

Both the actual Excel files and the Power BI reports can be considered a form of documentation. Documentation encompasses various materials, including letters, emails, agendas, administrative documents, and formal studies or evaluations related to the case company (Yin 2014). According to Yin (2014), documents must be used carefully to avoid bias and ensure validity. Nonetheless, documents are highly valuable when collecting data for case study research as they complement other sources of evidence and can serve as clues worthy of further investigation. (Yin 2014) The sources of documentation are summarized in Table 2.5.

Table 2.5: Sources of documentation used to collect information.

Documentation type	Purpose
Excel sheet current SPE system	Information about the current SPE process and the metrics used
Excel sheet previous supplier scorecard	Information about how the Company performed the SPE before. To gain a more nuanced overview and make sure previous work is not redone
Power BI reports, for example non conformance	Insights in how data is used today, and how the Company's data can be integrated and analyzed
Excel sheets deviations and complaints	Insights in how data is used today, and how the Company's data can be integrated and analyzed

Although documents should be used with awareness of potential bias, the documents were used with the sole purpose of making a truthful analysis to be able to provide relevant recommendations to the Company. Therefore, the Company had nothing to gain from providing the authors with

inaccurate documents and they are not likely biased.

2.5.4 Focus Group

When exploring what opinions may arise from different options of a solution it can be useful to gather a focus group, where group discussions focusing on a specific topic are led by a moderator gathering insights from people with expertise relevant to the topic. When forming a focus group the participants selected must be relevant to the topic and have some expertise that brings insights into the issue discussed. According to Kueger & Casey (2015) the focus group should include around 4-12 participants and the environment should be relaxed and encouraging. (Kueger & Casey 2015) The number of occasions the focus group should be held depends on the purpose of the focus group and should therefore be adapted to every project, and can vary between 1 to 50 or more (Fern 2001). Using a focus group can be a good complement to other strategies for data collection and analysis Morgan & Spanish (1984). Saunders et al. (2007) highlights the importance of creating a relaxed environment when conducting the focus group discussion, as well as making sure that the discussion is not dominated by only a few people and ensuring that you understand the participants' message and opinions correctly so that no incorrect conclusions are drawn.

A focus group was used in this project to collect insights into the applicability and appropriateness of different solutions to the Company's SPE system. The focus group validated the recommended evaluation approach, the identified metrics, and the weights connected to each metric. Participants were chosen according to their knowledge of the topic and the possibility that they would have valuable insights. During the focus group discussion, the authors ensured that all participants participated in the discussion and that their perspectives were correctly understood. The environment was also formed to encourage creative thinking and opinion-building. See the participating employees in Figure 2.6.
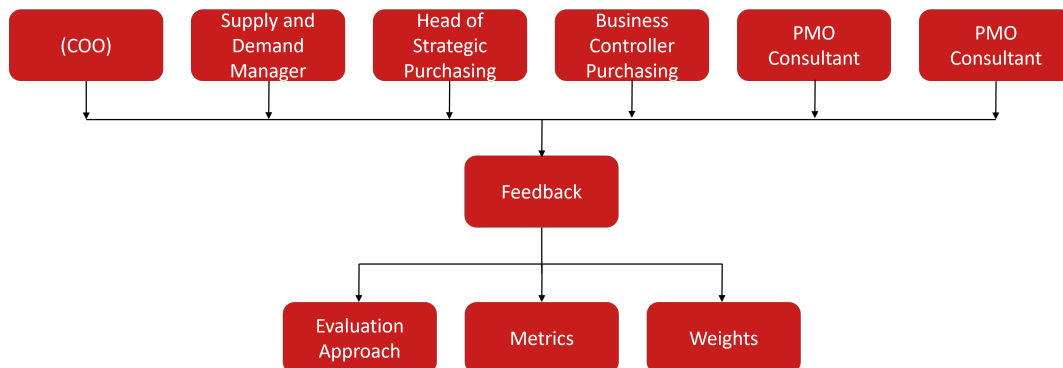
Figure 2.6: An overview of the employees that participated in the Focus Group.

The focus group started with an introduction to the research questions and the findings so far. The introduction was important to ensure that all participants had the knowledge needed to engage actively in the discussions. The purpose of the focus group was also explained and it was made clear that all opinions and thoughts were welcome. The goal was not to agree on a solution, but to discuss all potential perspectives. Afterward, the suggested evaluation approach was discussed. To leave room for everybody's opinion, the discussion started with everybody sharing their thoughts anonymously, and the topics were later discussed with the whole group. After a 10-minute break, the participants were introduced to how the potential metrics had been chosen. The participants got the opportunity to share their opinions on the metrics' relevance for the Company and confirm and reject information regarding the available data. They also gave their opinion on the importance of each metric.

The focus group turned out as expected and everybody participated actively in the discussions. The participants did not agree on everything but they listened to each other and were not afraid to argue for their own sake. The chosen evaluation approach and metrics were confirmed with small modifications to fit the Company even better. The focus group plan can be found in Appendix B.

2.6   Data Analysis

When the data collection phase is over it is time for the data analysis phase, which according to Yin (2014) can be done using five different techniques typically used in case studies. The techniques that Yin (2014) introduces are called pattern matching, explanation building, time-series analysis, logic models, and cross-case synthesis.

The data used in this project was mainly qualitative. Saunders et al. (2007) describes different strategies for analyzing qualitative data, both structured and less structured approaches. One approach that Saunders et al. (2007) describes is to categorize your data into groups with different themes and topics and use this as a framework further in your analysis. You continue by analyzing the relationship between the theory in different categories and form a hypothesis to test the relationships. If the data confirms the hypothesis you can move on with it, or you can alter the hypothesis several times before forming a conclusion in a process with an interactive nature. (Saunders et al. 2007) This process is similar to the four-step process described by Höst et al. (2006), which includes data collection, coding, grouping, and conclusions. According to Höst et al. (2006), you start by collecting your data and then marking keywords and sentences relevant to your project in the coding step. Grouping refers to the gathering of coded segments of text into themed groups. The conclusions will then be drawn based on the information in the different groups (Höst et al. 2006).

Inspired by Saunders et al. (2007) and Höst et al. (2006) the goal of this project was to create a theoretical framework through the literature review that could be explored and tested with the data collected from interviews, documentation, and focus groups. During the project, the initial thoughts of how the recommendation would be formed were changed several times since when data was added the author's understanding of the topic developed. This is similar to the interactive nature of processes analyzing qualitative data that Saunders et al. (2007) describes. The conclusions that could be drawn in the project were based on the information collected and sorted into groups of key themes.

The process described by Saunders et al. (2007) is related to the explanation-building technique described by Yin (2014). The research study conducted in this thesis mainly uses explanation building as a technique for data analysis. This technique is selected due to the exploratory nature of the study and the fact that it is a single-case study. Explanation building is normally used in exploratory case studies, and "how" and "why" questions are answered by building up a data analysis in an iterative process, where the final solution or recommendation normally is not known or correctly predicted. Instead, findings on different topics will result in alterations in the direction of the case study which can be redirected several times throughout the project. (Yin 2014)

The explanation building and processes described by Saunders et al. (2007) and Höst et al. (2006) formed the foundation for the study. After that, an analysis was made that compared the theory with the external requirements, and the Company's wishes and current system. The final recommendation presented is based on the analysis and the Company's operational conditions.

All potential evidence was thoroughly considered to ensure comprehensive coverage, and no information was disregarded solely because it conflicted with existing perspectives.

2.7   Quality of Research

When conducting a research study, the findings must be trustworthy. Four criteria are commonly used to assess the quality of a research study: construct validity, internal validity, external validity, and reliability. (Yin 2014) The measures taken to improve the quality of the study related to the four criteria are shown in Table 2.6.

Table 2.6: Measures taken to ensure validity.

Validity type	Measures
Construct validity	Multiple sources of evidence, validation of interviews, continous report reviews.
Internal validity	Explanation building, pattern matching.
External validity	Use of a lot of theory, results are not claimed to be generalizable if they are not, interview with another company, studies of other cases.
Reliability	Case study database, case study protocol, interviews under neutral conditions, second opinions.

2.7.1 Construct Validity

The first criterion is construct validity which concerns the formulation of operational measures for the phenomena under study. Some criticisms of case studies suggest that data collection is often based on subjective material, leading to issues of construct invalidity. (Yin 2014) Construct validity can be enhanced by employing multiple sources of evidence, establishing a chain of evidence, or having key informants read and review a draft of the report. These measures should be applied during the data collection phase. (Yin 2014) In this research study, multiple sources were used to validate sensitive data and ensure consistency. Interviewees have also validated the summary of their interviews to ensure a correct interpretation of their answers and key informants were allowed to read the report continuously to avoid potential discrepancies.

2.7.2 Internal Validity

The second criterion is internal validity. Questions regarding internal validity typically occur during the data analysis phase, primarily in experimental and quasi-experimental research studies. Internal validity refers to the extent to which the observed events can be attributed to the manipulated variables rather than other factors. Hence, it implies that a cause-and-effect relationship exists between the variables under investigation. False connections can undermine internal validity, leading to inaccurate conclusions. Therefore, maintaining internal validity is crucial for drawing valid and reliable conclusions from research findings. (Yin 2014)

Internal validity can be achieved through pattern matching, explanation building, using logic models, and addressing rival explanations (Yin 2014). Although this study is not an experimental study, explanation building was used to understand different factors that affect the analysis. Pattern matching that involves comparing empirical patterns observed in the data with predicted patterns from the theoretical framework was also used to strengthen the internal validity.

2.7.3 External Validity

The third criterion used to assess the quality of a research study is external validity. External validity, also known as generalizability, assesses the extent to which study results can be applied beyond the specific context. (Yin 2014) According to Saunders et al. (2007), worries about external validity are particularly common for case studies conducted within a single organization or across a limited number of organizations. Saunders et al. (2007) also claims that the purpose of such research is to explain a phenomenon within the chosen research setting, and not to propose a theory applicable in all cases.

Since this is a single case study, external validity is a major concern. To address external invalidity in a single case study, theory should be used (Yin 2014). It is also important that if the results are not generalizable to all populations, it should not be claimed that they are (Saunders et al. 2007). The case in this thesis is based on one single company and the goal of the study was to provide recommendations primarily directed to the Company. Thus, it is not claimed that *all* recommendations can be applied to all organizations.

Moreover, measures were taken to improve the external validity. First, the thesis has confirmed and applied existing theories. Additionally, theory was collected from interviews with an other company, as well as from previously performed research studies to broaden the applicability. Therefore, a significant part of the results, theory, and conclusions in this report apply to similar distributing companies and can be applied in a broader context.

2.7.4 Reliability

The fourth and final criterion is reliability which is explained by Yin (2014) as security in that when another researcher follows the method described in the study on the same case the same results and conclusions are received. Achieving reliability in the case study is important in order to minimize bias and inaccuracies in the study. Yin (2014) suggests that a case study protocol should be kept and a case study database should be created in order to document the procedures and save the material used throughout the study, which is an important part of ensuring reliability.

Saunders et al. (2007) defines 4 different threats to the reliability of the research. Subject or participant error and bias are the first two, which represent the risks of the participants giving different answers depending on factors like time of day, and the risk that they only give answers that they think their bosses want to hear. Observer error is the third threat which means the threat of getting different conclusions based on factors like how you perform the analysis. The final threat is observer bias which identifies the risk of observers interpreting the results differently.

Throughout this master thesis project, a case study database was kept by the authors to ensure documentation of the process. A case study protocol was also used to guide the authors in their research and ensure them following the research questions and planned methods and strategies. To minimize threats to the reliability the authors have conducted the interviews in this study at neutral times of the day when the employees are not expected to give answers based on their mood related to the time of day. Supervisors from the Company and LTH have given a second opinion of the research to minimize the risk of observer error and bias and all material from interviews and other forms of data collection was checked by both the authors.

2.8 Ethics

When doing research, questions regarding ethics will naturally appear. Saunders et al. (2007) define research ethics as the researcher's behavior concerning the rights of the people that are affected by the work or become a subject of it. Ethical issues could, for example, be regarding the privacy of participants, the possibility of withdrawing consent to participate in the study, and the behavior and objectivity of the researcher. (Saunders et al. 2007) An ethical mindset has been kept throughout the entire process. For example, the purpose of the research has been well-explained to the interview objects, and participation has always been voluntary. Additionally, the authors have acted neutral, objective, and professional in all moments of the process.

2.9 Thought Process Regarding Final Recommendation

Initially, the authors believed that a "best practice" solution formed specifically for a distributing company would serve as a guiding framework for the recommendation, illustrating the optimal approach to designing an SPE system. However, as the project progressed, it was evident that there were no definitive best practice cases for designing such a system specifically for a distribution company. Subsequently, the authors considered that a Fuzzy TOPSIS system might be suitable for the Company's requirements. Following several interviews it became evident to the authors that a Fuzzy TOPSIS system would not be the optimal solution. Instead, a combination of a supplier scorecard and weighted point evaluation system emerged as the more fitting choice for the Company's needs.

Chapter 3

Literature Review

This chapter presents the theoretical base the thesis is built upon. It begins with an introduction to purchasing- and company strategy, followed by information about SPE in general and different evaluation approaches. Thereafter, requirements and examples of metrics are presented. Some case studies are also included for the reader to receive more context. The chapter ends with a summary of the literature review.

3.1 Purchasing and Company Strategy

Purchased goods typically represent the majority of the sold value and income within a company which means that it impacts companies financial results substantially. Additionally, the purchasing function impacts the company's business by managing the suppliers ensuring that goods delivered are living up to the standard decided by the Company. This makes the purchasing function valuable, as it can significantly contribute to fulfilling company goals and objectives. Aligning the purchasing strategy with the business strategy is therefore essential, making sure that the purchasing function is working towards the same goals as the overall company. (Van Weele 2014)

To fully address all relevant areas, the purchasing function is often segmented into three levels: strategic, tactical, and operational. Practices across these levels may vary among companies, but strategic purchasing typically includes long-term strategies, negotiations, and supplier relationships. Operational activities generally cover day-to-day tasks such as ordering and troubleshooting. The tactical level bridges the gap between operational and strategic, often involving supplier selection, contracting non-long-term strategic contracts, and implementing certification programs. (Van Weele 2014)

Furthermore, the purchasing function plays an essential role in mitigating risks associated with suppliers. These risks can be minimized through the implementation of a resilient purchasing

strategy. By avoiding over-reliance on a limited number of suppliers and ensuring that the company is prioritized among their supplier's customers, businesses can reduce the risk of supply shortages. Additionally, there is a risk of suppliers not meeting commitments regarding fair labor practices, environmental regulations, and ethical production. The purchasing function can mitigate these risks by ensuring that suppliers comply with agreed-upon standards in these areas. (Van Weele 2014)

3.1.1 The Purchasing Process

Van Weele (2014) describes the purchasing process in six steps which shows the primary activities of the purchasing function and is illustrated in Figure 3.1. Determining specification includes defining what specifications need to be followed for products purchased. Selecting supplier involves determining what supplier is best aligned with defined requirements. In the next step negotiating and contracting are conducted. Ordering is the fourth step, where the purchasing function places an order with the supplier which is then tracked in the fifth step, making sure that supply is secured. The final step is called follow-up and evaluation, where the supplier's performance is evaluated.
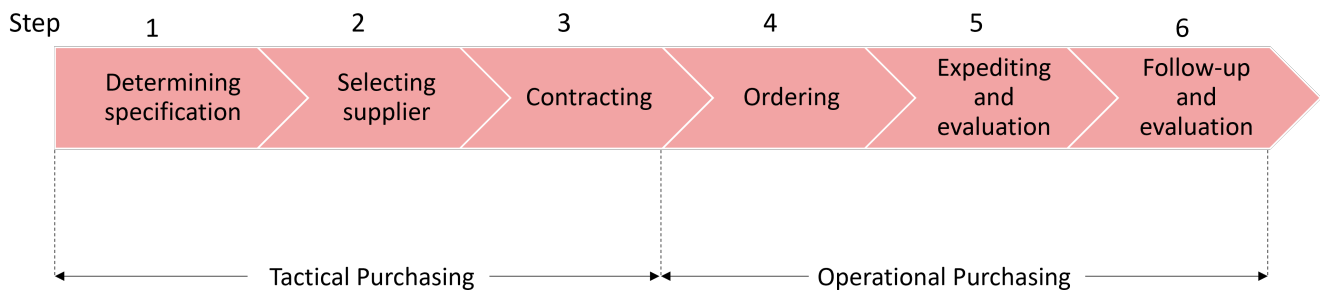
Figure 3.1: The purchasing process adapted from (Van Weele 2014, p.8).

3.1.2 Kraljic's Matrix

Kraljic (1984) suggests a method for two-dimensional classification of products leading to a recommendation for purchasing strategies relating to the four different product categories. The first dimension suggested is "purchasing's impact on the financial result". This dimension is assessed in terms of, for example, purchased volume, impact on business results, and percentage of total purchase cost. The second dimension is "supply risk" and is defined with regard to, for example, availability of product, number of alternative suppliers, and substitution possibilities. The two dimensions create a matrix with four different product categories that all require different purchasing strategies: strategic products, leverage products, noncritical products, and bottleneck products.

([Kraljic 1984](#)) The two dimensions and the product categories are visualized in [Figure 3.2](#).
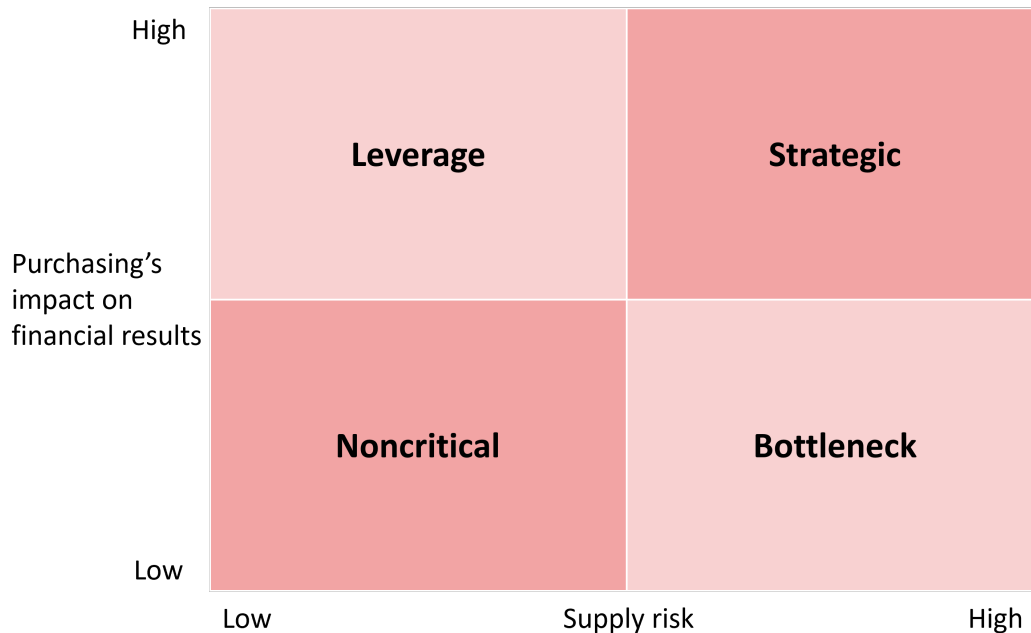
Figure 3.2: Classification of purchased goods. Adapted from ([Kraljic 1984](#), p. 109-117).

Strategic products are those characterized by a high supply risk and a significant impact on the company's financial outcomes. For such items, a recommended purchasing strategy is a performance-based partnership which focuses on partnership or collaboration to create mutual engagement between sellers and buyers. This is based on the buyer's significant reliance on the supplier, although the supplier may also depend on the buyer due to the substantial volumes typically purchased. The strategy for leverage products is competitive bidding, i.e. to prioritize favorable pricing. Bottleneck products, on the other hand, require a strategy based on securing supply, given the supplier's often dominant position in the relationship. Noncritical products, known for their minimal impact on the firm's financial performance and low supply risk, often incur higher handling costs than their actual value. Hence, the focus should be on minimizing procurement time to allocate resources more efficiently, particularly towards more interesting products.

3.2 Supplier Performance Evaluation

Post-pandemic, a higher focus in companies and the procurement function has been on creating a resilient supply chain and achieving goals connected to the business strategy rather than the specific focus on achieving lower costs that has been seen before. One tool in ensuring this is Supplier Performance Evaluation (SPE) which is a part of the final step in the purchasing process described

by Van Weele (2014), see Figure 3.1. SPE is highly relevant today and having a process for SPE can be very beneficial for companies, for example, to ensure product and process quality, identify areas for improvement, and being able to base supplier decisions on data (Ashcroft 2022). This is confirmed by Van Weele (2014), arguing that the increasing significance of suppliers within companies elevates the pressure on their performance, demanding not only the fulfillment of current requirements but also the anticipation of future needs. By systematically collecting and assessing supplier performance data, the buyer can establish clear and tangible performance measures with the supplier, including, for example, lead times and rejection rates. (Van Weele 2014)

The procurement function is important for organizations, and they often have numerous requirements to measure efficiency. Suppliers' performance is also important for organizational success but is not automatically included in the measure of the procurement function. Therefore, having an SPE process in place is important. O'Brien (2022) argues that due to the importance of well-functioning supplier performance, SPE is relevant to the whole business. SPE is integrated with an overall SRM and requires a cross-functional approach to the evaluation process. (O'Brien 2022)

Gordon (2008) argues that mitigating risk is one of the main reasons for SPE. Ensuring low supplier risks is important since supplier performance affects the whole business. Having an insight into supplier performance is a risk mitigation strategy and Gordon (2008) advises companies to measure relevant metrics regularly.

Even though it is clear that SPE is important for companies, Krishnadevarajan et al. (2015) found through interviews that many companies do not have a process for it. Companies might have a relationship and dialogue with their suppliers, but they do not involve metrics and performance evaluation. Krishnadevarajan et al. (2015) also found that it is common that too many or too few metrics are tracked.

3.2.1   Designing a Method for Supplier Performance Evaluation

O'Brien (2022) argues that when designing an SPE system, the desired outputs should determined before deciding how data should be collected and analyzed. This is to prevent the risk of only measuring what is easily accessible and not what is most relevant.

Gordon (2005) suggests seven steps to measure supplier performance, they are:

1. Align performance goals

2. Select an appropriate evaluation approach.

3. Establish a method for gathering information about suppliers.

4. Design and develop a solid measurement system.

5. Implement the system.

6. Provide feedback to suppliers regarding their performance.

7. Produce results

According to Krishnadevarajan et al. (2015) several factors should be considered when developing a framework for SPE. Most of the metrics should be quantitative. The framework should be easy to comprehend. It should also be comprehensive and flexible enough to adapt to the company's needs. A final grade should be allocated to the supplier based on a multi-criteria approach. (Krishnadevarajan et al. 2015) Many models allow the supplier performance to be converted to different ranks. The classification gives buyers the chance to differentiate the suppliers and direct actions to the most critical ones. (Van Weele 2014)

In section 3.3, several approaches for developing a framework for Multi-Criteria Performance Measurement (MCPM) will be presented. When developing a framework suitable for a specific company, a combination of approaches is often used. For example, Simple Multi-Attribute Rating Technique (SMART) and Fuzzy TOPSIS can be combined with balanced Scorecard (Rodrigues Lima-Junior & Ribeiro Campinetti 2016).

3.2.2 Supplier Performance Measurement According to BRCGS Storage and Distribution Standard

One of the companies providing a standard within the storage and distribution category is the British Retail Consortium Global Standards (BRCGS). The BRCGS standard called Storage and Distribution is not intended to replace legislation on food and product safety but serves as a means to assure customers that the goods they purchase are safe and have maintained high quality throughout the entire process of storage and distribution. Through audits performed by an external party, the customers are guaranteed that the standard continues to be followed. This is further secured by mandatory unannounced audits at least once every three years. To be certified according to the BRCGS Storage and Distribution standard you order an audit conducted by an external party when you believe you are following the standard correctly. The auditor will then determine if the standard is followed. (BRCGS 2020)

The BRCGS Storage and Distribution standard includes 19 sections. Sections 1-8 are mandatory for all companies certified according to the standard. They are Senior management commitment, Hazard and risk analysis, Product safety and quality management system, Site and building standards, Veichle operating standards, Facility management, Good operating practices, Personnel.

The ninth section is only applicable to companies handling open food products and is called the Handling of open food products. The final 10 sections consist of voluntary modules, that companies can choose to include in their certification if they want to. They are called the Wholesale module, the Cross-docking module, the E-commerce module, and the Contracted services module. The modules are voluntary, but if a company that, for instance, engages in activities involving purchasing and resale of products decides to exclude the wholesale module from its certification, this will be disclosed in the certificate. (BRCGS 2020)

The wholesale module contains two requirements regarding SPE. The clause 10.2 is related to branded products and clause 10.3 is related to wholesaler-own, wholesaler-exclusive and/or customer-exclusive products. The requirements related to SPE are 10.2.1.2 and 10.3.1.3 which include the same conditions for the different product types. The standard states:

> There shall be a documented process for the ongoing assessment of approved suppliers based on risk and defined performance criteria, including complaints. The process shall be fully implemented, and a formal review completed at least annually. Records of the review shall be kept. (BRCGS 2020, p.62, p.63)

Approved suppliers refer to all suppliers that have passed through the supplier approval process, which is a requirement according to clauses 10.2.1.1 and 10.3.1.1 for all suppliers in the categories branded products, wholesaler-own, wholesaler-exclusive, and/or customer-exclusive products.

3.3   Evaluation Approaches

There is not one way of performing SPE, companies adopt different methods based on their wishes and needs. There are therefore many possible ways to measure and evaluate supplier performance. Some of them are described in this section, applicable to different types of companies, business goals, and suppliers.

3.3.1   Supplier Scorecard

The balanced scorecard was first suggested in 1992 by David Norton and Robert Kaplan, as a way of monitoring business performance and a tool to identify areas in need of improvement. The balanced scorecard measured performance in areas like financial, customer, learning and growth, and internal business processes. Kaplan (2009)

While the balanced scorecard suggested by Norton and Kaplan was mainly used to monitor and improve an organization's performance, using scorecards aimed at improving supplier performance is suggested by Doolen et al. (2006). A supplier scorecard gives a clear visual presentation of

supplier performance, based on chosen metrics aligned with the customer company's goals and business objectives.

Doolen et al. (2006) suggests a five-step model to design and implement a supplier scorecard, see Figure 3.3. The first step includes determining what internal business goals and strategies should be aligned with the metrics. The second step involves deciding what metrics are relevant for evaluating the suppliers, ensuring a balanced approach aligned with the goals identified in step 1. This is a key step in the process, as choosing the right metrics is crucial in creating a balanced scorecard. In the third step, the suppliers are involved in the implementation of the scorecard, as this is important to facilitate cooperation between the organizations and make sure they are on board with the ideas behind the scorecard. The suppliers need to accept the performance metrics and be willing to work with the scorecard. The fourth step is creating a comprehensive visual design of the scorecard. This can be done in different ways depending on the organization's wishes. The final step involves informing the suppliers of the layout and procedures behind the scorecard and explaining the consequences related to different levels of performance. (Doolen et al. 2006)
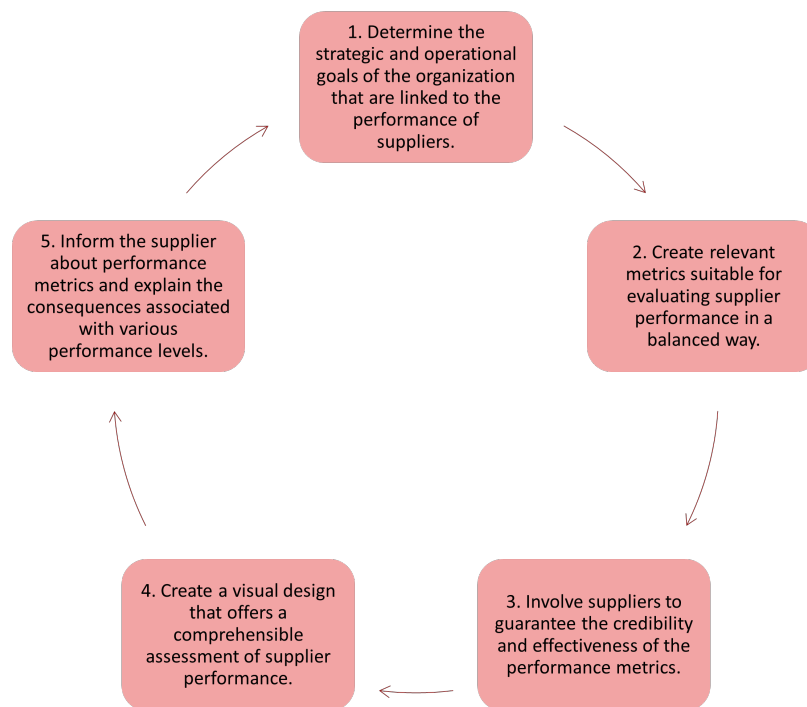
Figure 3.3: Steps to design and implement a supplier scorecard. Adapted from (Doolen et al. 2006, p. 27).

3.3.2   Supplier Audit

Supplier Audit is a time-consuming method requiring periodic visits from a specialist within the buying company to review the supplier's production process and quality organization. The reviews require thorough investigation and the findings are afterward discussed with the supplier. This is followed by a negotiation process for improvement of measures. Supplier audit is a method used for both initial supplier selection and follow-up, but due to its labor-intensive nature, it is only justifiable on strategic suppliers and products. (Van Weele 2014) Additionally, it needs to have clearly defined objectives that are surely value-adding for the buying organization. (Saunders 1994)

3.3.3   Weighted Point Evaluation

Weighted Point Evaluation is an approach where the suppliers are given scores for their performance in different performance dimensions and the performance dimensions are given a weight based on their importance. If these scores are based on collected data it can be an effective way of comprehending the performance of suppliers and using it in decision-making. (Van Weele 2014) Numerous SPE models utilize a weighting system to account for variations in the importance of different attributes.

One model that uses a weighting system is Simple Multi-Attribute Rating Technique (SMART). SMART is a common model in many types of decisions where the weights of the criteria are decided by first assigning all dimensions importance from 0 to 100, with 100 being the most important dimension, followed by a calculation of a weighted average which allows normalization and the weights to sum to 1. (Rahim & Risawandi 2016) After normalization, the criteria should be assigned values to be comparable. This works for both qualitative and quantitative criteria. The values can for example be on a scale from 1-4, where each number represents an interval within the category. See Figure 3.4 for an example based on Rahim & Risawandi (2016). Afterward, all alternatives are assigned values within each criterion, multiple the values with the weights, and sum the values. (Rahim & Risawandi 2016) Rahim & Risawandi (2016) further state that the SMART method can be combined with other methods to suit the specific purpose.

A Weighted Point Evaluation approach is usually used due to its reliable results and moderate implementation cost. Additionally, users can change the weights and the performance dimensions at any time. This enables quick adaptation and a very flexible system. Because the weights are pre-determined, the results are objective and don't favor some suppliers over others. On the other hand, it can be hard to specify one performance dimension over another, which is the case in this type of evaluation. (NC State University 2011)

Group	Parameter Value
Low	1
Mid	2
High	3
Very high	4

Group (kg)	Parameter Value
> 600	1
400 - 600	2
200 - 399	3
< 200	4

Figure 3.4: Example of how performance dimensions can be assigned values. Adapted from (Rahim & Risawandi 2016, p. 492-493).

3.3.4 Fuzzy TOPSIS

Fuzzy TOPSIS is a Multi Criteria Decision Making Model (MCDM) used both for supplier selection and SPE. Most similar MCDM models only consider highly quantifiable attributes which cause problems if the organization wants to measure non-quantifiable attributes as well. (Boonsong & Jarumaneeroj 2021) To deal with problems that lack sharply defined criteria, fuzzy set theory was developed. Fuzzy set theory provides a mathematical framework that makes it possible to study vague, linguistic, and conceptual phenomena in a precise way. (Zimmermann 2010)

When fuzzy set theory is combined with MCDM, new types of problems can be solved by quantifying the linguistic term with fuzzy numbers that represent weights. One of the most widely applied FMCDM models when working with supplier selection and evaluation is Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Fuzzy TOPSIS has been applied in multiple different industries because it is seen as a simple yet powerful tool. (Boonsong & Jarumaneeroj 2021) Fuzzy TOPSIS provides a tool for choosing the idea that is as close to the positive ideal solution, but as far from the negative ideal solution as possible. The positive ideal solution is the solution with maximized advantages and minimized cost, while the negative ideal solution is, on the contrary, the solution with maximized cost and minimized advantages. (Stevića et al. 2016) Supplier performance is represented by fuzzy numbers in a normalized matrix. Weighting is included in the matrix and it identifies the ideal and anti-ideal solutions and ranks alternatives based on their proximity to the ideal solution. (Stevića et al. 2016) This way, suppliers that are underperforming can be identified and appropriate actions can be taken if needed (Osiro et al. 2014).

3.4 Supplier Performance Metrics

Purchasing and Supply Chain Management (SCM) have a major strategic relevance within companies. Strategic purchasing focuses on integrating the purchasing function with other functions within the organization. Furthermore, strategic purchasing departments work to align the purchasing objectives with the company objectives. (Van Weele 2014) O'Brien (2022) states that supplier performance is a business measure and not just a procurement measure. In other words, the purpose of Supplier Performance Measurement (SPM) is to support the achievement of business goals, and therefore the measures should be aligned with the company's objectives. O'Brien (2022) defines SPM as achieving business outcomes and goals by targeted evaluation, measuring, and monitoring of suppliers' performance business processes and practices. Gordon (2008) further argues that the specific industry the company operates in should also be considered when measuring supplier performance.

3.4.1 Requirements on Metrics

There are several requirements that supplier performance metrics should fulfill. According to O'Brien (2022), an effective SPE approach needs to measure the correct amount of the correct thing, at the correct time. He further argues that many organizations measure a large quantity of metrics, but to use resources efficiently it is important to only measure what adds value to measure. O'Brien (2022) Gordon (2008) is confirming this, arguing that there are certain characteristics that metrics measuring supplier performance ought to encompass, see Table 3.1.

Table 3.1: Characteristics that supplier performance measurement should fulfill according to (Gordon 2008).

Characteristic	Explanation
Meaningful	What is measured should be related to the measuring organizations overall goals and objectives.
Valuable	When deciding what should be measured both customers requiremets and business goals should be considered.
Balanced	There should be a diversity among the metrics, making sure that many perspectives of supplier performance is taken into account.
Linked	The supplier has the responsibility to achieve the measure, and this should be facilitated by collaboration with the buying firm.
Practical	The metrics should rely on easily measurable and readily storable data, without the need for extensive post-processing.
Comparable	The metrics should be comparable over time.
Credible	The metrics needs to be based on reliable data in order to be credible.
Timely	The data should not get outdated and should be utlilized and interpreted within a sensible time frame.
Simple	The metrics should be easy to measure and comprehend.
Robust	The metrics should cover many relevant areas and align with best practices and the business belief.
Reasonable number of metrics	Only a reasonable number of metrics should be measured so that it is possible to handle and analyze the results.

3.4.2 Examples of Metrics

In general, there are many potential performance metrics to choose from. To ensure that the metrics are aligned with the business strategy, the metrics should be related to the most important business drivers. (Gordon 2008)

Different authors suggest different metrics for SPE. For example, Krishnadevarajan et al. (2015) describes different areas to measure and suggests that convenience, customer service, financial aspects, growth, innovation, effectiveness, quality, and risk are potential areas that could be measured depending on the company's goals and needs. Other authors suggests including fewer areas, like Cao et al. (2022) focusing on delivery performance, quality, risk management and supplier ability. Since there are many potential areas to measure in an SPE system, what metrics are chosen should depend on what the company in question finds important to track. O'Brien (2022) A compilation of suggestions of what areas should be measured in 8 different articles is presented in Table 3.2.

Table 3.2: Potential areas to include in an SPE system and what literature suggests the area.

Literature	Convenience	Customer service	Sustainability	Effectiveness	Financial aspects	Growth	Innovation	Delivery performance	Quality	Risk management	Supplier ability
Krishnadevarajan et al. (2015)	x	x		x	x	x	x		x	x	
O'Brien (2022)		x	x	x	x			x	x		
Gordon (2008)				x	x		x	x	x		
Doolen et al. (2015)		x			x			x	x	x	
Dey et al. (2015)			x		x			x	x	x	
Cao et al. (2022)								x	x	x	x
Garcia et al. (2013)					x			x	x		
Lee and Drake (2010)	x				x			x	x		

The compilation shows that criteria such as financial aspects, delivery performance and quality are the most commonly mentioned in the literature. Other areas that are often mentioned include risk management, customer service and effectiveness.

For the area of financial aspects, Krishnadevarajan et al. (2015) suggests tracking metrics such as payment terms and discounts, spend and quote responsiveness. O'Brien (2022) adds shipping and delivery cost as a potential metric. The delivery performance area is also widely mentioned in the literature, with Garcia et al. (2013) for example suggesting tracking how well the actual delivery matches the promised delivery date. Lee & Drake (2010) agrees with delivery being an important area to include, suggesting delivery speed and delivery reliability as important metrics. The third area, quality, is mentioned in all of the investigated literature. For this area metrics such as compliance with quality specification (Dey et al. 2015), percent complaints (Gordon 2008) and delivery quality (O'Brien 2022) are proposed.

In the effectiveness area, a data accuracy metric is suggested by O'Brien (2022) and forecast assistance and accuracy are added as potential metrics for this area by Krishnadevarajan et al. (2015). Number of customers and warranties are suggested by Krishnadevarajan et al. (2015) as metrics relevant to monitor related to the risk management area, where Cao et al. (2022) points out risk mitigation activities as an important metric to include as well. Regarding customer service, Krishnadevarajan et al. (2015) advocates for following up number of stock-outs and order visibility and tracking. Further, O'Brien (2022) suggests tracking relationship performance and Doolen et al. (2006) proposes including response time in the evaluation. The suggested metrics are illustrated

in Figure 3.5.

Financial aspects	Delivery performance	Quality
• Payment terms and discounts • Spend • Quote responsiveness • Shipping and delivery cost	• Service level • Delivery reliability • Delivery speed	• Compliance with quality specification • Percent complaints • Delivery quality
Effectiveness	Risk management	Customer service
• Data accuracy • Forecast assistance and accuracy	• Number of customers • Warranties • Risk mitigation activities	• Number of stock-outs • Order visibility and tracking • Relationship performance • Response time

Figure 3.5: Metrics related to the most frequently mentioned areas in the literature.

3.5 Follow-up and Evaluation

Gordon (2008) stresses the importance of following up the results of SPE. If this is not done, there is no point in actually tracking performance in the first place. In a company, there are many stakeholders related to suppliers' performance and they should all be able to take part of the results. O'Brien (2022) also mentions the value in sharing results of the SPE internally within the company. As supplier performance is important in other functions than just the procurement function, he agrees that stakeholders across the whole company should be aware of the results of the SPE. Who should be involved in the process of developing, maintaining, and following up the SPE depends on the company, their strategy and to what departments the SPE results are of value Gordon (2008).

O'Brien (2022) highlights the importance of following up the results from the SPE with the suppliers. If the results do not lead to any assessment and potential action, there is no point in actually having an SPE system as the suppliers will often not improve without any reason to. According to O'Brien (2022) it is common for companies to not follow up on the evaluation results with their suppliers. This could be because they do not want to spend resources on it or because they assume that there is no point in sharing the results with the supplier.

3.5.1 Levels of Measures

According to O'Brien (2022) there are six levels of measures to take relating to supplier's performance. They are described in Figure 3.6 and range from undertaking no action due to the nature of the issue and the categorization of the supplier, to working towards mutual goals and taking necessary measures to reach them. Even though O'Brien (2022) emphasizes how important it is to follow up on the results with the suppliers, he notes that suppliers' interest in improving may vary depending on what type of supplier it is. Strategic suppliers have a high chance of being motivated to improve since they often collaborate with the customer company. The same goes for suppliers where the customers have a high buying power since those suppliers want to secure their customers to stay. Suppliers that have the power themselves due to that there, for example, are not many alternatives on the market might not be as willing to take drastic actions to improve since they are confident that they will keep their customers anyway. Suppliers that are not leading to high spend might also not have a very high motivation to do other actions for improvement than just basic actions. (O'Brien 2022)
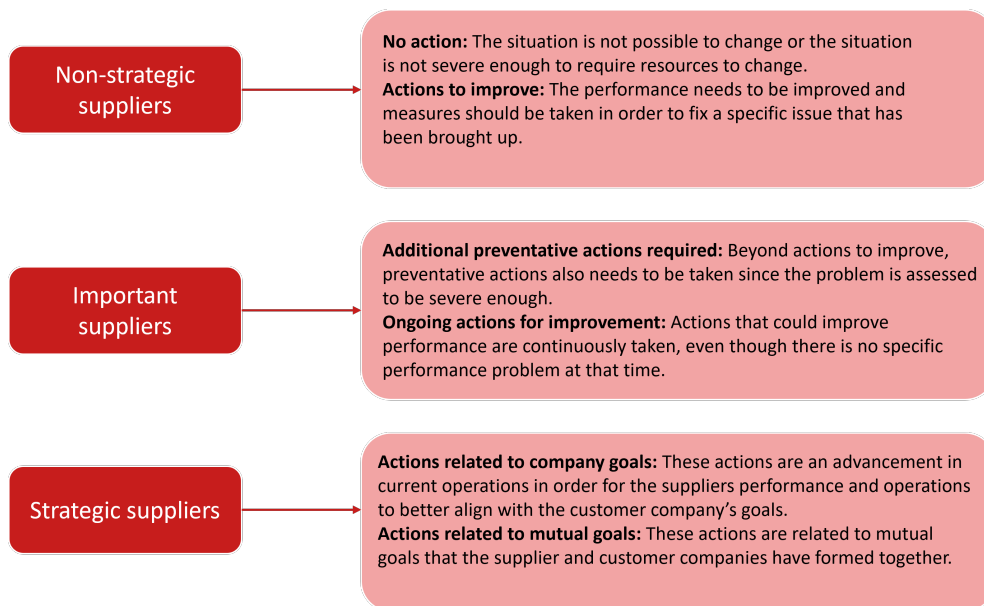
Figure 3.6: Actions related to supplier performance suggested by O'Brien (2022) depending on type of supplier.

One example of how groups of suppliers can be divided depending on what actions should be taken is described by Boonsong & Jarumaneeroj (2021). In their study, they divide suppliers based on their performance results in the SPE. If suppliers are underperforming in many categories in the SPE, they are placed in groups where they might get replaced. If they are only under-performing in one or a few categories, they will be included in improvement programs targeting these spe-

cific areas. If they are performing well in all categories, the suppliers will not be going through any improvement programs and the buyer-supplier relationship will be maintained. Boonsong & Jarumaneeroj (2021)

3.6 Application on Companies

Benchmarking against other companies comparing what metrics and approaches they use for SPE can be an effective strategy. When doing this it is important to be careful and always consider if their methods are relevant to the subject company and industry it is operating in. (Gordon 2008) Several studies investigate how applying an SPE system on a company can be done, and often the studies turn out differently depending on the company studied.

3.6.1 Supplier Scorecard in Manufacturing Company

In a study Doolen et al. (2006) implemented a supplier scorecard in a manufacturing company called NMI, working with metal for the electronics industry. The reason behind the choice of implementing a supplier scorecard was NMI's process of becoming a leaner organization and their wish to improve their work with the suppliers, their delivered quality, and their general performance. They had previously worked with SPE but not regularly and in a structured way.

The areas that were identified as suitable for NMI to measure were customer support, delivery, quality, and cost, and in all of the areas, several metrics were used. These areas were assessed as related to business goals and objectives both for NMI and their customers. (Doolen et al. 2006)

The metrics chosen for the scorecard needed to be possible to track for NMI, as well as being based on data that was objective. The metrics should also be able to help pinpoint potential areas that could be improved. The suppliers were given scores in different areas that in turn were multiplied with a weight assigned by NMI based on how they valued the area. Based on NMI's views on the specific product related to the supplier, the same metric could be assigned different weights for different suppliers. If a metric did not apply to the specific supplier, it was not measured for that specific supplier. The weights and specific metrics were discussed with the suppliers for them to be able to give their opinion on the SPE system. (Doolen et al. 2006)

The scorecard design aimed to quickly give an overview of overall supplier performance, by viewing a score for the specific supplier. It contained three sections viewing graphs and charts of performance for the most important metrics during the latest period of three months, performance data for the previous 12 months, and information on the definition of the metrics and how they were calculated. (Doolen et al. 2006)

The authors found that the relationship that NMI had with their suppliers, the information sharing between the parties, and the spirit of teamwork were essential in the process of developing the scorecard. Challenges during the process that the authors describe include the data collection and insertion in a scorecard since the data was collected via multiple sources. Using a single source for data collection would be preferable according to Doolen et al. (2006). Initially, the project focused on developing the scorecard for core suppliers, but in a second phase, NMI started to try and apply the system to non-core suppliers as well. To do this, it would be necessary for them to move on from the paper-based scorecard used in the first phase to a digital one. This is because the paper-based scorecard required a lot of manual work that would not be cost-efficient for the large number of suppliers. (Doolen et al. 2006)

3.6.2   Supplier Scorecard in Medical Device Company

To improve the supplier evaluation and monitoring process Cao et al. (2022) uses a case study to develop a supplier scorecard for a company in the medical device industry. The company has over 200 employees and is classified by Cao et al. (2022) as medium-sized. Since it is a company certified according to ISO13485:2016, there are certain requirements that their evaluation process needs to meet which was taken into account when developing the supplier scorecard. There are some guidelines for the supplier evaluation criteria, for example, they need to evaluate whether the product delivered affects the medical device's quality and if the supplier meets the requirements of the organization. It should also review the supplier's performance and the risk related to the device. However, Cao et al. (2022) claims that there is not a specific instruction of how the SPE system should be designed. Before the study, there were processes in place to evaluate suppliers, for example, reporting incidents when requirements were not met. However, the previous system did not make it clear when a supplier was underperforming, since it appeared that not all employees bothered to report smaller issues with supplier performance.

With the help of information gathered in semi-structured interviews and input from a review panel, Cao et al. (2022) determined appropriate evaluation criteria to use in the supplier scorecard. When developing the scorecard, Cao et al. (2022) considered other studies finding that a 50/50 ratio between qualitative and quantitative criteria should be used. They also considered theories around the need for the evaluation criteria to be related to the business goals and objectives of the company.

The areas that Cao et al. (2022) chose to measure in the final scorecard were supplier ability, risk control, supplier performance, and potential impact. These were based on the criteria required in the ISO13485:2016 standard. Each area includes several metrics which are used to measure the supplier's performance in the area. Based on employees' opinions of the importance of different areas, weights were assigned to the 4 areas. The scorecards differ between different suppliers since

not all metrics are relevant for all suppliers. On the scorecard, the suppliers are given a score of 1-3 based on their performance for that specific metric. The final score was calculated by multiplying the weight of each area with the score for all the metrics in that area.

According to Cao et al. (2022) the scorecard gave a clear indicator of suppliers' performance and an overview of areas they were performing well in but also areas that required improvement. This was visualized in an easily comprehensible scorecard. They suggest that organizations need to choose different areas to measure based on their needs and objectives and therefore scorecards should be customized to fit the specific organization.

3.6.3   Supplier Audit in the Confectionery Industry

Djekic et al. (2016) evaluated the benefits and constraints of using second-party audits as a method for improving suppliers' quality and food safety systems. To do this, an audit program was designed. In the program, nine flour mill- and four food packaging companies were included. One initial audit was performed at the beginning of the program and one follow-up was performed after one year. The audits were based on different standards and directives. The authors found that both types of companies increased their scores significantly after the implementation of the audit program. The study showed that second-party audits effectively drive improvement in the long term and that they are effective in improving suppliers' systems and not only in qualifying them. On the other hand, there are some limitations related to the narrow focus on a subset of the supply chain.

3.6.4   Weighted Point Evaluation System for Company in the Food Industry

In a study of a Swedish company in the Food Industry, Wuttke (2020) describes an SPE system based on a Weighted Point Evaluation system that includes scores and weights presented in an IT system. The model that Wuttke (2020) presents is based on suppliers being given scores between 0-100 for different aspects of their performance. Wuttke (2020) argues that it is important to be able to differentiate between supplier's performance and this is the reason for the large variety of possible points. Something that Wuttke (2020) highlights is the importance of defining requirements for how to perform to achieve different levels of scoring for qualitative attributes.

Further, Wuttke (2020) believes that several areas should be evaluated, with multiple metrics scored for each area. Suggestions of potential areas are product quality, food safety, logistics, environment and commercial but Wuttke (2020) emphasizes the significance of the company choosing areas and metrics that are relevant to their business and that the company should be the ones to make the final decision on what should be measured. Weights are assigned to all specific metrics

and to the areas measured depending on their importance to the company. The scores and weights are then multiplied and added to achieve a total score for the supplier.

All of the changes in the SPE system are suggested to be implemented in a cloud-based IT system. The IT system is designed with 3 parts, containing information about the suppliers' total score as well as their score in different areas. Suppliers ranking against each other is also provided in the system. The IT system includes functions making it possible to change weights assigned to metrics, as well as choosing what metrics should be tracked for a specific supplier. It is also possible to add new suppliers and delete old suppliers in the IT system.

3.6.5 Three-Dimensional Fuzzy TOPSIS Framework for a Fuel Commercial Marketing Company

Boonsong & Jarumaneeroj (2021) developed an SPE process for a company whose business is related to fuel commercial marketing. The proposed framework is a three-dimensional Fuzzy TOPSIS that iteratively applies three Fuzzy TOPSIS models to the suppliers. The three dimensions are cost, quality, and time, and the framework is applied to one aspect at a time. The selection of the Fuzzy TOPSIS approach was motivated by its ease of implementation and minimal data requirements. The authors also state that the Fuzzy TOPSIS framework is chosen for the company since some criteria are hard to quantify. If all criteria were completely quantifiable, an even simpler framework would be enough, for example SMART. Initially, they had 48 different criteria divided into the three dimensions, but after a review from experts from the company, they decided to only investigate 24 of them. (Boonsong & Jarumaneeroj 2021)

The framework enabled the company to perceive the position of its suppliers relative to others, thus providing an opportunity for supplier development in their areas of weakness. The framework enabled the suppliers to be placed in a three-dimensional cube and the cube could then, in turn, be divided into different groups of suppliers. Directives could then be devised for each group, to improve the buyer-supplier relationship. The directives varied from "Replace suppliers due to their high cost, low product quality, and poor service time". to " Maintain buyer-supplier relationship with suppliers with a superb performance in all domains". They found that all of their 33 suppliers performed in terms of quality, but 6 needed improvements on either cost or time, and one needed to improve both of them. The results confirmed the expert's initial opinions as the company's quality monitoring system is rigorous, but cost and service time are both non-regulated. (Boonsong & Jarumaneeroj 2021)

3.7 Concluding the Literature Review

To conclude the literature review, a framework that forms the basis for further evaluation has been created. The framework considers all main topics studied in the theoretical study.

SPE is part of the final step in the purchasing model created by Van Weele (2014), see Figure 3.7. This step includes measuring the performance of the suppliers and can be conducted in many different ways. Having an SPE system in a company is essential to ensure the safety and quality of products and services, mitigate risk, and be able to reach business goals, but it can also be a requirement in order to be certified according to a standard, like the BRCGS standard.
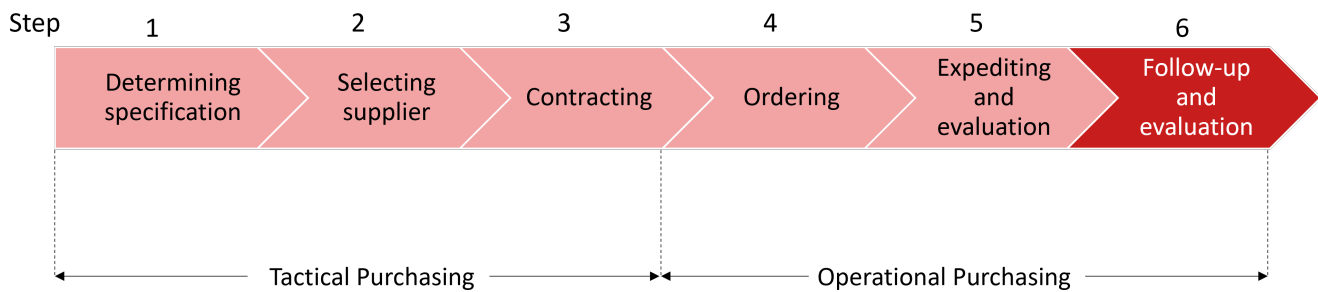
Figure 3.7: Van Weele's purchasing process. Adapted from (Van Weele 2014, p. 8).

Gordon (2008) and O'Brien (2022) states several areas to consider when designing an SPE system. Considering this, in combination with the research questions, a process for designing an SPE system was determined.

The first step is to present the performance goals that the system needs to be aligned with. This part of the framework was selected as the first step since strategic alignment is relevant to both the selection of evaluation approach and performance metrics and needs to be defined before these areas are further analyzed. The second step is to select an appropriate evaluation approach. After that, the metrics should be determined. Finally, it is important that the model can be used in the organization, and the implementation should thus be designed. The process is visualized in Figure 3.8.

Figure 3.8: The identified process for designing an SPE system.

O'Brien (2022) describes that there are some guidelines to follow when developing an SPE system, including adapting the SPE system to the business goals and objectives of the company. This is important in order to make sure that the SPE system brings as much value as possible to the company. This process is visualized in Figure 3.9.

Figure 3.9: It is important that the SPE strategy is aligned with the overall organizational goals and objectives.

There are many methods to choose from when creating the SPE system, presented in Figure 3.10. The Weighted Point Evaluation System and supplier scorecard are similar in terms of how it is possible in both processes to assign scores for different metrics and multiply them with a weight based on their importance. The methods differ in how the scores are presented, and the Weighted Point Evaluation System has a defined span for scores between 1-100 while the supplier scorecard is more customizable in terms of what scores should be possible to achieve. In the supplier scorecard, it is not a requirement to include weights, while in the Weighted Point Evaluation method it is. In the Fuzzy TOPSIS method, weights are instead represented by fuzzy numbers, which makes the model better at handling uncertainties and qualitative data. The supplier audit is based on visits to the supplier where qualitative data is collected, and differs from the other systems in terms of time demand and way of collecting data.
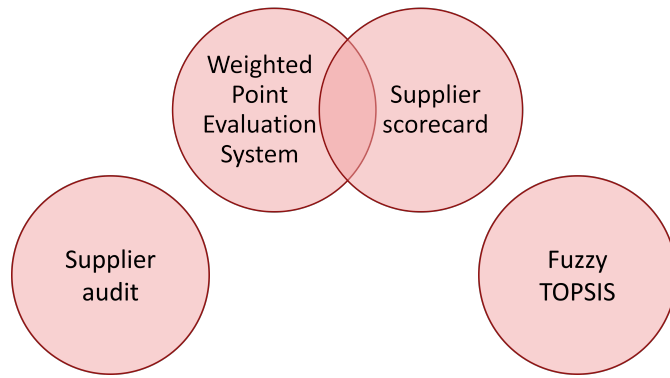
Figure 3.10: A Venn diagram with potential supplier performance evaluation methods.

According to Gordon (2008), metrics should be chosen based on the appropriateness of measuring them related to the business goals and objectives in the specific company. Krishnadevarajan et al. (2015) emphasizes that metrics should monitor supplier performance from different perspectives. Potential areas to choose from and specific metrics related to the areas based on the compilation of areas and metrics in Table 3.2 and Figure 3.5 are presented in Figure 3.11.

Financial aspects	Delivery performance	Quality
• Payment terms and discounts • Spend • Quote responsiveness • Shipping and delivery cost	• Service level • Delivery reliability • Delivery speed	• Compliance with quality specification • Percent complaints • Delivery quality

Effectiveness	Risk management	Customer service
• Data accuracy • Forecast assistance and accuracy	• Number of customers • Warranties • Risk mitigation activities	• Number of stock-outs • Order visibility and tracking • Relationship performance • Response time

Figure 3.11: Potential areas to include in the SPE and metrics related to them.

When selecting the metrics, certain requirements should be fulfilled for them to be valuable according to Gordon (2008), see Figure 3.12.

47
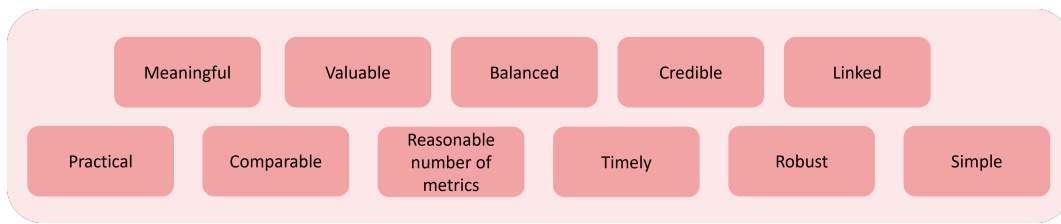
Figure 3.12: Requirements on metrics according to Gordon (2008).

To be able to implement the SPE system in the organization and make it as valuable as possible, two main areas have been identified within the scope of this thesis, based on theory presented by O'Brien (2022) and Gordon (2008). The first area is related to determining how suppliers should be followed up. Furthermore, the data integration must be considered to be able to practically perform the SPE, see 3.13.

Figure 3.13: Elements included in the implementation phase.

The step-by-step approach in Figure 3.8 was combined with insights regarding each area and can be used as a foundation for developing an SPE system. The framework is presented in Figure 3.14.
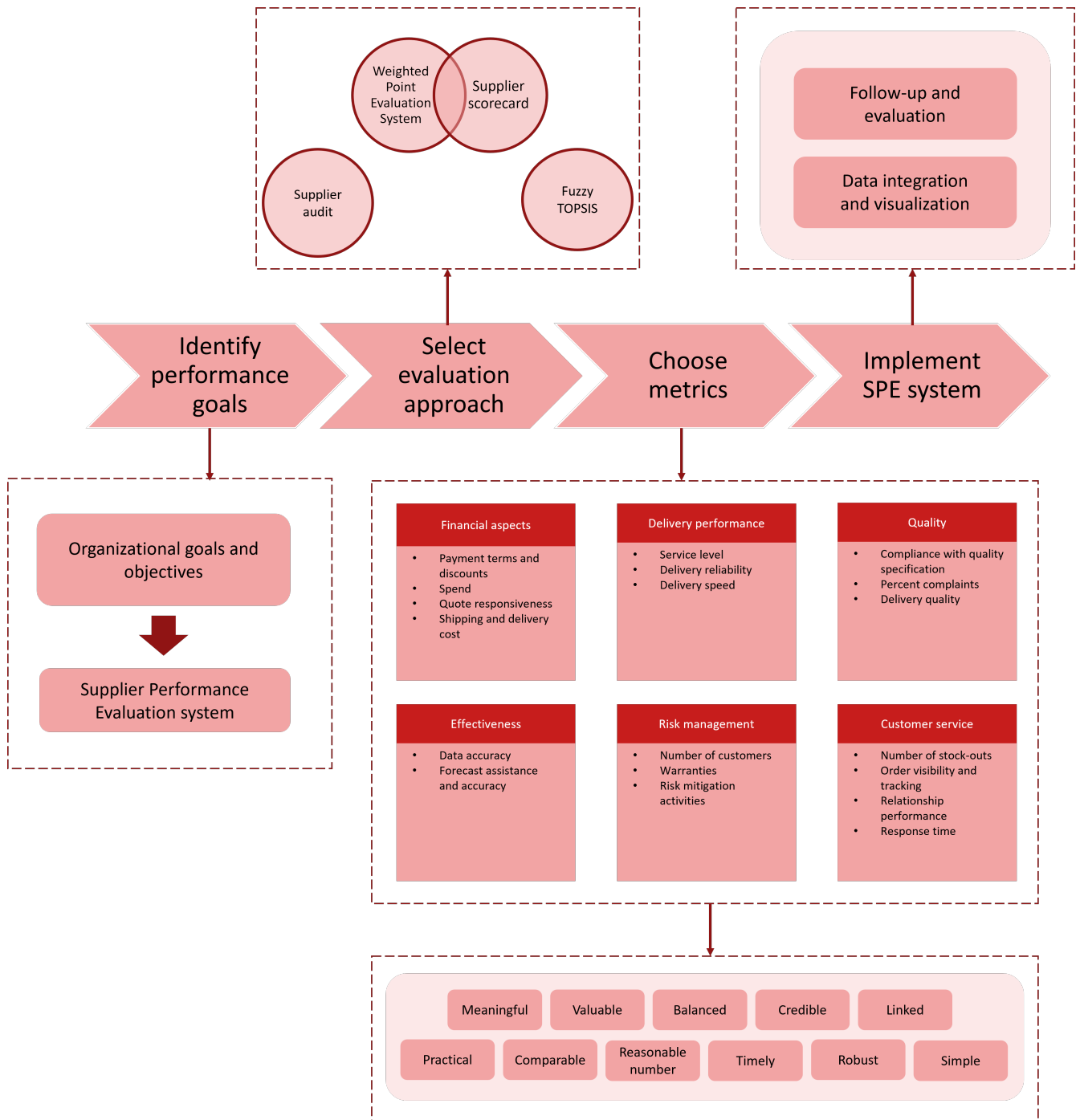
Figure 3.14: Framework for designing a Supplier Performance Evaluation system.

Chapter 4

Empirical Study

This chapter presents information about the Company and thoughts about its operations and current work with SPE. It also presents wishes for the new SPE system from the interview objects, and how the Procurement Company within the Group works with SPE today. If nothing else is stated, all information in this chapter is based on interviews with representatives from the Company, the Group, and documentation provided by the Company. When responses relate to factual matters or demonstrate agreement, the interviewees will not be specified. However, when discussing personal opinions or preferences, the persons of each viewpoint will be specified.

4.1 Company Strategy

The Company's overarching strategy revolves around facilitating the success of its customers in the food industry. The Company's goal is to be a comprehensive supplier, offering the necessary products and services to meet their customer's needs. While aiming for competitiveness in the market, the Company also emphasizes delivering added value to its customers through, for example, recipe systems, and on-site resources to assist in concept implementation. Consequently, the Company does not prioritize being the cheapest option but still strives to maintain competitiveness. The Company operates as a sales and distribution entity rather than a traditional wholesaler, focusing on offering superior products rather than offering a broad range of the same product. Moreover, the Company has developed its own brand.

4.2 Purchasing Strategy

While cost leadership is not the primary strategy for the Company, maintaining competitive prices is still important. The purchasing department continuously engages in negotiations to secure favorable pricing. Furthermore, they are well aware of current trends and market prices on commodities, and they do not take for granted that they will get the best price already in the first quotation.

The strategic purchasers have the ultimate responsibility for the negotiations, though for certain suppliers the negotiations are handled by the Procurement Company within the Group. This is the case, particularly for the suppliers shared among entities within the Group.

The Procurement Company within the Group focuses on driving the procurement from a collective standpoint. Several policies and standards, such as the BRCGS certification and a Code of Conduct, apply to all companies. Consequently, the Procurement Company within the Group establishes routines and rules aimed at enabling uniformity in procurement for all entities, including the Company. Meanwhile, the Company still forms its own purchasing strategy and growth agenda.

An important share of the products the Company procures come from within its corporate network, indicating a strategic emphasis on cross-buying within the Group. The cross-buying leads to synergies as it enables margins for both the buying and the selling parties. Additionally, no quality approval is needed as the internal suppliers are already approved by the Group. The cross-buying also entails some challenges. Although the requirements are the same for the internal as for the external suppliers, it is more challenging to set demands on the internal suppliers. One reason for this is that the relationship is even more important and that it is not expected that a sister company will be questioned in the same way as an external supplier. Another difficulty with internal suppliers is the lack of competition. If the Company determines that it wants to buy a specific product from an internal supplier, there may only be one existing option. This puts the Company in a position with little to no negotiating power and it is consequently hard to set demands.

The purchasing function operates with several Key Performance Indicator (KPI) and objectives. One example of an important KPI is service level towards customers, which is defined as the difference between actual and requested delivery date. Weekly follow-ups are conducted to monitor these KPIs, and if there have been any major deviations or incidents, those are discussed. While the focus during these discussions is primarily operational and short-term, strategic actions taken can yield long-term results.

The Company does not have an official classification of which suppliers are strategic, and which are not as important. On the other hand, there are only a few suppliers who deliver the majority of the purchased volume, and the relationships with them are prioritized. The purchasers learn from experience which those suppliers are. Consequently, while there is no official classification of strategic suppliers, certain suppliers are prioritized as if they were.

The Company is exposed to several risks. One risk is related to the trading with international suppliers, since they may not have the same legislation related to working conditions as in Sweden. Another risk discussed by both the COO and the Head of Strategic Purchasing is the risk of

not being prioritized by the supplier. This is mostly the case for suppliers where the Company is not one of their largest customers. To make sure the Company is offered the correct prices and conditions, it is crucial to build strong relationships and make the supplier think that the Company is a customer of importance. Correct prices toward customers are also important to maintain reliability.

4.3 Previous Work with Supplier Performance Evaluation

Four years ago, the Company changed its business system from Movex to Microsoft Dynamics 365. During this change, the routine of following up supplier performance in a supplier scorecard was lost. The supplier scorecard was previously filled in every six months by someone working with purchasing. When Movex was used no Power BI system was connected to it, so the Excel sheet with the supplier scorecard needed to be filled in manually based on the data that could be found in Movex. An Excel sheet with the old scorecard has been provided to the authors, where the categories the suppliers were assessed on are listed. The categories are:

- Delivery performance to request date - The percentage of completed orderlines fulfilled on or before the Company's requested date

- Quality conformance - The percentage of completed orderlines that have an absence of defects

- Quality customer satisfaction - The percentage of sold kgs that meet the degree of customer satisfaction with a product's characteristics and features

- Inventory turns - How many times inventory has been sold during a period of time

- Quality certification - Different numbers of points are distributed depending on the quality certification(s) the supplier has, if any

The points achieved in each criterion were multiplied by weights which resulted in a comparable total point. The criteria were also assessed one by one, to see if they reached the targets.

4.4 Current System for Supplier Performance Evaluation

The current SPE system was created when the Company got a deviation during an unannounced BRCGS audit due to the lack of an implemented SPE system. The Head of Strategic Purchasing then used her experience from working with SPE and created a temporary template that would be approved by BRCGS and was simple enough to use. The motive behind this system was to fulfill the requirements by BRCGS, but resources were not enough to work more in-depth with perfecting the system. Therefore the Company cannot currently take advantage of the SPE in their daily operations.

4.4.1 Supplier Performance Evaluation System Design

The SPE system is based on an Excel sheet updated annually by the Head of Strategic Purchasing. The evaluation incorporates a combination of objective statistics and subjective assessments based on the purchaser's experiences in collaborating with the suppliers. Approximately 50 suppliers are included in the evaluation, chosen for their strategic significance or substantial expenditure by the company. The reason why not all suppliers are included in the evaluation is that the Company does not think it is worth going through the time-consuming process in the current evaluation system to evaluate the small and non-strategic suppliers. However, if problems occur throughout the year with any of the Company's suppliers, they usually take action regardless of whether they are included in the SPE system or not. This is dependent on someone being alerted of the issues and judging that actions should be taken, and is not systematically detected in for example an SPE system. Additionally, the Business Controller for Sales notes that the purchasing- and sales departments cooperate when needed in issues regarding certain products.

4.4.2 Supplier Audits

The Company also uses supplier audit as an evaluation method in some cases. Supplier audits are used when the Company needs to ensure the quality of the products by examining the production process, as well as to ensure that the suppliers have fair working conditions and a safe production process. It is especially important to check that suppliers operating outside of the European Union are following the requirements that the Company has. Child labor and poor safety are specifically things that need to be investigated.

Supplier audits can also be a way to build a strong relationship with the suppliers and ensure that the Company is seen as an important customer to the supplier. This is important when there are, for example, limited resources and the suppliers need to prioritize what customers can get products, but also to ensure that the Company gets a fair price.

When a supplier is not certified according to a standard like BRCGS the Company needs to check that certain requirements are fulfilled according to the Group's and the Company's policies to be able to approve them as a supplier, and a supplier audit is one way of doing that. Supplier audits are also used when there have been issues with the supplier or if the supplier is new and strategically important.

4.4.3 Metrics

There are several metrics included in the currently used SPE system. First, the supplier number, supplier name, purchaser responsible, and reason for evaluation are stated. Suppliers are evaluated either due to high a spend or strategic importance. Whether it is a product from the Company's

own brand or not is also declared. Thereafter the assessment from the strategic purchasing department is included. This is a score between 1 and 3 that includes a subjective assessment from the responsible strategic purchaser and depends on criteria like cooperation, price and assortment. They do not base this score on any exact data, but more of a feeling of the supplier's performance. The assessment from the operative purchaser is also a score between 1 and 3 based on experience from working with the suppliers in aspects like delivery security, cooperation and lack of order confirmation. There are no exact guidelines that the operative purchasers follow when they assign the score to the suppliers, it is up to them what they want to consider in the assessment.

There is also quantitative data related to the suppliers' performance included in the SPE system. Quality is measured by collecting data on the number of deviations and complaints that are related to each supplier. Deviations are issues with the products that are detected at the Company, and complaints are customer feedback that they receive. The Company has predefined thresholds for deviations and complaints, resulting in a supplier score ranging from 1 and 3. Additionally, there is a quantitative category labeled "warehouse," focusing on non-conformance identified upon product arrival. Non-conformance may escalate to deviations if they are severe, but otherwise, they are just registered in the warehouse category in the Excel sheet. The quantity of non-conformance is translated into a score between 1 and 3, determined by specific criteria outlining how many non-conformance correspond to each score. The current SPE system also includes a metric that states the difference in days between expected delivery date and actual delivery date.

4.4.4 Departments Involved

Currently, the Head of Strategic Purchasing is responsible for the SPE system, and the operative purchasers are reminded annually to provide their assessment for the operational purchasing category. However, aside from this annual input, they are not actively engaged in the process. The COO reviews the results of the evaluation if he needs background information on supplier performance to prepare for a meeting with a supplier.

4.4.5 Follow-up and Evaluation

After rating the suppliers according to the predetermined attributes, an average score is calculated to reflect the performance of the specific supplier. This calculation is done within the same Excel sheet used for the rest of the evaluation process. Apart from this, the Company currently does not have any thorough method for analyzing the data collected in the SPE process.

A comment or action point is required when a supplier receives an average score lower than 2. In some instances where it is impractical to take corrective measures or replace the supplier, the reason for this decision must be explicitly stated. A follow-up on the suppliers identified for action

is done after six months to identify and evaluate any improvements. The strategic purchasing department has the ultimate responsibility for the follow-up but depending on the situation and the relationship with the specific supplier, the operative purchasing department may also be a part of it.

Although only 50 of the suppliers are currently included in the SPE process, the Head of Strategic Purchasing emphasizes that the rest of the suppliers can not underperform without it being noticed. If a supplier underperforms throughout the year, the Company will notice it and take necessary measures even though the supplier is not included in the Company's general SPE routine.

4.5   Data Integration and Visualization

Despite the lack of data analysis of current SPE data, a lot of data is gathered, managed, and analyzed for other purposes. The Company regularly works with several Power BI reports and the system for that has been developed over several years. One advantage of working in Power BI, is that it is easy to use for everyone interested. To get access to the information in the report, the only thing that has to be done is to open it. The information from Microsoft Dynamics updates every night. Another advantage is that it allows the user to dive deeper into the categories that they consider relevant, and for example, follow certain suppliers or articles.

One challenge with the system is that the sales data and the data of warehouse transactions are in different databases and can not be combined in one Power BI report. Currently, if an employee is interested in combining, for example, purchasing statistics with warehouse transactions, they must look into two different reports from different databases. Some data can also only be accessed through the Customer Relationship Management (CRM) system. CRM data can, for example, be contact details for the suppliers, but data about complaints is also only stored in the CRM system.

4.5.1   Change of Data Bases

The databases from where representatives from the Company get their data have been changed several times and they are currently in the process of changing it again. The change will hopefully enable a more flexible system where more types of data can be collected into one single report.

To change databases, the Power BI reports must be moved to the new system, and employees must be trained in how the reports are built and used. It is also important that the reports are based on dynamic documents to ensure they are up to date to support the operations in the way they are supposed to. Another important factor is that the reports are developed based on what is feasible for the organization to measure and follow. Since the data transaction has not been made yet, representatives from the Company have not yet started to look into details about how the data

from different sources should be combined.

4.6 Potential Areas of Improvement and Thoughts on Future System

The employees have different opinions on potential areas for improvement in the current SPE system, but there is a consensus that some areas are insufficient and need improvement. The current system is perceived as reactive, driven solely by the BRCGS requirements. However, the COO and Head of Strategic Purchasing see the potential for creating a proactive system to be used as a valuable tool for continuous improvement that could contribute significant value to the company.

Automating updates and eliminating the need for manual score input is something that all interviewees agree would add significant value. Many also agree that a more frequent system update, beyond the current annual update, could substantially benefit the company. According to the Head of Strategic Purchasing, it would be valuable to see results of supplier performance after just a few months of working with them as well.

The Head of Strategic Purchasing and the Supply and Demand Manager advocate for a more interactive system, since they believe that this would increase the utilization of the system within the Company. The COO supports this perspective, emphasizing the value of easily accessible supplier performance data in enhancing negotiations and discussions with suppliers. He also sees potential value for the Chief Executive Officer (CEO) of the Company to use these results, particularly during dialogues with owners and leaders of supplier companies. According to the COO, most of the data needed for developing the current SPE system further already exists but it is not collected in one place. Resources are therefore required to compile all the data into one place. The COO explains that he would prefer having a general flash picture of the suppliers' performance and then the possibility of digging deeper into a more detailed description of the supplier performance. The Supply and Demand Manager emphasizes the importance of registering and documenting the data in a smooth way to minimize the use of excessive resources for data collection and compilation.

The Head of Strategic Purchasing emphasizes the value of incorporating all suppliers into the SPE system as they can not currently compare and evaluate all their suppliers. This would also be in line with the requirements of the BRCGS standard. However, the COO believes that there are a few strategic suppliers that are especially valuable for him to be updated on and that small suppliers with a low spend are not particularly relevant in his role.

The Head of Strategic Purchasing also raises concerns regarding the subjective metrics used for strategic and operational purchasing scores. According to her, adopting an objective scoring sys-

tem would be preferable, as the individual purchaser can influence the current scoring process, and it also demands additional resources for score assignment. The Supply and Demand Manager shares these concerns, highlighting the potential variability in subjective scores based on the purchaser. Additionally, he points out the risk that scoring variations may arise depending on the frequency of interaction between the purchaser and the supplier. When there is no requirement for ongoing communication with the supplier, there is a risk of forgetting the impressions formed about the supplier.

The Head of Strategic Purchasing wishes to gain an overview of supplier performance, encompassing trends, historical data, and the current status. This could include different colors to represent varying levels of performance, with results that are sometimes presented in a score format and sometimes as a percentage. Additionally, she seeks the ability to access a compiled list showcasing the overall scores of all suppliers, facilitating easy comparison and identification of underperforming suppliers. She emphasizes that implementing a supplier scorecard would be an improvement of the current system. The Business Controller for Sales states that a supplier scorecard similar to the one they used during the time of Movex, could be a suitable solution.

Continuing to use supplier audits as a part of the supplier performance evaluation system might also bring value to the Company according to the COO and Head of Strategic Purchasing. The qualitative evaluation that supplier audits bring can ensure fair and safe working conditions in the supplier companies, as well as the quality of the products. It can also be a valuable part of building a strong relationship with the supplier.

4.6.1 Adoption to the BRCGS Standard

Following the BRCGS Storage and Distribution standard correctly, the Company should include all their suppliers in the evaluation. However, the standard does not include any information on what metrics should be included in the evaluation. To follow the BRCGS standard correctly all the suppliers should be included in the evaluation. The Head of Strategic Purchasing thinks that this would benefit the company both in order to follow the standard but also to make sure that the Company keeps track of the performance of all suppliers and not just a selected few.

4.6.2 New Metrics

Including more quantitative data in the new system since the qualitative metrics may not accurately portray reality is something that all interviewees agree on. There are several specific metrics that the employees think could be valuable to include.

In the current system, transport-related issues are not included, which the Head of Strategic

Purchasing believes could be a valuable addition to the evaluation. Identifying problems with specific suppliers in this context could be important in order to get a complete view of supplier performance. The COO shares this concern, expressing the current lack of clear information on transportation-related issues as a negative aspect in the current SPE system.

The COO also highlights suppliers' service level as an important metric, which is something that the Business Controller for Sales agrees on. The Business Controller for Sales mentions that there currently is a Power BI Report that shows "service level and precision" both from suppliers and towards customers. This report shows the service level from three perspectives:

- The difference in days between the first requested delivery date and the actual delivery date.

- The difference in days between the first confirmed delivery date and the actual delivery date.

- The difference in days between the confirmed delivery date (updated continuously when issues come up) and the actual delivery date.

The COO also requests "volume development" which can be described as how much volume the Company has currently bought from the supplier. This metric serves as an indicator of how well the Company is fulfilling its promised volume commitments. Additionally, the COO advocates for tracking "product deviations" as a valuable metric for the SPE process. He also suggests considering including "earnings" per supplier as a metric, offering insights into potential low-profit margins on sales. Cassations are also highlighted by both the COO and the Business Controller for Purchasing as a critical metric to monitor in the supplier evaluation.

The Supply and Demand Manager explains that there is currently a lack of a comprehensive overview when it comes to tracking delivery errors. This can include for example when a volume too large has been delivered. He also highlights the importance of knowing why you have chosen the specific metrics and argues that it is crucial not to measure for the sake of measurement but to ensure there's a purpose behind each metric and that it adds tangible value. The Business Controller for Purchasing highlights sustainability and climate footprint as important aspects as well and mentions that this is something that the Group wants to be at the forefront of as well. He also brings up percent non-conformance as a valuable metric. All metrics suggested to include in a new SPE system are compiled in Figure 4.1.

Financial aspects	Delivery performance	Quality	Other metrics
• Earnings per supplier	• Transport related issues • Service level • Delivery errors	• Percent non-conformance • Number of product deviations	• Volume development • Cassations • Carbon footprint
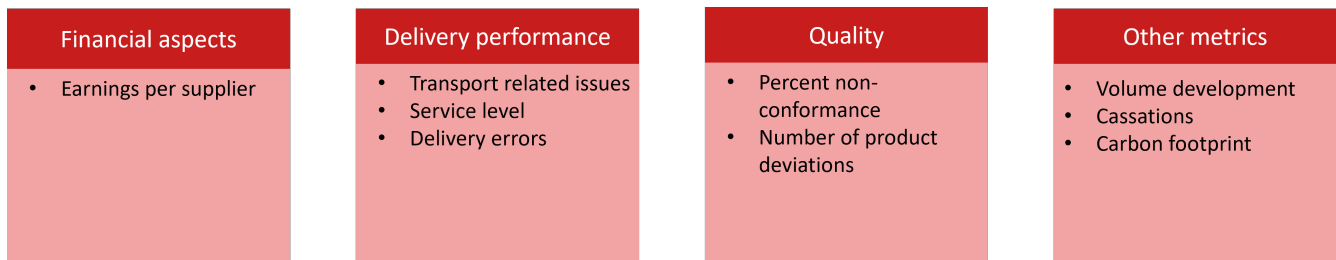
Figure 4.1: The metrics that have been suggested by employees at the Company.

4.6.3   Future Data System

The most common opinion about the future data system is a wish for the ability to combine data from different systems into one overview, and avoid the problem with different data in completely different places. However, there is also a risk that the system gets too slow since there is a lot of available data within the Company that could potentially be processed. Another wish is that everything should come from a dynamic source so that the information can be updated every day and not require a lot of manual work every time.

The Business Controller for Purchasing highlights that despite the challenges, there is still potential in integrating the CRM system and the Power BI system and the progress that has already been made in this area should be utilized. He further says that there may be an opportunity to combine data from different databases and gather all supplier information in the CRM system. This solution is already partly implemented on the customer side of the organization. The users can visit a customer's page in the CRM system and find all relevant Power BI reports as well as easily compare statistics.

4.7   Input from the Procurement Company within the Group

From the Procurement Company within the Group, the Head of a Product Group and the Director for Digital Procurement and Development were interviewed. The Head of a Product Group negotiates contracts with suppliers of products related to her area of responsibility. She is only involved in work related to SPE when there is an issue with a supplier, when she negotiates and stays in touch with the supplier until the issue is fixed. The Director for Digital Procurement and Development works with purchasing process development and digitalization of the strategic purchasing function.

4.7.1   About the Procurement Company within the Group

The role of the centralized purchasing function is to secure the best possible competitive advantages and terms for all the Group's companies in everything they purchase and need to operate. Additionally, they aim to ensure synergies between the companies within the Group. By working together, the Group achieves greater buying power and can negotiate better terms. The team members are experts in their respective categories, providing advice and expertise as they maintain daily oversight of their areas of responsibility. In this way, they secure the best price, terms, and competitiveness for the Group's companies and ensure that they are supplied with the products they need. Moreover, they focus on improving processes and systems to make it possible for the companies that are part of the Group to also utilize them. Common for the suppliers where the Procurement Company within the Group handles the purchasing is that they have a high spend.

4.7.2   Evaluation Approach

The Procurement Company within the Group does not work with continuous evaluation of suppliers themselves. They provide data and guidelines that the companies within the group can use when they do their SPE. The purpose of the SPE is not to do daily follow-ups. They provide the data monthly and it is then up to the companies to use it however they want. In other words, they have not chosen a specific approach like the ones presented in Chapter 3. Some of the metrics are updated automatically but that function is not available for Microsoft Dynamics yet.

A few years ago a project was started aiming to improve the SPE process in the procurement company. One challenge with this project was that some suppliers had problems with unreliable data. It was therefore decided not to proceed with working actively with SPE in the Procurement Company within the Group. One conclusion was to not work with SPE until the quality of the data is ensured since inadequate data leads to poor decisions.

4.7.3   Data Analysis

There is a platform where data from many of the business systems used in companies part of the Group are integrated. This data can partly also be visualized in Power BI. Data related to some of the business systems is not currently downloaded and provided to the companies, for example, data from Microsoft Dynamic that the Company uses. From that business system, only invoice information is provided.

4.8 Focus Group

A focus group was arranged after the interviews and after most of the analysis was made. During the focus group, the participants got to share their opinions about the suggested evaluation approach and the metrics. They also got a chance to share their opinions on the metrics' importance to the Company.

4.8.1 Evaluation Approach

The solution presented to the focus group was a supplier scorecard with weights included, but all details were not yet determined. The participants were overall happy with the solution and highlighted how the solution is user-friendly and enables an overview of supplier performance which allows them to see where action is needed. They thought it would help the Company to work more proactively than they do today. They also expressed that this solution would enable a more objective evaluation than the approach they currently use.

All participants agreed that they wanted to rate the suppliers on a scale from 1 to 5. This would provide some nuance to base the actions on, but still not make it more complicated than necessary. One of the participants expressed a will to demand a different score depending on how important the metric is for the Company. For instance, guidelines might recommend actions for suppliers falling below a score of 4 in certain metrics, while only requiring actions for those graded below 3 in others. After some discussions, everybody agreed that it would be more appropriate to adapt the grading thresholds across all metrics so that the score between 1 and 5 mean the same no matter the metric. This would ensure uniform interpretation of scores for all metrics.

A wish to divide the suppliers into different groups was also expressed since there are different expectations and needs for different types of suppliers. Dividing them into a few groups would also enable easier comparison as suppliers can be compared to suppliers where a similar performance can be expected. One of the participants expressed that they already have an A, B, and C classification on their suppliers. They think the classification is based on spend but they were not completely sure. Some of the other participants were not aware of the classification at all and did not use it in their daily work although it could be useful. While some participants advocated for aligning the grading threshold with the expectations of each group, others proposed adjusting the weightings for supplier groups. This approach would ensure that the total score reflects the varying importance of different metrics for different groups.

4.8.2 Metrics

During the focus group, the participants highlighted the importance of including the supplier's performance related to service level in the scorecard. The currently available data includes several ways of measuring service level, and the participants requested including four different ways of measuring service level. A suggestion for weighting the different types of service levels into one came up during the discussion. This was something that was suggested to be considered further in the final recommendation. The four ways of measuring service level are listed below:

- The percentage of order lines when the requested delivery date has not differed from the actual delivery date.

- The percentage of order lines when the first confirmed delivery date has not differed from the actual delivery date.

- The percentage of order lines where the requested quantity has not differed from the actual delivered quantity.

- The percentage of order lines where the first confirmed quantity has not differed from the actual delivered quantity.

One of the project consultants highlighted that the Company has decided that if there is any difference in delivery date or delivered quantity between the actual, requested, and first confirmed date and quantity, the supplier will receive 0 percent service level for that specific order line. If the date and quantity match, they will receive a 100 percent service level for that specific order line. This can then be summarized as an average service level score for all order lines.

Both the metrics concerning delivery errors and the number of stock-outs are encompassed within the Company's definitions of service level. During discussions on delivery errors, participants agreed that only the wrong quantity delivered, already accounted for within the service level definition, was relevant to include in this metric. Similarly, the number of stock-outs is currently captured in the service level data, and participants reached a consensus that it does not need to be a separate metric.

Percent complaints is seen as an important metric to include by the participants, as it both affects customers and is time-consuming for the Company to handle. Product deviations and non-conformance are also metrics that are important to include in the SPE system which the Head of Strategic Purchasing highlighted and the other participants agreed on. They are all tracking how well the suppliers are fulfilling a high quality in their deliveries.

There was a consensus among the participants that carbon footprint is not a relevant metric to include in the system. They emphasized its potential relevance on a product level rather than for individual suppliers, particularly in the context of comparing suppliers offering the same product. The Group has a strong wish to work sustainable, but their main focus is product related sustainability and that is why it would be more relevant to measure carbon footprint in that context. Therefore, this was not a metric that was seen as important to include in the SPE system.

Transport-related issues is a metric that the participants all agreed could be interesting, but more related to evaluating the transport companies than the suppliers. Therefore, the participants do not think this is a metric that should be included in the supplier scorecard.

The Head of Strategic Purchasing did not think that the quality certification metric should be included in the SPE system. It is important that the suppliers are certified, but sometimes this is not possible and in those cases the Company have other ways of ensuring that they are fulfilling required quality aspects. As a result, all utilized suppliers are guaranteed, through various means, to meet quality certification requirements, and it is not something that needs to be included in the SPE system. After this explanation, all participants agreed on excluding this metric.

Cassations and spend per supplier were both metrics the participants thought would be relevant to include in the SPE system even though the suppliers are not directly responsible for them. The participants in the focus group suggested that cassations can be an important metric to track when, for example, a large number of cassations depend on other aspects than too large quantities ordered, like poor quality delivered. If cassations are included in an overview in the SPE system, it could be easier to identify trends like this when evaluating suppliers. The same reasoning applies to spend per supplier. It is not directly affected by supplier behavior and performance, but the participants still believed it to be relevant for the SPE system. It could be utilized when discussing the importance of taking action on specific supplier's performance for example. The data for these metrics is available.

The participants agreed that earnings per supplier and volume development were irrelevant metrics to include in the SPE system. Since earnings per supplier depend on how the sales team are performing this is not something that should be used to evaluate specific suppliers. Volume development is a metric that the participants believed would be difficult to analyze, and they did not quite see the use of the metric in evaluating the suppliers.

A compilation of the metrics that the focus group suggested to include and not to include in the SPE system can be seen in Figure 4.2. The number of metrics was assessed by the focus group to be reasonable to include.

Metrics suggested to include by the focus group:

- Service level – requested delivery date compared to actual delivery date
- Service level – first confirmed delivery date compared to actual delivery date
- Service level – requested quantity compared to actual delivered quantity
- Service level – first confirmed quantity compared to actual delivered quantity
- Percent complaints
- Number of product deviations
- Percent non-conformance
- Cassations
- Spend per supplier

Metrics suggested not to include by the focus group:

- Delivery errors
- Carbon footprint
- Transport related issues
- Quality certification
- Number of stock-outs
- Earnings per supplier
- Volume development

Figure 4.2: The metrics that the participants suggested to include and to not include in the SPE system.

4.8.3 Weights

The participants shared their thoughts about weights at the end of the focus group. The opinions were collected through a form where the attendees gave each metric a score from 0 to 100, where 100 meant that it was the most important metric for the Company. The results are shown in Table 4.1.

Table 4.1: Average importance of metrics, data collected during the focus group.

Metric	Average Importance
Service level - requested delivery date compared to actual delivery date	84.25
Service level – first confirmed delivery data compared to actual delivery date	85
Service level – requested quantity compared to actual delivered quantity	84.25
Service level – first confirmed quantity compared to actual delivered quantity	80
Percent complaints	76.75
Number of product deviations	62.5
Percent non-conformance	75

Chapter 5

Findings and Analysis

This chapter presents an analysis based on the findings presented in chapter 4 and the theory presented in chapter 3. The analysis is guided by the steps presented in the framework created in Concluding the Literature Review, see Figure 5.1. First, the Company's performance goals and objectives are identified. Next, the appropriate evaluation approach is discussed, based on external requirements and internal wishes and needs. Further, suitable metrics to include in the SPE system are considered, followed by an analysis of important aspects to consider in the implementation phase. Finally, additional aspects related to the scope of the thesis are briefly presented, as well as the advantages of implementing the SPE system.

Figure 5.1: The identified process for designing an SPE system.

5.1 Identify Performance Goals

The first step in designing an SPE system is to identify performance goals, see Figure 5.2.
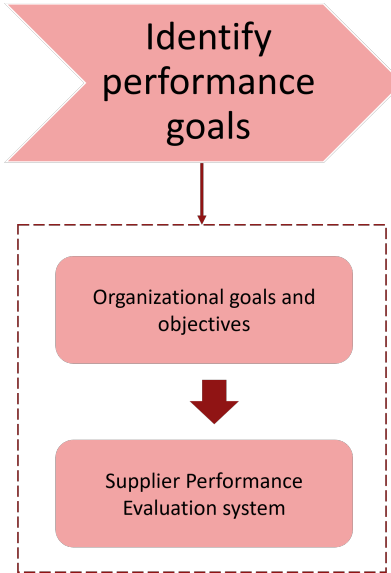
Figure 5.2: The first step of the SPE system design process.

Based on the interviews with employees at the Company several key organizational goals and objectives relevant to take into account when designing the SPE system have been identified. They are presented in Figure 5.3 and are all emphasized by employees in the interviews and related to the Company's core business.

The Company is aiming to deliver a comprehensive solution making sure their customers are satisfied with their service. Rather than competing solely on offering the lowest price, their focus lies in delivering high-quality products that offer added value to customers through associated services, such as providing resources on recipes and concepts. A central goal for the Company is to deliver high-quality products part of a comprehensive solution.
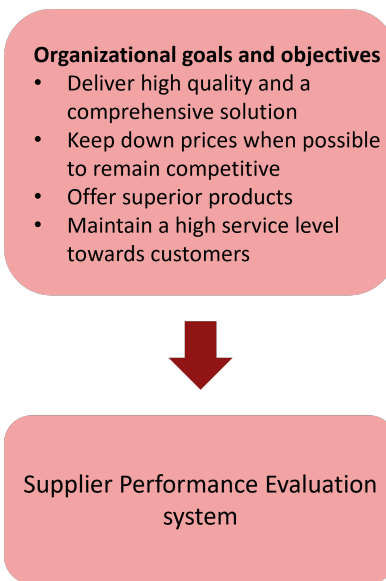
Figure 5.3: The Company's organizational goals and objectives that the SPE system should be adapted to.

Although the Company doesn't prioritize providing the cheapest products, maintaining competitiveness is essential. Thus, a vital aspect of the Company's strategic agenda involves ensuring that the procurement department secures the lowest prices possible while maintaining the requested quality. The Company's business idea is not to offer their customers a broad range of the same type of product, but rather to select the products they believe are the best in every category. This is a core business idea and therefore also a part of the Company's core strategy.

As a sales and distribution company committed to delivering a comprehensive solution to its customers, the Company must ensure it can meet the demand for necessary products. Providing a high service level is therefore an important part of their offer and something that is included in the core strategic goals and objectives.

5.2 Select Evaluation Approach

After identifying the performance goals, the evaluation approach should be selected. The considered evaluation approaches are the ones presented in the literature review, see Figure 5.4.

Several requirements and wishes for the new system were identified during the interviews. The goal of the new system is to align with as many as possible. The criteria are listed below.

- Include all suppliers to meet the requirements of BRCGS

- Automate updates without the need for manual input

- Frequent updates

- See the results of a new supplier´s performance shortly after its introduction

- Easy to use

- Objective approach

- Handle qualitative data to, for example, ensure fair and safe working conditions

- View more detailed information about every supplier

- Compiled list showcasing overall score of all suppliers - facilitating easy comparison and identification of underperforming suppliers

- Easy to get an overview

- Easy comparison
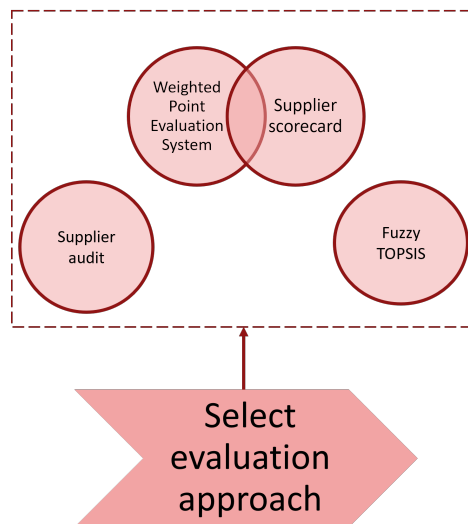
Figure 5.4: The second step of the SPE system design process.

Some of the criteria are mostly related to the technical aspects of the system, which are handled more in 5.4.2 Data Integration and Visualization. However, the selected evaluation approach should still be able to align with the technical wishes and those requirements are also considered during the selection. The list of requirements resulted in five different criteria, see Figure 5.5
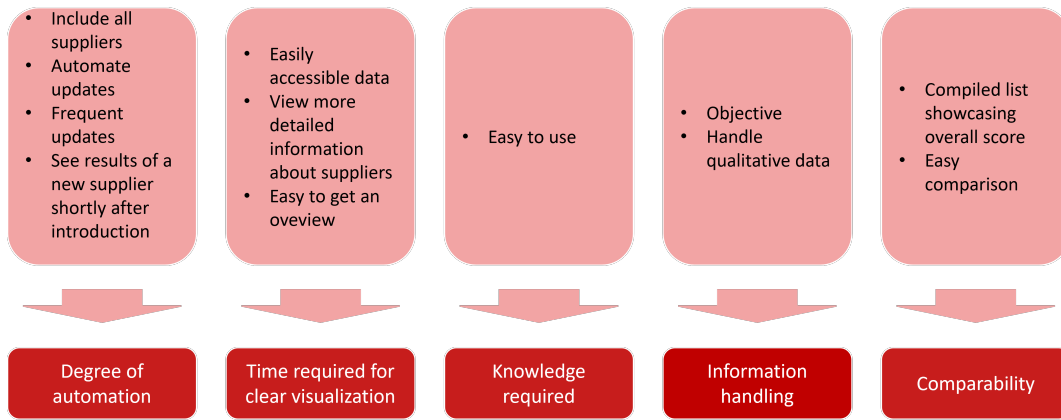
Figure 5.5: Requirements included in the criteria.

To choose an evaluation approach, the different approaches are ranked according to their fulfillment of the areas of requirements. The ranking of how well the current system meets the requirements and an indicator of what the Company's employees wishes for the new system to fulfill is also included. For the ranking, see Table 5.1, Table 5.2, Table 5.3. Table 5.4, and Table 5.5.

The first criterion is *degree of automation* and refers to how easy it is to update the evaluation regularly, see Table 5.1. If the evaluation approach has a high degree of automation it requires zero to a little time to update it. This enables frequent updates for all suppliers and enables new suppliers to be included in the SPE shortly after their introduction. Supplier audits require physical visits to the supplier (Van Weele 2014) and are therefore automated to a very low degree. Fuzzy TOPSIS handles fuzzy data and uncertainties (Zimmermann 2010), and it is therefore hard to automate the process completely, while supplier scorecard and weighted point evaluation system can be updated automatically as long as the data system enables automatic updates from, for example, the ERP system. The currently used SPE system is not fully automated, as it depends on manual updates once every year.

Table 5.1: Methods ranked based on their degree of automation.

Degree of automation	Low degree of automation	Medium degree of automation	High degree of automation
Supplier Audit	x		
Scorecard			x
Weighted point			x
Fuzzy TOPSIS		x	
The Company currently		x	
The Company's wishes			x

The next criterion is *time required for clear visualization* and originates from the wishes for easily accessible data, that it should be easy to get an overview, and at the same time be possible to dig deeper and view more detailed information about the suppliers, see Table 5.2. Since supplier audits result in qualitative and nuanced data (Van Weele 2014), visualizing it would require a lot of time and manual work. As soon as the data from the other evaluation approaches is collected, it will not require too much time to organize the data to achieve a comprehensive overview with the ability to dig deeper. The currently used SPE system requires moderate time for clear visualization. When it has been updated manually a view of the suppliers score is presented which partly gives a clear overview, but it does not include any other automated visualization elements.

Table 5.2: Methods ranked based on the time required for getting a clear visualization.

Time required for clear visualization	Extensive time required for clear visualization	Moderate time required for clear visualization	Minimal time required for clear visualization
Supplier Audit	x		
Scorecard			x
Weighted point			x
Fuzzy TOPSIS			x
The Company currently		x	
The Company's wishes			x

Another criterion is *knowledge required* and refers to how easy the approach is to use and understand, see Table 5.3. The interviewees expressed a desire for all colleagues, including those not working with SPE on a daily basis to have the opportunity to access, understand, and benefit from the information. Since supplier audit require thorough investigation and discussions with

the specific suppliers (Van Weele 2014), it is difficult for less experienced colleagues to use the information and produce the results. On the other hand, supplier scorecard and weighted point evaluation only require basic knowledge to update and use the information (Doolen et al. 2006) (NC State University 2011). The currently used SPE system requires an annual update where someone needs to have moderate knowledge about how to use and update the system. To understand the more complicated results, some knowledge is also required. This leads to the currently used system being ranked in the "Moderate knowledge required"-category.

Table 5.3: Methods ranked based on the knowledge and competence required for the employees.

Knowledge required	Extensive knowledge required	Moderate knowledge required	Basic knowledge required
Supplier Audit	x		
Scorecard			x
Weighted point			x
Fuzzy TOPSIS		x	
The Company currently		x	
The Company's wishes			x

The next criterion accounts for the wishes regarding the information the evaluation approach can handle, see Table 5.4. The employees expressed a will for the approach to handle as many types of data as possible. It should handle simple quantitative data but also account for nuances and qualitative criteria. The supplier scorecard nor the weighted point evaluation can handle nuanced information while Fuzzy TOPSIS can take uncertainties into account (Zimmermann 2010). Supplier audit even collects and handles data and information only possible to notice during physical visits (Van Weele 2014). Therefore, supplier audits can handle the most nuanced information. The currently used SPE system can only handle basic information, where no uncertainties can be taken into account.

Table 5.4: Methods ranked based on how nuanced information it can handle.

Information handling	Handles basic information	Handles moderate information	Handles nuanced information
Supplier Audit			x
Scorecard	x		
Weighted point	x		
Fuzzy TOPSIS		x	
The Company currently	x		
The Company's wishes			x

The final criterion is *comparability* which refers to the ability to compare suppliers to each other, see Table 5.5. Since supplier audit require a person to interpret the information, it is hard to quantitatively compare all suppliers to each other. Weighted point evaluation, on the other hand, even considers the importance of different criteria and enables all suppliers to get a total score (Rahim & Risawandi 2016). This makes it easy to quickly see how the suppliers perform relative the others and take action when needed. The currently used SPE system is ranked moderate in comparability, as it can compare the suppliers based on total score but not based on importance of different criteria.

Table 5.5: Methods ranked based on how well suppliers can be compared to each other.

Comparability	Low comparability	Moderate comparability	High comparability
Supplier Audit	x		
Scorecard		x	
Weighted point			x
Fuzzy TOPSIS		x	
The Company currently		x	
The Company's wishes			x

Points from 1 to 3 were distributed among the evaluation approaches, according to how well they align with the Company's wishes. See the total scores in Table 5.6.

Table 5.6: Point distribution based on the different requirements.

Summary	Degree of Automation	Time required for clear visualization	Knowledge required	Information handling	Comparability	SUM
Supplier Audit	1	1	1	3	1	7
Scorecard	3	3	3	1	2	12
Weighted point	3	3	3	1	3	13
Fuzzy TOPSIS	2	3	2	2	2	11
The Company currently	2	2	2	1	2	9
The Company's wishes	3	3	3	3	3	15

The point distribution shows that the weighted point evaluation approach fulfills the requirements and wishes to the largest extent, closely followed by the supplier scorecard. The features of the weighted point evaluation approach can often be included in a scorecard to get the overview of a scorecard, but the comparability of weighted point evaluation. This was the solution in both of the case examples 3.6.1 described by Doolen et al. (2006), and 3.6.2 described by Cao et al. (2022). In case example 3.6.1, the weights were even adjusted to the suppliers to enable a more dynamic evaluation approach. In case example 3.6.2, weights were included to consider the importance of each criterion, and multiplied with scores between 1 and 3 to receive a final score. Both of the SPE systems were implemented successfully and led to a clear indicator of suppliers' performance. Wuttke (2020) also included weights in the design of the SPE system, as described in case example 3.6.4. The approach was similar to the SMART approach described by Rahim & Risawandi (2016), but not presented in a scorecard.

If only a combination of supplier scorecard and weighted point evaluation were implemented in the Company´s operation, the criterion *information handling* would not be fulfilled. The mentioned approaches only handle information provided by the supplier or collected by the Company, and can not be used to ensure, for example, good working conditions in their manufacturing. To fulfill this criteria, supplier audits could be used as a complement. This could not only be valuable to ensure the suppliers perform as expected, but can even improve the performance of the suppliers. This was the situation in case example 3.6.3 by Djekic et al. (2016), where the implementation of a supplier audit program increased the suppliers' scores and effectively drove long-term improvement.

If a combination of a supplier scorecard and weighted point evaluation were implemented, along with supplier audits in specific cases, the sole excluded evaluation approach among those considered in the literature review would be Fuzzy TOPSIS. In the case study described by Boonsong & Jarumaneeroj (2021), the Fuzzy TOPSIS approach was selected due to the case company's need for hardly quantifiable criteria. If that was not the case, the authors stated that a simpler framework, for example SMART, would be enough. Since the employees at the Company did not request any fuzzy attributes which are hard to quantify, the Fuzzy TOPSIS is probably not a suitable approach.

5.2.1 Classification of Suppliers

To be able to choose the correct evaluation approach for the correct suppliers, the suppliers can be classified according to Kraljic's matrix (Kraljic 1984) depending on what types of products they deliver.

As suggested in 5.2 Select Evaluation Approach, supplier audit could complement more quantitative evaluation approaches. However, since supplier audit demands more resources than the other presented approaches, it would not be feasible to do regular supplier audits of all suppliers. The resources must be allocated to where they make the most difference. A suitable framework for defining which suppliers could benefit from supplier audits is Kraljic's matrix, as presented in 3.1.2 Kraljic's Matrix (Kraljic 1984). Since strategic suppliers are of high importance financially and have a high supply risk, maintaining the relationship with them is of big interest to the Company. See Figure 5.6 for an overview of the evaluation approaches suggested for each group of suppliers.
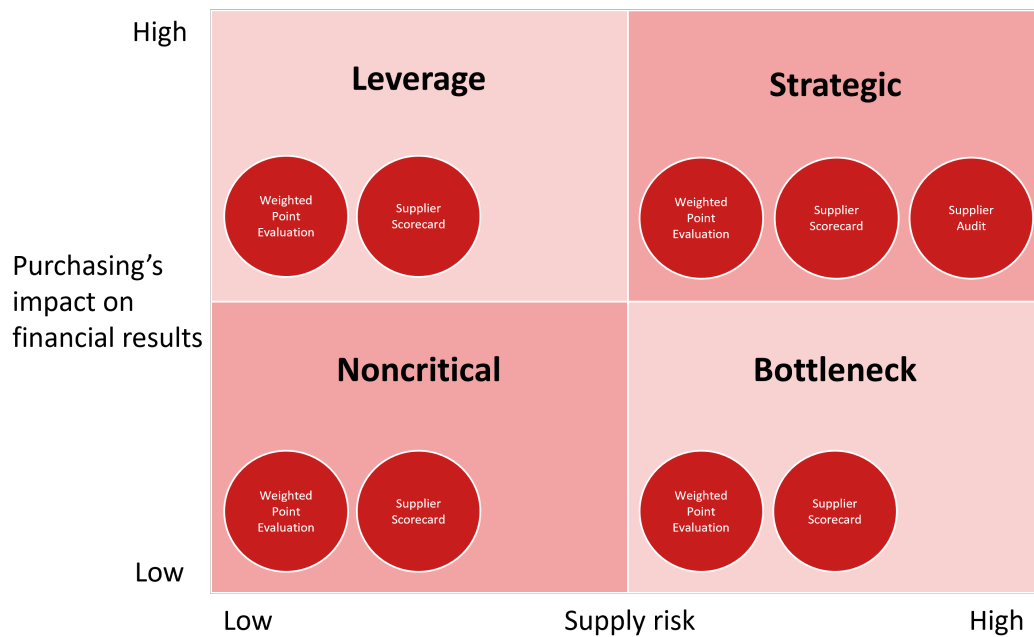
Figure 5.6: Overview of which evaluation approaches are suitable for which categories of suppliers.

Although Figure 5.6 indicates which suppliers could use which evaluation approaches, the reality is a bit more complex and exceptions must be made. For example, some of the strategic suppliers may have certifications which makes the need for supplier audits less prominent. This scenario may apply to internal suppliers. Given their lack of competition and significant financial impact, they will probably often be classified as strategic. Nevertheless, as they operate under the same expectations from the Group as the Company, allocating resources to frequent visits may prove unnecessary. Consequently, some non-strategic suppliers may need supplier audits due to their high risk. One example of this could be suppliers producing in countries where it is a challenge to ensure, for example, safe working conditions and a certain quality. This was mentioned during the interviews as a risk for the Company and a final assessment of what suppliers should be covered by supplier audits will have to be done by the Company.

5.3   Choose Metrics

After selecting the evaluation approach, metrics suitable for the situation and the Company should be selected, see Figure 5.7.

The compilation of a number of articles in Table 3.2 shows several areas of metrics widely suggested to include in the SPE system. The most suggested areas are financial aspects, delivery performance, and quality. Three other areas were also mentioned numerous times, including customer service, effectiveness, and risk management. Related to these areas several metrics could be

relevant to the Company's SPE system, see Figure 3.11.
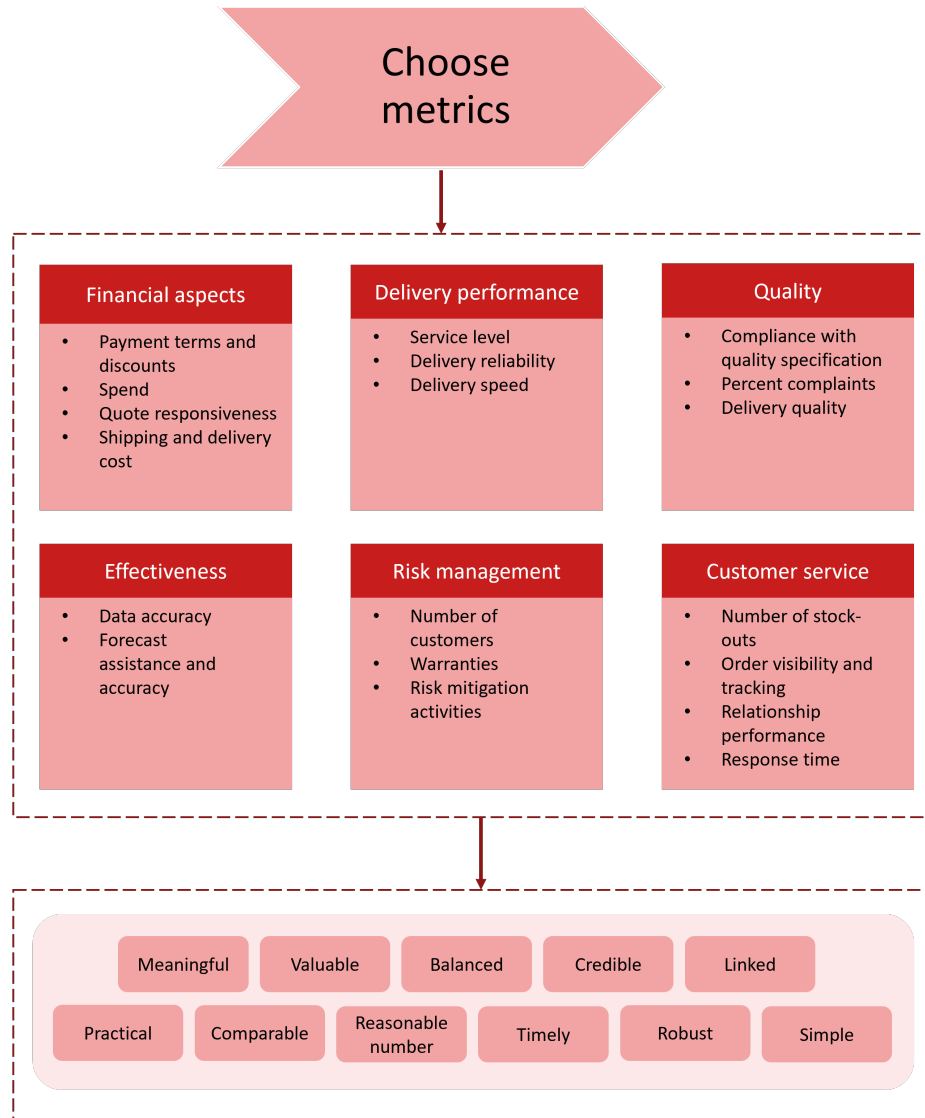
Figure 5.7: The third step of the SPE system design process.

The metrics considered to be implemented in the Company's SPE system are presented in Table 5.7. Metrics suggested from the literature, from interviews with employees at the Company and from the previously used SPE system with a supplier scorecard were included in the evaluation. Where the metrics were suggested is marked in the table. The metrics have been evaluated according to the requirements on supplier performance metrics presented by Gordon (2008), visualized in Table 3.1. The definitions used for each metric when evaluating them according to the requirements described by Gordon (2008) are described in Appendix C.

Table 5.7: Metrics evaluated based on the requirements presented by Gordon (2008).

	Mentioned by the Company	Mentioned in literature	Meaningful	Valuable	Linked	Practical	Comparable	Credible	Timely	Simple	Number of requirements fulfilled
Financial aspects											
Payment terms and discounts		x	Yes	Yes	Yes	No	No	Yes	Yes	No	5
Spend per supplier		x	Yes	No	No	Yes	Yes	Yes	Yes	Yes	6
Quote responsiveness		x	No	No	Yes	No	No	No	Yes	No	2
Shipping and delivery cost		x	Yes	Yes	Yes	No	Yes	Yes	Yes	No	6
Earnings per supplier	x		Yes	No	No	Yes	Yes	Yes	Yes	Yes	6
Delivery performance											
Service level	x	x	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Delivery speed		x	No	No	Yes	No	Yes	No	Yes	No	3
Transport related issues	x		Yes	No	Yes	No	Yes	Yes	Yes	Yes	6
Delivery errors	x		Yes	No	Yes	No	Yes	Yes	Yes	Yes	6
Quality											
Percent complaints	x	x	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Number of product deviations	x	x	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Percent non-conformance	x		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Quality certification	x		Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7
Effectiveness											
Data accuracy		x	Yes	No	Yes	No	Yes	Yes	Yes	No	5
Forecast assistance and accurcay		x	Yes	No	Yes	No	No	Yes	Yes	No	4
Risk management											
Number of customers		x	Yes	No	Yes	No	Yes	Yes	Yes	No	5
Warranties		x	Yes	No	Yes	No	No	Yes	Yes	No	4
Risk mitigation activities		x	Yes	No	Yes	No	No	No	Yes	No	3
Customer service											
Number of stock-outs		x	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	7
Order visibility and tracking		x	Yes	No	Yes	No	No	No	Yes	No	3
Relationship performance		x	Yes	No	Yes	No	No	No	Yes	No	3
Response time		x	Yes	No	Yes	No	No	No	Yes	No	3
Other metrics											
Volume development	x		Yes	No	No	Yes	Yes	Yes	Yes	Yes	6
Carbon footprint	x		Yes	Yes	Yes	No	Yes	Yes	Yes	No	6
Cassations	x		Yes	No	No	Yes	Yes	Yes	Yes	Yes	6

When evaluating the metrics the definitions of the requirements presented by Gordon (2008) were adjusted to be suitable for this specific case company. The authors used the definitions presented in Table 5.8 when evaluating all metrics, resulting in a "Yes" or "No" for all criteria. The motivations to each "Yes" and "No" can be found in Appendix D.

Table 5.8: Definitions used when evaluating the metrics in Table 5.7.

Requirement	Definition in analysis
Meaningful	Is the metric related to the Company's strategy and goals?
Valuable	Is the metric related to the Company's customer's requirements?
Linked	Is the supplier responsible for meeting this requirement?
Practical	Is the metric based on available data and does it require minimal post-processing?
Comparable	Is the metric comparable over time?
Credible	Is the metric based on reliable data?
Timely	Can the data be utilized and analyzed before it gets outdated?
Simple	Is the metric simple to comprehend and measure?

From the results of the evaluation in Table 5.7, metrics were selected to present to the focus group based on how well they fulfill the requirements. The metrics that fulfilled all requirements were all selected. The metrics fulfilling a minimum of five requirements were also considered to select for presenting to the focus group. If they were assessed to potentially be relevant to include in the Company's SPE system, they were selected to be further discussed in the focus group. If not, they were considered to be included in a recommendation of metrics that could be relevant for the Company to include in the future. If the metrics fulfilled less than five requirements they were only considered to include in the future recommendation but not to be discussed in the focus group. Figure 5.8 shows the process of how metrics were selected to the focus group and future recommendation.

Does the metric fulfil all requirements?

NO

YES

Does the metric fulfil a minimum of 5 requirements?

YES

NO

Is the metric assessed to be relevant to include in the Company's SPE system?

YES

NO

Discuss further in focus group

Consider for future recommendation
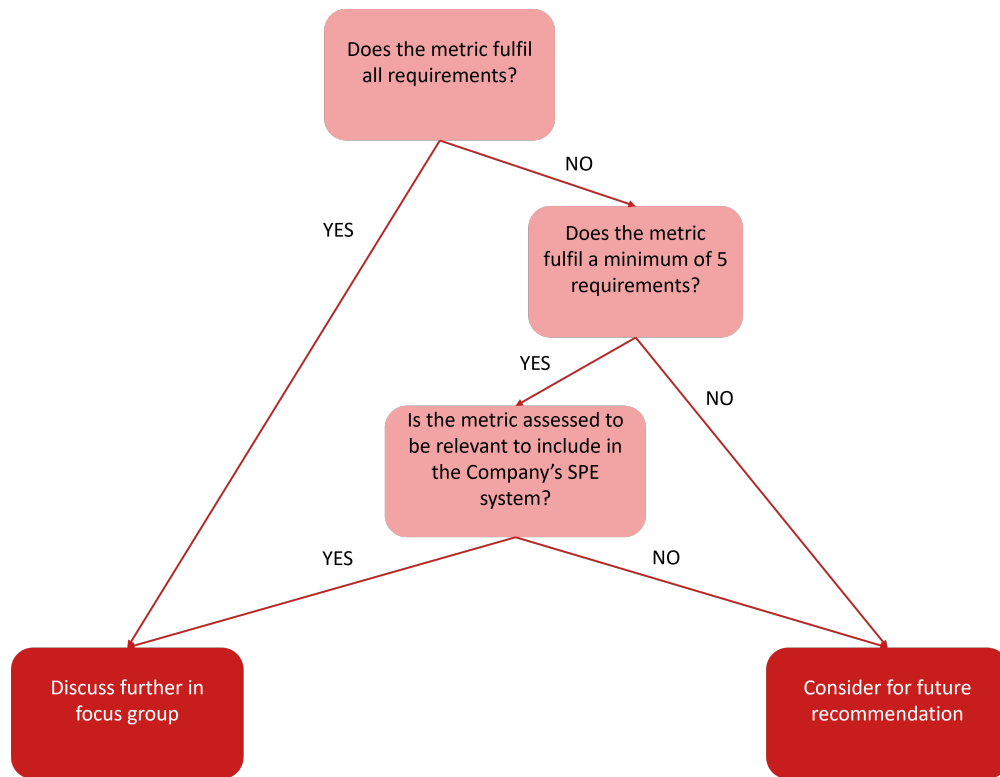
Figure 5.8: What metrics were selected to the focus group and future recommendation.

The metrics fulfilling all requirements and therefore were selected straight to the focus group were service level, percent complaints, number of product deviations, and percent non-conformance.

The metrics fulfilling a minimum of 5 requirements and therefore were assessed according to their relevance to the Company's SPE system were payment terms and discounts, spend per supplier, shipping and delivery cost, earnings per supplier, delivery errors, quality certification, data accuracy, number of customers, number of stock-outs, volume development, carbon footprint, and cassations.

Payment terms and discounts, data accuracy, number of customers and shipping and delivery cost are all metrics not currently tracked and data related to the metrics is not easy to compile and comprehend. This means that the metrics will not easily be integrated in the SPE system and they should not be a part of the recommended solution. Therefore, the metrics were not further discussed in the focus group and were instead considered for a future recommendation. Carbon footprint is not fulfilling these requirements either, but since the metric was suggested by one of the employees at the Company, carbon footprint was assessed to be relevant enough to be further discussed in the focus group.

Spend per supplier, earnings per supplier, volume development, and cassations are metrics that are not related to the Company's customer's requirements and are not within the supplier's responsibility to fulfill. However, the metrics are aligned with the Company's strategy and the data is available, easy to comprehend, and reliable. Additionally, they have been highlighted during interviews and are considered important by the Company's employees. Since suppliers are not accountable for meeting these metrics, their performance cannot be evaluated based on them. However, given their relevance to the Company's objectives, these metrics could still be incorporated into the same report as the scorecard. Therefore, these metrics were assessed as relevant to be further discussed in the focus group.

Delivery errors and transport-related issues were both suggested by an employee at the Company, and other than not having accessible data in the current system and the metrics not being related to customer requirements they fulfill all requirements. Therefore these metrics were also selected for the focus group. Quality certification was included in the previously used scorecard at the Company and other than not being comparable over time it fulfills all requirements. Therefore it was further discussed in the focus group. Despite lacking currently available data, the number of stock-outs fulfills all other requirements. Even though this metric might therefore be complicated to include in the SPE system, it was selected to be further considered by the focus group.

Metrics that do not fulfill more than a maximum of four of the eight requirements were eliminated in the selection of metrics for the focus group. These metrics include quote responsiveness, delivery speed, forecast assistance and accuracy, warranties, risk mitigation activities, order visibility and tracking, relationship performance, and response time. They were considered to include in a recommendation for future improvements of the SPE system instead. In Figure 5.9 an overview of what metrics were selected to be further discussed in the focus group and what metrics were considered for a future recommendation can be seen.
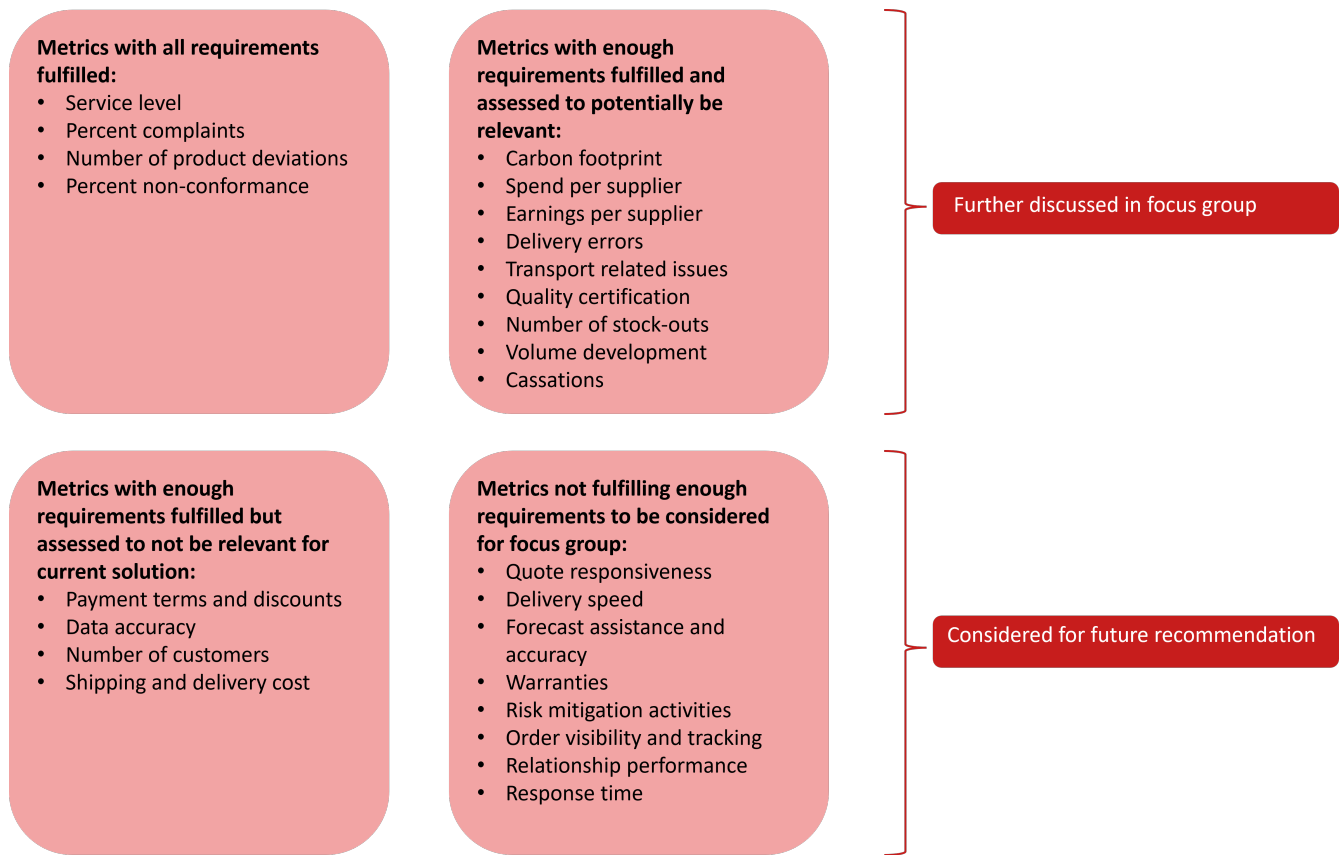
Figure 5.9: Overview of which metrics were further discussed in the focus group and which metrics were only considered for a future recommendation.

All metrics that an employee at the Company mentioned were included in the discussion at the focus group, and only metrics suggested in the literature were rejected. No metric suggested by an employee at the Company fulfilled fewer requirements than five and they were all therefore assessed further. Metrics proposed by employees were valued as relevant since employees can capture nuances and specific needs important to the Company's operations. This direct experience can reveal aspects that the standardized metric requirements might overlook.

5.3.1 Metrics Considered for Future Recommendation

Quote responsiveness and delivery speed are both not fulfilling the criteria called meaningful, which means that they are not related to the Company's core goals and strategy which is an important requirement on metrics in an SPE system (O'Brien 2022). Together with risk mitigation activities, order visibility and tracking, relationship performance and response time they are also not credible. This means that the metrics are not based on reliable data, and including these metrics would compromise the reliability of the system. Therefore, neither of these six metrics were included in a recommendation for future metrics to include.

The rest of the metrics could all be relevant to include in a system in the future, if they are adapted to the Company's needs and assessed to be valuable by the employees. These metrics include payment terms and discounts, shipping and delivery cost, data accuracy, forecast assistance and accuracy, number of customers and warranties. They are not essential to include in the SPE system, but could be further considered if there is a wish to extend the system. A compilation of what metrics are suggested to potentially include in an extended system can be seen in Figure 5.10.

Metrics suggested to consider including in the system in the future:

- Payment terms and discounts
- Shipping and delivery cost
- Data accuracy
- Forecast assistance and accuracy
- Number of customers
- Warranties
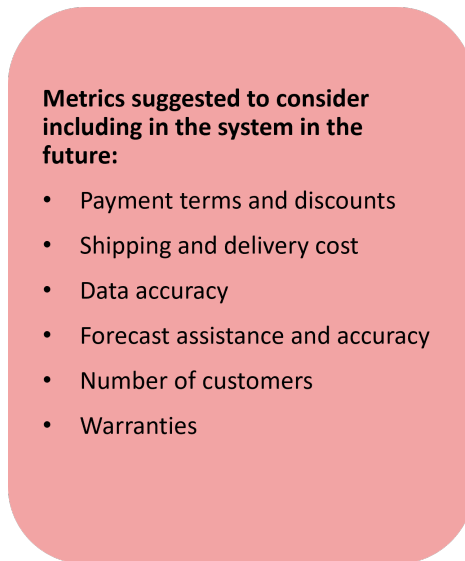
Figure 5.10: Metrics suggested to be potentially included in an extended SPE system in the future.

5.3.2 Metrics Discussed in the Focus Group

In the focus group, the participants gave their opinions on the proposed metrics. They commented on whether or not they found the metrics important to include in the SPE system, and this resulted in nine metrics that they suggested to include in the SPE system. The metrics that were suggested to include by the focus group are percent complaints, number of product deviations, percent non-conformance, cassations, spend per supplier and service level based on requested and first confirmed delivery date and quantity.

When discussing the metric service level, it was revealed that it is measured in four relevant ways. However, participants in the focus group suggested merging the various service level metrics into a weighted measure instead of maintaining them as four separate metrics. To capture the nuanced difference between service level related to delivery precision and whether the correct quantity has been delivered, the four metrics could be combined into two different values - "service level delivery date" and "service level quantity."

All metrics the participants wished to include in the SPE system were assessed as relevant to potentially include in the SPE system in Table 5.7. The requirements suggested by Gordon (2008) which were not included in the evaluation in Table 5.7 include the need for the group of metrics to cover several areas of supplier performance while ensuring the metrics are not too many. The proposed metrics are related to all of the three most mentioned areas in the literature according to the compilation in Table 3.2, which are financial aspects, delivery performance, and quality. If the aspects of service level are merged into two metrics, a total of seven metrics are assessed as relevant which the focus group agreed was a reasonable number. According to Krishnadevarajan et al. (2015), metrics included in an SPE system should be mainly quantitative, and including only quantitative metrics has been requested during interviews with the employees as well. All metrics suggested by the focus group are quantitative which means that the metrics fulfill this requirement too.

The metrics discussed to include in the SPE system fulfill at least most of the requirements presented by Gordon (2008) and Krishnadevarajan et al. (2015). Furthermore, they are both assessed- and confirmed as relevant and valuable by the focus group. Therefore, they should be included in the SPE system. An overview of the metrics included in the SPE system and their definitions is presented in Table 5.9.

Table 5.9: The final metrics recommended to include in the SPE system and their definitions.

Metric	Definition
Service level – delivery date	The weighted average of percentage of order lines where the requested delivery date or the first confirmed delivery date has not differed from the actual delivery date.
Service level - quantity	The weighted average of percentage of order lines where the requested quantity or the first confirmed quantity has not differed from the actual quantity.
Percent complaints	The percentage of total delivered order lines that has received a complaint related to the supplier's delivered products.
Number of product deviations	The number of times where there has been a deviation compared to the expected specifications, related to the delivered product.
Percent non-conformance	The percentage of delivered order lines where there has been a non conformity registered at the goods receipt.
Cassations	Value in money of products that has had to be cassated, bought from the specific supplier.
Spend per supplier	The total amount of money spent on each supplier.

5.4 Implement SPE System

When the performance goals are identified, the evaluation approach is determined, and the metrics are chosen, the SPE system is ready to be implemented, see Figure 5.11. There are numerous things to think of when implementing an SPE system. This thesis focuses on two main areas: follow-up and evaluation, and data integration and visualization.
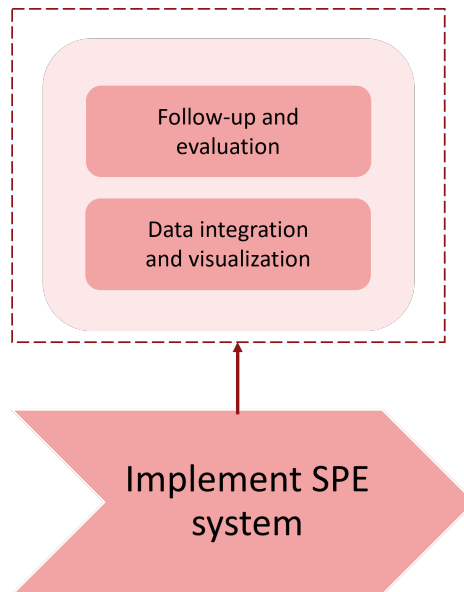
Figure 5.11: The fourth step of the SPE system design process.

5.4.1 Follow-up and Evaluation

Both Gordon (2008) and O'Brien (2022) describe how important it is to use the information collected in an SPE system in order for it to reach its full potential. This is confirmed during the interviews with employees at the Company. To have a clear structure of the follow-up, one solution could be to create target values for all metrics included in the SPE system (Boonsong & Jarumaneeroj 2021). Specific targets need to be determined by every individual company to match company goals and what is perceived internally as acceptable levels of supplier performance. When weights are included in the system, the overall score of supplier performance, the weighted average, could also be given a target value. In the focus group, the employees requested a 5-grade scale where the grades 1 and 2 both mean that the suppliers perform below expectations, with a focus on prioritizing actions for those graded as 1 if resources are limited. A potential expansion of this approach could involve categorizing suppliers into groups and customizing threshold values based on the expectations of each group.

To make the system require as few manual updates as possible, the target values should be mainly generalized, but if a specific contract with a supplier has specified another target value this specific target value could be used instead. In the interviews with employees at the Company it has been clear that it can be difficult to demand that suppliers should perform according to a specific target value if it has not been agreed upon in a contract. This highlights a topic that potentially needs to be addressed when setting target values, where it can be important to try to agree upon target values in the contracts with the suppliers.

Action Plan

According to Gordon (2008), what actions should be taken depends on individual companies and their needs and preferences. One way of designing a general action plan to have as a guideline is to divide suppliers into different groups based on the evaluation. Inspired by Boonsong & Jarumaneeroj (2021), actions can be adjusted to the suppliers' performance in different categories. If they only underperform in one or a few areas, they can be included in improvement programs targeting the specific areas. If they underperform in all areas, a replacement should be considered. Below is an example of how actions could be prioritized.

1. Tier 1: High performers

   - Suppliers with a weighted average score of 4 or above.

   - Well performing in all areas, consistently meeting or exceeding expectations.

   - Work on maintaining the relationship, consider strategic collaboration.

2. Tier 2: Acceptable performers

   - Suppliers with a weighted average score between 3 and 4.

   - Meet target values overall but may have isolated issues.

   - Require ongoing monitoring and targeted support to maintain satisfactory performance.

3. Tier 3: Improvement needed

   - Suppliers with a weighted average score between 2 and 3.

   - Show inconsistency or significant deficiencies across one or multiple areas.

   - Need focused interventions and action plans to enhance overall performance.

4. Tier 4: Underperformers

   - Suppliers with a weighted average score below 2.

   - Fail to meet target values across multiple areas.

- Requires immediate attention and potential replacement if performance does not improve.

5. Tier 5: Specific action needed

   - Suppliers with sufficient overall weighted average but poor performance in one or a few specific areas.
   - Identified for targeted action plans aimed at improving performance in the specified area(s).
   - Require close monitoring and support to rectify deficiencies and prevent overall performance degradation.

This plan is only a guideline and depending on the available resources, it can be adjusted accordingly. For instance, suppliers receiving a grade of 1 should take precedence over those graded as 2, both when it comes to overall performance and within specific areas. Similarly, suppliers failing to meet the preferred weighted average should be prioritized over those falling short in only one or a few categories since the weighted average considers the significance of metrics within the score. The type of supplier should also be considered when planning the actions, as proposed by O'Brien (2022). If a supplier is financially important to the Company and the opportunities for replacement are limited, supplier developing programs should be prioritized and underperformance might have to be accepted. Some suppliers may even be aware of the situation but not bother to improve due to their confidence in not being replaced, as described by O'Brien (2022). In those cases, actions may be pointless and the resources should be prioritized elsewhere. For suppliers that are not financially important and where many alternatives are available, it could be more feasible to replace them than to prioritize resources on improving their performance.

The BRCGS require that a formal review of suppliers should be completed at least annually. However, employees have expressed a need for a more proactive approach, particularly in evaluating new suppliers sooner than the annual review allows. Since the Company has limited resources they do not want to spend more time than necessary on SPE. However, the goal of this project has been to design a more streamlined process for SPE, which leaves room for more frequent evaluations. Considering these aspects, a suitable interval for SPE could be every 3 months. This would leave enough room for suppliers to improve between evaluations, and would also enable the Company to note insufficient performance earlier than with the current system. To make sure the routines are followed, someone must be responsible for it. The Company should appoint one dedicated employee, such as one of the strategic purchasers, to conduct the SPE every 3 months. In cases where actions are required, the responsible for SPE should communicate the requirements to the purchasers responsible for the specific suppliers, who are then accountable for implementing the necessary measures. Without subsequent actions following poor results, the evaluation lacks

practical utility and the follow-up is therefore an important step in an SPE system. Moreover, employees should be encouraged to utilize the SPE whenever it is relevant, such as before engaging in negotiations with a supplier.

5.4.2   Data Integration and Visualization

To implement the SPE system, the data must be integrated into a system combining the evaluation approach and the data required for the metrics. In the current situation, it would not be worth spending a lot of time on creating a fully functional SPE solution, as the Company is currently in the process of changing databases, and the work would have to be redone as soon as the new system is implemented. Instead, the focus in this section will be on explaining the functions needed to get the suggested SPE system to work as well as possible. The interviews made it clear that the employees demand a system that works with as little manual work as possible, and that it enables a clear overview. These aspects were both considered when designing the suggestion.

Weighted Supplier Scorecard Specifications

The analysis shows, and the focus group confirmed, that the main solution should be a supplier scorecard with weights included. Therefore, the technical solution should enable an overview of the score per supplier. To make the supplier scorecard as clear and useful as possible, several functions are needed:

- All chosen metrics should be presented alongside their assigned weights and the supplier's score.

- To be able to compare the performance between metrics, and to get a comparable total score, the performance within each metric should be translated to a score between 1 and 5.

- Based on the method described by Rahim & Risawandi (2016), the weights should be normalized.

  - The normalization of weights should be done automatically by a pre-programmed formula. This enables the weights to always add up to 1 even if the importance of one metric changes. The process is done by summing all importance scores and dividing the score assigned to each metric by the total sum of importance scores.

- The system should be able to calculate the weights of the two types of service levels based on the importance for them separately.

- Since some of the metrics measure the occurrence of a certain event in percentage, there must be a function that divides the number of occurrences by the number of order lines or orders depending on the metric.

- It should be possible to use different weights for different groups of suppliers to be able to take into account that some metrics are more important for some suppliers.

With this solution, the score between 1 and 5 can be multiplied by the weights and summed. This will lead to suppliers that fulfill all requirements getting a total score of 5. It also enables qualitative measures to be included in the evaluation in the future since the performance can be translated to a score between 1 and 5 based on pre-determined requirements for each category.

There are also numerous ways to make the supplier scorecard even more functional:

- Include descriptions with definitions of all metrics to make the interface more user-friendly and easy to understand.

- Incorporate additional information that is not directly dependent on the supplier performance, but is still relevant information related to the supplier. The additional metrics should not be included in the calculation of the overall score since the supplier is not solely responsible for the performance within those areas.

  ○ Metrics such as cassations and spend per supplier are examples of this.

- A tab with an executive summary should be included to allow an overview that presents the overall performance of suppliers.

  ○ The executive summary should show a sorted list of supplier performance, making it easy to see where actions should be prioritized.

  ○ A similar sorted list should be created for all metrics individually.

  ○ It should be possible to filter per supplier group for all features. It should also be possible to filter everything per time period and visualized in a graph.

A compilation of the requirements presented above is shown in Table 5.10. To align with employees' requests, the requirements should be fulfilled in a way that requires as little manual work and time as possible. Implementing the system according to the requirements will enable regular updates and follow-ups on every supplier.

Table 5.10: Requirement specifications regarding the technical solution for the SPE system.

Requirement	Explanation
Filter per supplier	Get a scorecard per supplier. Make it simple to see the performance of a specific supplier.
Be presented as a scorecard	To get an overview per supplier.
Universal weights per group	Makes it possible to only change one weight if the importance changes, and the changes will be automatically taken into account for all supplies within the specific supplier group.
Show supplier group	Show what group of suppliers the supplier belong to.
Automatic update of weights when the importance changes	If the importance of one attribute increases, the importance value can be changed and the weights will automatically be normalized to be summed to 1.
Threshold values that result in a score from 1 to 5	This allows easy identification where supplier performance is insufficient. It also allows qualitative aspects to be translated to a score from 1 to 5 and be included in the Supplier Performance Evaluation.
Multiply grade with weight	Allows the score to be summed into a comparable total score where the maximum value is 5.
Include explanation of metrics	To have a uniform definition of metrics easily available.
Count the occurence of certain events	To see how many times a certain event happen.
Divide the event with the number of order lines or orders	To get a percentage of how often the specific event happens. Otherwise suppliers that supply a lot of goods would be disfavored compared to smaller suppliers (as certain events would naturally occur less often).
Merge service level values to two types	Makes it possible to get one service level for quantity and one for delivery date.
Include other metrics regarding the supplier, but not in the total score	To gather all information regarding one supplier into one place. However, the information not directly related to the supplier's performance should not be included in the total score.
Executive summary for stakeholders interested in an overview, possible to visualize per time period.	There should be one tab with an executive summary for stakeholders only interested in the overall performance.

Most of the requirements could be fulfilled by creating the supplier scorecard in an ordinary Excel file. The problem with creating it in Excel is though that a lot of the work would have to be done manually every time a new evaluation should be done. This could work if only a few suppliers were evaluated only one time a year, but to create a long-term sustainable solution the SPE has to happen more automatically. A visualization of an Excel sheet including all elements of the scorecard can be found in Appendix E: Visualization of scorecard principles. All requested functions could also be fulfilled by making Power BI reports. The advantage of Power BI is that new data can be uploaded continuously and the evaluation will be based upon the new data. This means that it would only require a little time to update the evaluation to apply for a new period or a newly introduced supplier can quickly be included. The challenge with this is that the data setup is currently not customized for these functions. The information gathered in the interviews has pointed towards a potential solution by integrating multiple Power BI reports with the CRM system. This would enable all information to be gathered in one place although all data can not yet be merged. Gathering all supplier information in the CRM system could be a possibility to look into before the new database system is in place.

Data Improvements

From the interviews, it has been clear that there are some issues with data being stored in different databases and the inability to combine information from different databases into one Power BI report. Two main problem areas related to the available data have been identified. When implementing the new database, these could be considered to ensure smooth integration with the SPE system. First, the names of some of the suppliers differ depending on where the data comes from. This makes it difficult to gather information about the suppliers in the same place. To handle this, the supplier ID could be attached to all information regarding specific suppliers, no matter if the information comes from the warehouse data, sales data, or manually filled-in reports. There is also a lot of missing data. For example, the deviations report is missing the supplier name in approximately half of the cases which causes problems when the number of deviations per supplier is requested.

5.5   Additional Aspects Related to the Scope

Related to the report's scope, but not within the scope, there are additional areas worth looking into. However, exploring them in depth would be too broad for this thesis since they are out of scope, and therefore, these parts are not included in the research questions and only a little literature review has been conducted on the topics. Nevertheless, the authors want to share their thoughts on how the Company should address these topics to make the solution as comprehensive as possible. The analysis is mostly based on information gained from the interviews.

5.5.1   Areas of Responsibility

It is important to have people responsible for all parts of the SPE system, not only for the regular evaluation and the supplier follow-ups. Firstly, someone needs to be responsible for implementing the system and ensuring it is configured according to the specifications. Since the evaluation relies entirely on data, its reliability depends on the trustworthiness of the data. Therefore, someone must be accountable to guarantee that the data is available, trustworthy, and up-to-date to maintain the reliability of the system. Someone must be responsible for ensuring that everyone who should have access to the SPE system has it. This is to ensure that the result of the SPE is ready to be used whenever someone needs it. Additionally, all employees that might benefit from the SPE system should be aware of its existence and functions. By ensuring this, duplicate work can be avoided and all functions will be fully utilized.

5.5.2 Cooperation with Suppliers

To ensure willingness among suppliers to work towards achieving the goals and requirements set by the Company, the Company should inform them about the ongoing SPE. This clarifies the expectation of a certain level of performance for the suppliers. Transparency about the Company conducting SPE encourages open communication and enables both parties to address any issues or areas of improvement.

The interviews revealed a lack of clarity in the contracts regarding the Company's supplier performance expectations. The challenge with holding suppliers accountable for poor performance when requirements are not explicitly stated in a contract also became apparent. Therefore, the Company could start defining as many of the requirements as possible in the contracts to leverage the results of the SPE in negotiations with suppliers. By clarifying expectations, the Company can establish a structure for accountability and ensure that suppliers understand the standards they are expected to meet. This transparency fosters a more constructive relationship between parties and enables better management of supplier performance.

5.5.3 Future Extension

If the Company wishes to extend the applicability of the SPE system in the future, additional functions could be considered to include in the system to meet future requirements.
For example, an interest in evaluating suppliers of services, especially transportation since many errors occur during this stage, has been expressed. This would require other metrics, thus requiring additional effort before implementation can proceed. The system could also be extended by including other metrics, as listed in Figure 5.10.

The Procurement Company within the Group does not currently provide assistance with SPE. Although they provide supplier performance data to some subsidiaries, this service has not been extended to the Company. The Procurement Company within the Group's problems with inadequate data are still prominent and starting a cooperation regarding SPE would not be relevant today. Nonetheless, it might be advantageous for the Company to have a dialogue with the Procurement Company within the Group to explore the possibility of incorporating their support and data offerings for potential future system expansions. Establishing a broader SPE collaboration within the Group may yield benefits in the long term, fostering synergies among the companies, particularly as many share the same suppliers.

5.6 Advantages with the SPE System

The proposed SPE system offers numerous benefits to the Company, and comprehending these advantages will enable employees to recognize the system's potential. First, the proposed SPE system will fulfill both the BRCGS requirements 10.2.1.2 and 10.3.1.3 that need to be met by certified companies. The currently used system does not include all suppliers, which is a requirement and makes the system unaligned with the certification requirements.

Another notable advantage offered by the system is its potential to offer leverage in negotiations. One employee described a situation in which they were about to negotiate with a supplier after failing to fulfill the Company's promised purchase volume. Despite initial unease before the negotiation, the team discovered that the supplier's service level was significantly low. This realization facilitated a constructive dialogue during the meeting, and an agreement beneficial for the Company could be reached. The reason why the Company had not purchased the agreed volume was the supplier's poor service level. This scenario effectively underscores the power of SPE in negotiations. The proposed SPE system, will further amplify this capability, eliminating the need to manually retrieve results for negotiation purposes.

This system also facilitates proactive work with supplier evaluation rather than reactive approaches. This was highlighted as a disadvantage of the current system by one of the employees, who expressed a desire for a more proactive approach. The proposed SPE system will enable continuous monitoring of supplier performance, allowing for early intervention when deviations from expected performance are detected.

The implementation of an SPE system can help mitigate certain risks the Company is exposed to. One such risk is suppliers not adhering to agreed-upon working conditions and not maintaining an approved production process. This risk can be mitigated by a structured SPE, where the Company for example is recommended to conduct supplier audits when appropriate. These audits can provide valuable insights into the production processes and conditions under which the suppliers operate.

The SPE system can also provide valuable business insights valuable across the company. Using the data to gain insights into suppliers' actual performance can enable data-driven decision making rather than relying on subjective impressions. Strategic utilization of data enables the right suppliers to be rewarded and prompt action if a supplier fails to meet expectations. Data-driven decision making is essential in business operations, and implementing a structured approach to collecting and visualizing supplier performance data will significantly enhance the Company's ability of this.

Chapter 6

Conclusion

This chapter presents a review of the thesis's purpose and the process of writing the thesis followed by a description of how the research questions have been answered, including a description of how the SPE system should be designed and implemented. The generalizability of the content in the thesis as well as the thesis' contribution to theory and practice are also discussed. Lastly, suggestions for future research are provided.

6.1 Review of the Purpose and Process

This master thesis has been written with the purpose of designing an SPE system that aligns with company preferences, literature insights, and external requirements. In order to meet this purpose, a case study was designed.

First, a literature review was conducted exploring different important areas in an SPE system. Prior to the literature review, interviews with employees at the Company were conducted. Information about the previously and currently used SPE system was collected, as well as the employees' wishes and thoughts for the new system. The Company's strategy was also discussed during the interviews. The previously used supplier scorecard was also studied as a part of the information collection. An analysis of how the new SPE system could be designed was conducted, by first identifying performance goals, then selecting evaluation approach followed by selecting suitable metrics and finally considering how the system could be implemented. The analysis was based on the literature review and the wishes and requirements highlighted by the employees as well as the BRCGS requirements.

The literature review, information collection, and analysis were conducted iteratively. This approach involved revisiting areas where information gaps existed and filling them with additional relevant data. A focus group was finally gathered and provided their thoughts on the suggested

solution for the new SPE system, which validated the final recommendations. The final recommendations for the design of the SPE system fulfills both the requirements presented by the employees at the Company and the external requirements set by BRCGS.

6.1.1 Answer to Research Questions

To design a system for SPE for the Company and fulfill the purpose of this project, three research questions have been answered.

Research Question 1

How does the Company currently evaluate its suppliers?

The Company currently includes around 50 of their suppliers which are either strategically or financially important in their SPE system. This is a temporary solution to the BRCGS requirement of having a continuous evaluation of suppliers and requires a manual update annually. The currently used SPE system is summarized in Figure 6.1.

What evaluation approach is used?
• An Excel sheet is filled in manually once a year
• An average score is calculated based on the scores of each metric

What metrics are included?
• Subjective assessmet from strategic purchasing
• Subjective assessment from operational purchasing
• Number of deviations
• Number of complaints
• Number of non-conformance
• Difference in days between expected delivery date and actual delivery date

How are the results followed up?
• When a supplier receives an average score below 2, action is required
• The suppliers that require an action are followed up after six months to see if there have been any improvements

Figure 6.1: The evaluation approach and metrics included in the currently used SPE system, as well as how the results are followed up.

Research Question 2

What requirements and preferences should the system meet?

The employees at the Company have expressed several requests for functions and information to include in the SPE system. They want the system to include all suppliers. They also want automated and more frequent updates of the system, as well as easily accessible data in the system. They have requested a system that gives a clear overview of all suppliers to facilitate a comparison between them, and individual suppliers to view more details about their performance. The employees also wish the SPE system to be easily used to enable as many employees as possible to benefit from the system. The employees wish for solely quantitative metrics in the SPE system that gives a clear picture of how the supplier is performing. They also request a solution for handling qualitative data when needed.

The literature clearly states that how an SPE system should be designed depends on the company in question. Aligning the SPE system with company goals and objectives is a crucial part of designing a SPE system and this should be considered when selecting an evaluation approach and metrics. Important steps in designing a SPE system have been identified in the literature as aligning SPE system with performance goals, selecting an evaluation approach, choosing metrics to include, and implementing the system. According to the literature review, the system should mainly or solely include quantitative metrics. There are also several requirements that metrics should fulfill. They should be meaningful, valuable, balanced, linked, practical, comparable, credible, timely, simple, robust, and there should be a reasonable number of them.

The SPE system the Company uses needs to be adapted to the requirements included in the BRCGS standard for Storage and Distribution. The standard states that all suppliers should be assessed continuously on set performance criteria. What performance criteria to include is not stated, except for including complaints which is a requirement. The review needs to be completed at least annually. Other than this, no external requirements need to be taken into account when designing the system. The requirements are summarized in Figure 6.2.
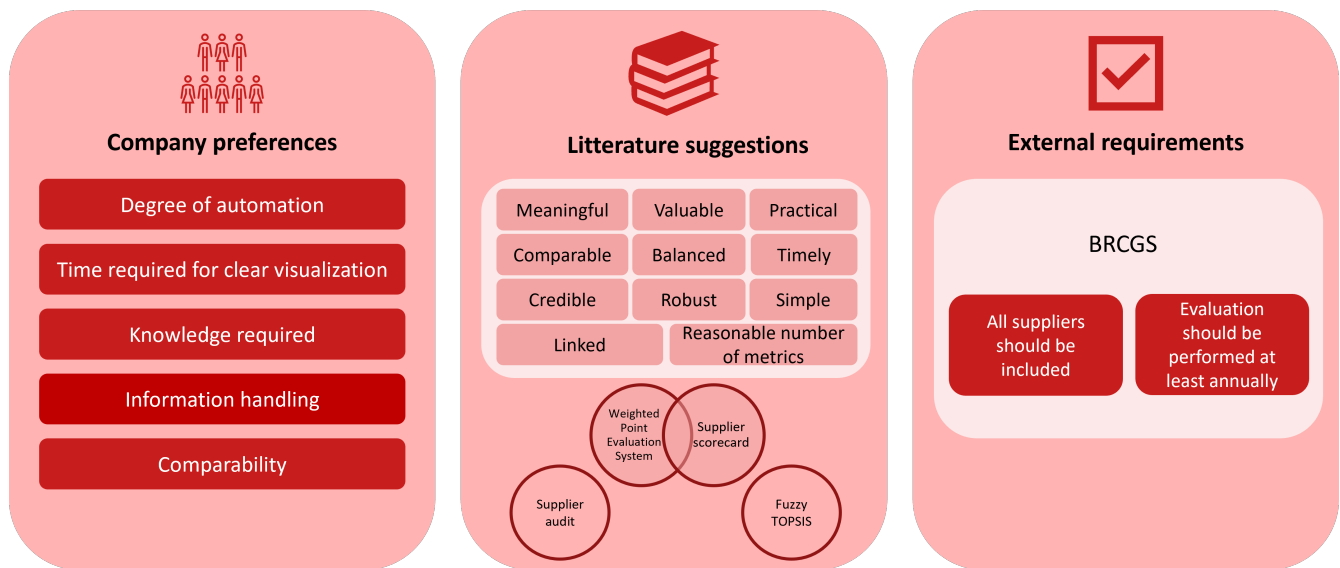
Figure 6.2: Overview of company preferences, literature suggestions, and external requirements.

Research Question 3

How could the Supplier Performance Evaluation system be designed to align with the identified requirements and preferences?

The recommendation for how the SPE system should be designed is divided according to the steps in the framework described in Figure 3.8. It consists of recommendations of what evaluation approach to use, what metrics to include and how the system should be implemented in the Company.

Evaluation Approach   The Company is advised to implement a supplier scorecard with incorporated weights. The supplier scorecard will give a clear overview of supplier performance as well as the possibility to both compare the suppliers' total score and analyze individual suppliers' performance. The weights included in the scorecard should be based on the suggested weights from the focus group. In order to cover all the Company's needs, including supplier audits in the SPE routine for strategically important suppliers is recommended. The division of suppliers to be covered by only the scorecard and both the scorecard and supplier audits is presented in Figure 6.3. This evaluation approach is recommended since it fulfills all the requirements and wishes presented by employees at the Company. It has been compared with other evaluation approaches suggested in the literature but no other approach has been as well aligned with the Company's wishes and needs.
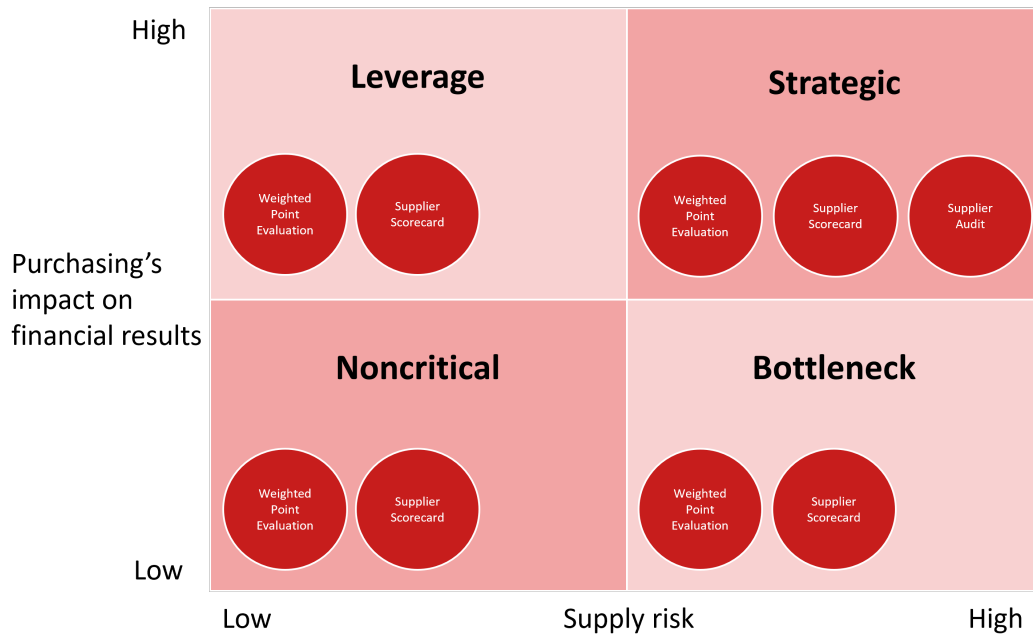
Figure 6.3: Overview of the recommended SPE approaches.

The selected evaluation approach is automated to a high degree, limiting the need for manual input and updates to keep it up to date. In order to clearly visualize the results of the evaluation, minimal time is required. This means that results can be easily understood and collected when needed, and a clear overview is easily accessible. It only requires basic knowledge by the employees working with the system which facilitates the use of the system as well as makes it easy to learn by new employees. It can handle nuanced information when needed, like in the case of suppliers without the required certification or with the risk of not living up to the required standards. Since weights are incorporated into the system, it is also possible to compare the suppliers' performance with each other which has been a wish from the employees at the Company.

Metrics The metrics recommended to be included in the SPE system are service level - delivery date, service level - quality, percent complaints, number of product deviations, percent non-conformance, cassations, and spend per supplier, see Figure 6.4. They are described more in detail in Table 5.9.
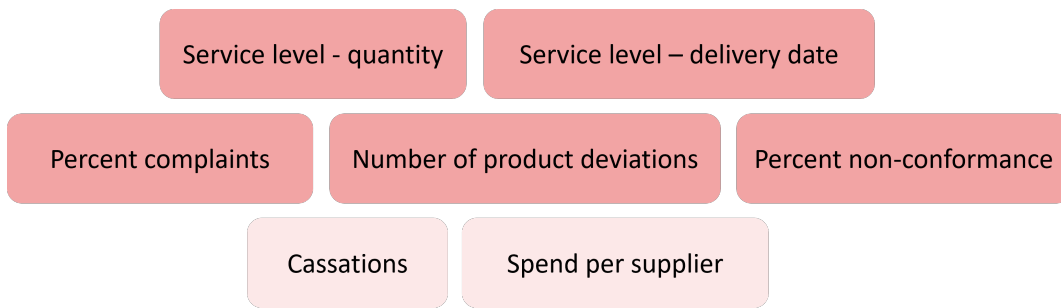
Figure 6.4: The metrics recommended to include in SPE system.

The metrics have all been assessed as relevant to include by fulfilling at least most of the requirements on metrics presented by Gordon (2008) and validated by the focus group consisting of employees at the Company. They are also solely quantitative which fulfills requirements described in the literature as well as by the employees at the Company. Therefore, the metrics are considered to be relevant to include in the SPE system.

Implementation   This thesis has covered two main topics regarding the implementation of the SPE system: the technical solution, and how actions on supplier performance should be prioritized, see Figure 6.5.
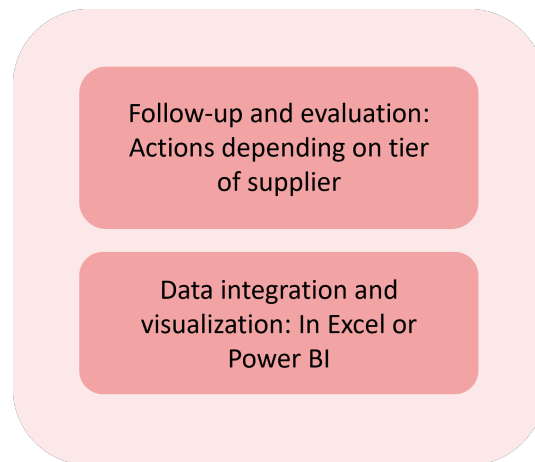
Figure 6.5: Summary of the implementation of the SPE system.

To make sure that supplier performance is followed up and actions are taken when needed, suppliers could be divided into groups based on performance. The authors suggest a division like the one described in Figure 6.6, but depending on the Company's situation and available resources this can be adjusted. The authors also suggest to consider what type of supplier it is when taking action. Some non-strategically important suppliers might not be worth spending a lot of resources on.

Tier 1: High performers
- Suppliers with a weighted average score of 4 or above.
- Well performing in all areas, consistently meeting or exceeding expectations.
- Work on maintaining the relationship, consider strategic collaboration.

Tier 2: Acceptable Performers
- Suppliers with a weighted average score between 3 and 4.
- Meet target values overall but may have isolated issues.
- Require ongoing monitoring and targeted support to maintain satisfactory performance.

Tier 3: Improvement Needed
- Suppliers with a weighted average score between 2 and 3.
- Show inconsistency or significant deficiencies across one or multiple areas.
- Need focused interventions and action plans to enhance overall performance.

Tier 4: Underperformers
- Suppliers with a weighted average score below 2.
- Fail to meet target values across multiple areas.
- Requires immediate attention and potential replacement if performance does not improve.

Tier 5: Specific Action Needed
- Suppliers with sufficient overall weighted average but poor performance in one or a few specific areas.
- Identified for targeted action plans aimed at improving performance in the specified area(s).
- Require close monitoring and support to rectify deficiencies and prevent overall performance degradation.

Figure 6.6: An example of how suppliers could be divided according to performance.

The SPE is recommended to be conducted every three months. This frequency allows for continuous monitoring of supplier performance, providing opportunities for improvement between evaluations. Additionally, conducting assessments every three months enables earlier follow-up on new suppliers compared to the current annual assessment cycle.

To enable frequent evaluations with the designed SPE system without the need for too much manual work, a list of specifications the technical solution must fulfill has been created. The requirements encompass, among others, the ability to filter the results per supplier, that the weights should be updated and normalized automatically if the importance changes, and that pre-defined threshold values should be translated to a score between 1 and 5 to enable a uniform interpretation of results. Most of the requirements could be fulfilled by creating the supplier scorecard in an ordinary Excel file, but since Excel requires some manual work for each evaluation, Power BI would be more suitable. The major obstacle with creating the SPE system in Power BI today is that the data setup is currently not customized for the desired functions. However, since the Company is currently in the process of changing its database system, there is potential to tailor the data setup to accommodate the desired functions in Power BI in the future.

Conclusion To align with the Company's goals of delivering a comprehensive solution with competitive prices and a high service level, the final recommendation can be described as a weighted supplier scorecard, measuring five metrics: service level - quality, service level - date, percent complaints, number of product deviations, and percent non-conformance. Included in the supplier scorecard are also cassations and spend per supplier, but they should not be included in the final score. Based on the evaluation, the suppliers will be divided into five tiers based on their performance. All tiers have different priorities when it comes to actions. The evaluation can be performed in Excel but since it requires some manual work, the Company is recommended to do the evaluation in Power BI as soon as the new database system is implemented. An overview of the final recommendation can be seen in Figure 6.7.
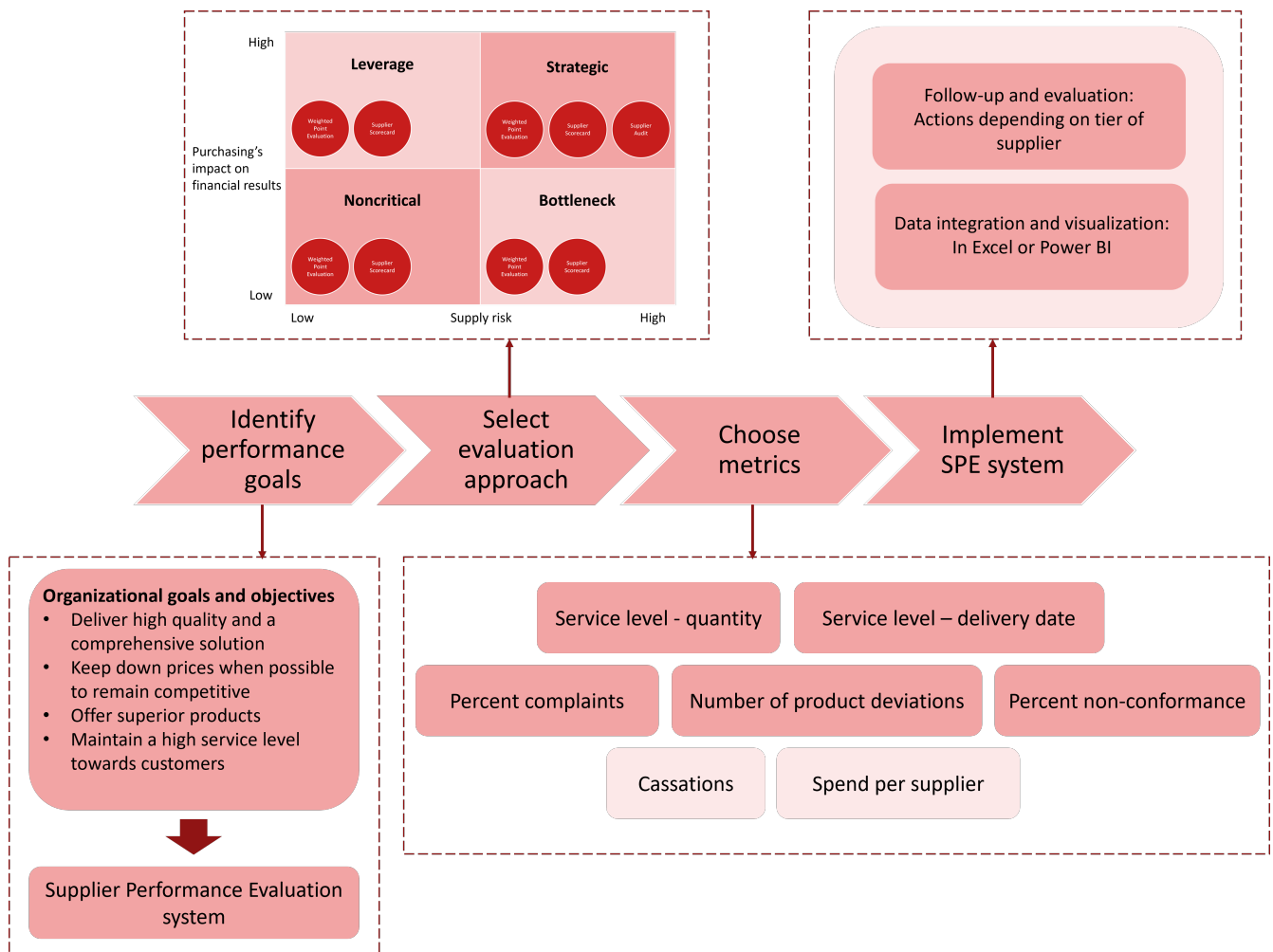

Figure 6.7: Overview of final recommendation.

6.2   Generalizability

This thesis is built upon a single case study, where numerous conclusions and recommendations stem from the Company's inputs and data. As a result, the extent to which these findings can be generalized is constrained. This aligns with the perspective put forth by Saunders et al. (2007), as the research project aims to explain a phenomenon within the chosen research setting. Therefore, it is important to acknowledge that not all findings can be universally applied to other companies with the expectation of achieving identical outcomes and improvements. On the other hand, many of the preferences expressed by representatives from the Company may be similar to what other companies prefer. For example, most companies may want to have a solution requiring as little unnecessary manual work as possible. In other words, the suggested solution may act as a source of inspiration for companies with similar specifications on their SPE system. The system can also be adjusted to fulfill expectations better. For example, other metrics can be chosen to better align with the specific company's strategy. Many of the approaches used in the analysis could be used for other organizations interested in designing an SPE system. For example, to assess evaluation approaches based on a combination of company preferences, external requirements, and literature suggestions.

6.3   Contribution to Theory and Practice

In the introduction, it was determined that SRM is essential for organizations to ensure competitiveness and success, and that SPE is important to manage supplier relationships. It is extra important for businesses selling food since they operate under high pressure on product safety. At the same time, a gap was identified in the literature when searching for how a distributor of food and food-related products should perform their SPE. There is a lot of literature on different evaluation approaches, as well as numerous cases where different approaches are applied to companies. However, the choice of a specific approach among the many existing ones is rarely motivated and there is no standardized way of how to design an SPE system for this specific context. To bridge this gap, a solid literature review was performed including, for example, a study of different evaluation approaches, requirements on metrics, and several cases where SPE systems have been applied. This thesis has confirmed the applicability of existing theory by combining elements from different studies to design an SPE system suitable for the Company.

There are several ways in which the master thesis can be utilized by the Company. Firstly, the SPE system design can be implemented as soon as the change of databases is finished and the issue with data integration is solved. This thesis provides an extensive description of the evaluation approach, metrics, weights, and a potential plan for follow-up. It also includes system requirements useful when implementing the system.

There are also many advantages with implementing the proposed SPE system, including fulfilling the requirements set by BRCGS, potential to use the results as leverage in negotiations, working proactively with supplier performance, mitigating risks related to supplier performance and provide business insights. The advantages are described more in detail in Advantages with the SPE System.

Other organizations with similar wishes and requirements to the Company can use the findings in the study as a base when designing a SPE system. The step-by-step framework developed in this thesis can be used as a guide when organizing the design of the system. However, it is important to adapt the system to their own business goals and objectives and select metrics that they find important to include.

6.4   Future Research

This master thesis was written with certain delimitations. The first delimitation was to not include suppliers providing indirect material. The authors, in consultation with the Company, decided on this delimitation since the goal of the project was to help the Company to fulfill the BRCGS requirements in chapters 10.2 and 10.3 which only includes suppliers of direct material. The authors believe there would be no major difference in the results and recommendations if suppliers of indirect material had been included as well, but since this has not been investigated in this study, this theory can not be confirmed.

The thesis has also only focused on SPE with the perspective of evaluating currently used suppliers, and not selecting new suppliers. The topic of SPE from the perspective of supplier selection could therefore be an interesting continuation of this master thesis. For instance, how the Company should design its system for initial supplier selection could be a future master thesis if this is seen as valuable by the Company.

In the recommendations for how to implement the SPE system, only two perspectives were considered. This is due to the nature of the thesis, where it would be out of scope and too broad to include more perspectives and these two perspectives were assessed as the most important ones by the Company. However, future research could focus on the implementation phase of an SPE system - both from the Company's perspective but also in companies in general.

Within the Company, several potential topics for future research studies have been identified. Firstly, a lack of segmentation between strategic and non-strategic suppliers has been identified by the authors. A master thesis focusing on how the Company should classify its suppliers could therefore be relevant. Another area that has been identified is the importance of making sure that

there is willingness among suppliers to perform well and improve. Related to this, questions about whether this could be done by an incentive system or be included as requirements in contracts with suppliers have come up. Including this topic in a future master's thesis could also be relevant.

Conducting a larger research study comparing companies in different situations and with differing requirements and wishes could be an interesting extension of this study. Such a study could potentially identify what specific SPE systems are suitable for different companies and provide results more generalizable than the results in this study.

To implement the results of this study, the Company needs to improve its data. One example of this is that currently, different data files have different names for each supplier. This makes it hard to integrate the data into one report and filter results on specific suppliers. The change of databases also needs to be completed by the Company before the SPE system can be implemented. The employees at the Company described a problem with integrating the data from different databases into one Power BI report. If Power BI is the desired tool to use for the SPE system this problem needs to be solved. Investigating how this could be done could potentially be a suitable future master thesis project as well.

Bibliography

Ashcroft, S. (2022), 'Top benefits of supplier performance-management solutions', *Digital Supply Chain* . https://supplychaindigital.com/digital-supply-chain/top-benefits-of-supplier-performance-management-solutions.

Boonsong, N. & Jarumaneeroj, P. (2021), 'An evaluation of supplier performance based on a three-dimensional fuzzy topsis framework', *Institute of Electrical and Electronics Engineers* . 10.1109/ICIEA52957.2021.9436815.

BRCGS (2020), 'Issue 4 storage and distribution', *Storage and distribution* **4**.

BRCGS (n.d.*a*), 'Discover brcgs'.

BRCGS (n.d.*b*), 'Storage and distribution certification'.

Cao, Y., Umberger, G., Shelton, A. & Butts, T. (2022), 'Development of a supplier scorecard for a medical device company to formalize its supplier monitoring and re-evaluation process toward iso13485:2016', *Journal of Pharmaceutical Innovation* **17**. https://doi.org/10.1007/s12247-021-09604-y.

Dey, P. K., Bhattacharya, A., Ho, W. & Clegg, B. (2015), 'Strategic supplier performance evaluation: A case-based action research of a uk manufacturing organisation', *International Journal of Production Economics* **166**. https://doi.org/10.1016/j.ijpe.2014.09.021.

Djekic, I., Dragojlovic, S., Miloradovic, Z., Miljkovic-Zivanovic, S., Savic, M. & Kekic, V. (2016), 'Improving the confectionery industry supply chain through second party audits', *British Food Journal* **118**(5). http://www.emeraldinsight.com/doi/10.1108/BFJ-11-2015-0448.

Doolen, T., Traxler, M. M. & McBride, K. (2006), 'Using scorecards for supplier performance improvement: Case application in a lean manufacturing organization', *Engineering Mangement Journal* **18**(2). http://dx.doi.org/10.1080/10429247.2006.11431691.

Fern, E. F. (2001), *Advanced Focus Group Research*, Vol. 1, SAGE Publications.

Garcia, N., Puente, J., Fernandez, I. & Priore, P. (2013), 'Supplier selection model for commodities procurement. optimised assessment using a fuzzy decision support system', *Applied Soft Computing* **13**(4). https://www.sciencedirect.com/science/article/pii/S1568494612005522.

Gordon, S. R. (2005), 'Seven steps to measure supplier performance', *Quality Progress* **38**(8).

Gordon, S. R. (2008), *Supplier evaluation and performance excellence: a guide to meaningful metrics and successful results.*, Vol. 1, J. Ross Publishing.

Höst, M., Regnell, B. & Runeson, P. (2006), *Att genomföra examensarbete*, Vol. 1, Studentlitteratur.

Jayant, A. (2018), 'An analytical hierarchy process (ahp) based approach for supplier selection: An automotive industry case study', *International Journal of Latest Technology in Engineering, Management and Applied Science* **7**(1). ISSN 2278-2540.

Kaplan, R. S. (2009), 'Conceptual foundations of the balanced scorecard', *Handbooks of Management Accounting Research* **3**.

Kraljic, P. (1984), 'Purchasing must become supply management', *Harvard Business Review* **61**(5).

Krishnadevarajan, P. K., Ravichandran, V., Balasubramanian, S. & Kannan, N. (2015), 'Supplier management: A framework for selction, evaluation and performance', *International Journal of Management* **6**(9).

Kueger, R. A. & Casey, M. A. (2015), *Focus groups: A guide for applied research*, 5 edn, SAGE Publications.

Lee, D. M. & Drake, P. R. (2010), 'A portfolio model for component purchasing strategy and the case study of two south korean elevator manufacturers', *International Journal of Production Research* **48**(22). 10.1080/00207540902897780.

Morgan, D. L. & Spanish, M. T. (1984), 'Focus groups: A new tool for qualitative research', *Qualitative Sociology* **7**. https://doi.org/10.1007/BF00987314.

NC State University (2011), 'Performance measurements and metrics: An analysis of supplier evaluation'. https://scm.ncsu.edu/scm-articles/article/performance-measurements-and-metrics-an-analysis-of-supplier-evaluation.

O'Brien, J. (2022), *Supplier Relationship Management: Unlocking the Value in Your Supply Base.*, Vol. 2, Kogan Page Limited.

Osiro, L., Lima-Junior, F. R. & Carpinetti, L. C. R. (2014), 'A fuzzy logic approach to supplier evaluation for development', *International Journal of Production Economic* **153**. https://doi.org/10.1016/j.ijpe.2014.02.009.

Rahim, R. & Risawandi (2016), 'Study of the simple multi-attribute rating technique for decision support', *International Journal of Research in Science and Technology* **2**(6).

Rodrigues Lima-Junior, F. & Ribeiro Campinetti, L. C. (2016), 'Combining scor® model and fuzzy topsis for supplier evaluation and management', *International Journal of Production Economics* **174**. https://doi.org/10.1016/j.ijpe.2016.01.023.

Rowley, J. & Slack, F. (2004), 'Conducting a literature review', *Management Research News* . https://doi.org/10.1108/01409170410784185.

Saunders, A. G. (1994), 'Supplier audits as part of a supplier partnership', *The TQM Magazine* **6**(2). https://doi.org/10.1108/09544789410054028.

Saunders, M., Lewis, P. & Thornhill, A. (2007), *Research methods for business students*, Vol. 4, Harlow, England ; New York : Financial Times/Prentice Hall.

Saunders, M., Lewis, P. & Thornhill, A. (2009), *Research methods for business students*, Vol. 5, Harlow, England, New York, Financial Times/Prentice Hall.

Stevića, Z., Tanackovb, I., Vasiljevića, M., Novarlićc, B. & Stojićb, G. (2016), 'An integrated fuzzy ahp and topsis model for supplier evaluation', *Serbian Journal of Management* **11**(1). 10.5937/sjm11-10452.

Trienekens, J. & Zuurbire, P. (2008), 'Quality and safety standards in the food industry, developments and challenges', *Int. J. Production Economics* **113**(1), 107–122. https://doi.org/10.1016/j.ijpe.2007.02.050.

Van Weele, A. J. (2014), *Purchasing and Supply Chain Management. Analysis, Strategy, Planning and Practice*, Vol. 6, Pearson Education.

Wuttke, M. (2020), 'Supplier evaluation system in the food industry', *Lunds Tekniska Högskola* .

Yin, R. K. (2014), *Case Study Research*, Vol. 5, SAGE.

Zimmermann, H. J. (2010), 'Wires computational statistics', **2**(3). https://doi.org/10.1002/wics.82.

Appendix A

This Appendix shows the guides used during the interview questions. It starts with more general questions that were asked to two or more of the interviewees, followed by specific questions for each person. Please note that the order of the questions may have been changed. The interview guides are provided in Swedish since the interviews were held in Swedish.

Questions asked to multiple persons

Introduction

- Fråga om det går bra att vi spelar in intervjun, endast i syftet att vi ska kunna lyssna i efterhand om vi missar att skriva ner något.

- När vi har summerat intervjun skulle vi gärna vilja skicka den till dig så att du kan bekräfta att vi har uppfattat det du berättat korrekt. Detta är för att öka validiteten av vårt arbete. Har du möjlighet att ställa upp på detta?

- Vi skriver ett examensarbete om hur *Företaget* ska utveckla sitt system för leverantörsutvärdering för att följa BRCGS standard för Storage and Distribution och dra nytta av de fördelar som kommer med ett välutvecklat leverantörsutvärderingssystem. Vi kommer jämföra hur ni gör idag med teori och era önskemål, och genom det identifiera vilka områden ni kan förbättra för att få ett mer effektivt leverantörsutvärderingssystem. Vi fokuserar alltså på uppföljning av leverantörer, och inte den initiala processen när de väljs.

General questions

- Skulle du kunna beskriva vad dina huvudsakliga ansvarsområden är?

- Hur skulle du beskriva företagets övergripande strategi?

- Kan du beskriva hur du/din avdelning är involverade i leverarantörsuppföljningen i dagsläget?

- Har inköpsfunktionen några mål eller nyckeltal som ni ska förhålla er till?

- Ser du leverantörsuppföljning som en viktig del, eller potentiellt viktig del, i företagets arbete?

- Tar du del av resultaten från leverantörsuppföljningen?

- Tror du det hade varit givande i din roll att ta del av resultaten från leverantörsuppföljningen?

- Vidtar ni några åtgärder om leverantörer underpresterar?

- Använder ni leverantörsuppföljningen när ni förhandlar med leverantören?

- Skulle du kunna visa någon av era Power BI Dashboards?

- Ser du någon ytterligare utmaning med leverantörsuppföljning, utöver de vi redan tagit upp.

Thoughts about the new system

- Ser du några förbättringsmöjligheter med hur ni arbetar idag?

- Vilka mätvärden anser du viktiga att mäta i leverantörsuppföljningen?

- Hur mycket tid och resurser är ni villiga att lägga på leverantörsuppföljningen?

- Ser du potential i att genomföra leverantörsutvärderingen i Power BI?

- Har ni några specifika krav på era leverantörer som exempelvis står i era kontrakt och därför är relevanta att mäta i leverantörsutvärderingen?

- Se powerpoint "Diskussionsunderlag SPE modeller" för diskussion om initiala tankar från företaget kring olika metoders relevans för projektet. Vad är dina tankar kring de modeller vi presenterar i diskussionsunderlaget?

    - Vad är dina tankar kring de modeller vi presenterar i diskussionsunderlaget?

- Vår hypotetiska lösning är att skapa en kombination av Weighted Point Evaluation och Supplier Scorecard, där leverantörens poäng presenteras på ett visuellt lättillgängligt sätt, exempelvis i Excel/Power BI. Detta då det inte kräver så mycket tid och resurser för regelbundet arbete med utvärderingen. Men ger en bra och enkel bild. Vad tänker du kring detta?

- Under vår litteraturstudie har vi uppfattat att en anledning till att använda sig av ett leverantörsutvärderingssystem är för att förhindra risker och mildra konsekvenser av att olika risker i försörjningskedjan inträffar. Har du någon tanke kring risker som företaget är exponerade för?

Wrap-up

- Har vi missat att fråga om något som du tror vore bra för oss att veta?

- Får vi kontakta dig om vi kommer på någon mer fråga som vi glömt ställa?

- Vi skulle gärna vilja anordna en fokusgrupp för att samla in input på våra olika tankar och idéer lite senare under våren. Hade du velat och haft möjlighet att delta i ett sådant möte?

- Har du någon kontakt på något annat företag inom Orkla som eventuellt skulle kunna ställa upp på en intervju?

- Stort tack för att du har tagit dig tiden att delta i denna intervjun.

Specific questions - Strategic Purchaser

General questions

- Skulle du säga att ni har olika typer av leverantörer, mer och mindre strategiska?

- Har du någon tanke kring varför ni inte hade ett system för leverantörsuppföljning innan ni fick en anmärkning på att det inte följde BRC-standarden?

Current system

- Hur har ni arbetat för att ta fram systemet som ni använder er av i dagsläget?

- Vilka nyckeltal finns med i ert nuvarande system för leverantörsbedömning?

- Hur mäter ni nyckeltalen? Är det baserat på kvantitativ data eller subjektiva åsikter kring leverantörens prestation?

- Hur analyseras datan? Finns det värden för när en leverantör presterar "bra" respektive "dåligt", eller konstaterar ni endast resultaten?

- Fylls datan i manuellt i Excel eller har ni ett integrerat system?

- Hur ofta mäts nyckeltalen och hur ofta fylls excelarket i?

- Hur följer ni upp resultaten?

- Vad ser du för för- och nackdelar i det nuvarande systemet?

- Vilka leverantöerr utvärderar ni i dagsläget?

BRC Certification

- Som vi förstår det på BRC-standarden så sker det även oannonserade bedömningar, är detta något som ingår för företaget också?

- Som vi förstår det i BRC-standarden så står det inget om vad man specifikt behöver mäta. Det verkar bara som att man ska ha en documented process och att det inte finns specifika krav på vad man ska mäta. Stämmer detta eller är det något vi har missat i definitionen?

- Förstår vi det rätt som att "approved suppliers" i standarden innebär alla leverantörer inom området branded products, wholesaler-own, wholesaler-exclusive och customer-exclusive products?

Thoughts on future system?

- Finns det någon parameter som du på rak arm känner att ni borde mäta och utvärdera era leverantörer utifrån, men inte gör?

- Har ni, som du är medveten om, tillgång till mer data än den du använder dig av i dagsläget?

Specific questions - Operational Purchaser

- Vi har hört att det är ni som är ansvariga för att hålla koll på transportskador. Hur går detta till? Vad är det som mäts?

- Vi har hört att ni har en kolumn där det operativa inköpet bedömer leverantören lite "subjektivt" (leveranssäkerhet, samarbete, dåliga med transporten), alltså vad er uppfattning kring leverantören är. Hur går denna bedömning till?

- Vad har ni tillgång till för data på er avdelning som eventuellt skulle vara relevant för leverantörsuppföljning?

- Hur mäter ni leveranssäkerhet?

Specific questions - Chief Operating Officer

- Vi har hört att du även har en roll inom gruppen, kan du beskriva den?

- Vad är målet att centralisera inköpet?

- Hur skulle du beskriva Företagets roll inom Gruppen, hur skiljer ni er från de andra företagen?

- Är det någon skillnad på förväntningarna företaget har på leverantörer som är externa och leverantörer som är systerbolag?

Specific questions - Business Controller Sales

- Vad arbetar du med för data och mätvärden i Power BI?

- Hur fungerar er datainsamling kopplat till Power BI idag? Finns det någon automatiserad del som kommer från Microsoft Dynamic? Hur ofta uppdateras den relevanta datan? (Är det "levande" dokument, eller är datan statisk?)

Specific questions - Business Controller Purchasing

- Hur samarbetar du med operativt respektive strategiskt inköp?

- Används den data du tar fram/analyserar? Ser du potential i att det du gör skulle kunna vara användbart för leverantörsuppföljning?

- Har ni undersökt om det i den nya databasen går att kombinera all data i en rapport i Power BI?

- Är du insatt i hur ni följde upp leverantörer under tiden med Movex som affärssystem? Om ja: Vi har hört att det eventuellt finns kvar ett scorecard från den tiden - skulle du kunna visa det för oss?

- Varför tror du att arbetet leverantörsutväredring föll mellan stolarna i samband med bytet?

Specific questions - Representatives from the Group
Their roles within the Group

- Skulle ni kunna beskriva vad era huvudsakliga ansvarsområden är?

- Hur arbetar ni kopplat till leverantörsuppföljning?

About the Purchasing Company within the Group

- Beskriv inköpsföretagets roll inom koncernen?

- Hur påverkar inköpsföretagets arbete de andra bolagen i koncernen?

- Vilka typer av leverantörer förhandlar ni med centralt?

System for Supplier Performance Evaluation

- Hur ser ert leverantörsuppföljningssystem ut?

- Vilka nyckeltal är med i ert nuvarande system?

- Hur mäter ni nyckeltalen? Är det baserat på kvantitativ data eller subjektiva åsikter kring leverantörens prestation?

- Hur analyseras datan? Finns det värden för när en leverantör presterar "bra" respektive "dåligt", eller konstaterar ni endast resultaten?

- Hur fungerar ert system rent tekniskt, vad använder ni er av för program/verktyg för uppföljningen?

- Hur följer ni upp resultaten av leverantörsuppföljningen?

  - Pratar ni om det internt?

  - För vem presenteras resultatet av uppföljningarna?

- Vad ser ni för för- och nackdelar i det nuvarande systemet?

- Finns det någon parameter som ni på rak arm känner att ni borde mäta och utvärdera era leverantörer utifrån, men inte gör?

Appendix B

This appendix shows the plan for the focus group. The plan was used as a support to follow the time plan and not forget any important information.

Introduction

- Present moderator and assistant. The moderator's role will be to guide the discussion.

- Make sure that the participants do not need to agree with each other, but they must listen respectfully as the others share their opinions.

- Encourage the participants to talk to each other.

- Remind them of the background of the project. Describe the goal of the focus group.

First topic: Evaluation approach

- Present the evaluation approach designed so far.

- Discuss: What advantages and disadvantages do you see with this solution? (First, share thoughts anonymously through centimeter).

- Discuss: Will the solution be useful in your role?

- Discuss: Is something missing for this solution to work as good as possible?

Break: 10 min

Second topic: Metrics

- Present how it was decided which metrics to bring to the focus group.

- Discussion: Discuss the metrics one by one. Is it relevant? Is the data available?

- Weights: Fill in form about the importance of the metrics. (0-100 where 100 is "the most important metric")

Appendix C

This appendix shows the definitions for all metrics evaluated as potential metrics for the final solution.

Table 1: The definitions used for each metric.

Financial aspects	Definition
Payment terms and discounts	The agreed-upon conditions for payment and any reductions in price.
Spend per supplier	The total amount of money spent on each supplier.
Quote responsiveness	The time in days with which the suppliers respond to requests for price quotes or proposals.
Shipping and delivery cost	Costs associated with transporting and delivering goods.
Earnings per supplier	The profits from selling goods delivered by the supplier with the related costs subtracted.
Delivery performance	
Service level	The difference in days between actual delivery date and requested delivery date.
Delivery speed	The number of days it takes from an order being placed until the products are delivered.
Transport related issues	The percentage of deliveries where issues related to the transportation of the goods were reported.
Delivery errors	The percentage of deliveries where the delivery has not matched the actual order.
Quality	
Percent complaints	The percentage of total delivered order lines that has received a complaint related to the supplier's delivered products.
Number of product deviations	The number of delivered orders where there has been a deviation compared to the expected specifications, related to the delivered product.
Percent non-conformance	The percentage of delivered orders where there has been a non conformity registered at the goods receipt.
Quality certification	What quality certification the supplier is certified in accordance with.
Effectiveness	
Data accuracy	The percentage of times data provided by the supplier has been inaccurate.
Forecast assistance and accurcay	The support provided by the supplier in predicting future capacity and the precision in this forecasting.
Risk management	
Number of customers	The total amount of customers that the supplier has.
Warranties	Warranies provided by the suppliers regaring the delivery and quality of their products.
Risk mitigation activities	What measures are taken in order to minimize or eliminate risks to the supplier's ability to provide products.
Customer service	
Number of stock-outs	Percentage of times where the supplier have had a stock-out and not been able to deliver as the Company has wished.
Order visibility and tracking	Whether or not the service of tracking the delivery of the order is provided.
Relationship performance	How well the relationship with the supplier is percieved to be working.
Response time	The number of hours it takes for the supplier to respond to inquiries or requests.
Other metrics	
Volume development	The changes in quantity purchased from the supplier over time.
Carbon footprint	The total amount of greenhouse gases emitted related to the purchased product.
Cassations	Value in money of products that has had to be cassated, bought from the specific supplier.

Appendix D

All metrics were given a "yes" or "no" depending on whether they fulfilled the pre-determined requirements or not. This appendix shows the final motivations for the assessment of metrics.

Table 2: The motivations to why the different metrics were given a "yes" or "no" for the different requirements, part 1.

	Meaningful	Valuable	Linked	Practical	Comparable	Credible	Timely	Simple
Financial aspects								
Payment terms and discounts	Yes - important to stay competitive by securing low prices	Yes - customers wants low prices when possible	Yes - supplier is responsible for payment terms/discounts	No - the data is not currently available	No - can vary too much and be dependent on many different factors	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Spend per supplier	Yes - to ensure profitability and reasonable prices	No - customer's requirements are not related to this metric	No - the supplier is not responsible for the Company's total spend on them	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Quote responsiveness	No - does not relate to any core business strategy	No - customer's requirements are not related to this metric	Yes - the supplier is responsible for quote responsiveness	No - the data is not currently available	No - can vary too much and be dependent on many different factors	No - this can vary and be dependent on many factors, data can not be guaranteed to be correct	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Shipping and delivery cost	Yes - important to stay competitive by keeping down costs	Yes - customers wants low prices when possible	Yes - the supplier is responsible for shipping and delivery cost	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Earnings per supplier	Yes - important to be as profitable as possible	No - customers mostly care about sales price	No - the supplier is not responsible for total earnings	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Delivery performance								
Service level	Yes - important to maintain a high service level towards own customers	Yes - customers require a high service level	Yes - supplier is responisble for delivering on time	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Delivery speed	No - does not relate to any core business strategy	No - customer's requirements are not related to this metric	Yes - supplier is responsible for the speed it delivers with	No - the data is not currently available	Yes - it is possible to compare over time	No - this can vary and be dependent on many factors, data can not be guaranteed to be correct	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Transport related issues	Yes - important to maintain a high service level towards own customers	No - customer's requirements are not related to this metric	Yes - supplier is responsible for delivery errors	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Delivery errors	Yes - important to maintain a high service level towards own customers	No - customer's requirements are not related to this metric	Yes - supplier is responsible for delivery errors	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Quality								
Percent complaints	Yes - important to deliver products of high quality	Yes - customers value high-quality products	Yes - supplier is responisble for complaints related to delivered product	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Number of product deviations	Yes - important to maintain high quality	Yes - customers value high-quality products	Yes - supplier is responisble for product quality	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Percent non-conformance	Yes - important to maintain high quality	Yes - customers value high-quality products	Yes - supplier is responisble for product quality	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Quality certification	Yes - the Group wants suppliers to comply with quality certifications	Yes - customers value high-quality products	Yes - the supplier is responsible for being certified	Yes - the data is currently available	No - not something that you compare over time, either they are or aren't	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track

Table 3: The motivations to why the different metrics were given a "yes" or "no" for the different requirements, part 2.

	Meaningful	Valuable	Linked	Practical	Comparable	Credible	Timely	Simple
Effectiveness								
Data accuracy	Yes - to base decisions on correct information	No - customer's requirements are not related to this metric	Yes - the supplier is responsible for the accuracy of data	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Forecast assistance and accurcay	Yes - to base decisions on correct information	No - customer's requirements are not related to this metric	Yes - the supplier is responsible for forecast accuracy	No - the data is not currently available	No - qualitative metric, can't really be compared	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Risk management								
Number of customers	Yes - important to be a prioritized customer in the case of shortage of material	No - customer's requirements are not related to this metric	Yes - the suppliers are responsible for how many customers they have	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information, dependant on suppliers sharing
Warranties	Yes - important to deliver products of high quality and that promised quality is delivered	No - customer's requirements are not related to this metric	Yes - supplier is responsible for warranties provided	No - the data is not currently available	No - qualitative metric, can't really be compared	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Risk mitigation activities	Yes - important that suppliers can deliver and not be exposed to too many risks	No - customer's requirements are not related to this metric	Yes - supplier is responsible for risk mitigation activities conducted	No - the data is not currently available	No - can vary too much and be dependent on many different factors	No - this can vary and be subjective, data can not be guaranteed to be correct	Yes - data can be analyzed before getting outdated	No - not simple to compile this information, dependant on suppliers sharing
Customer service								
Number of stock-outs	Yes - important to maintain a high service level towards own customers	Yes - customers require a high service level	Yes - supplier is responsible for number of stock-outs	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Order visibility and tracking	Yes - important to ensure a high service level towards own customers	No - customer's requirements are not related to this metric	Yes - supplier is responsible for order visibility/tracking	No - the data is not currently available	No - can vary too much and be dependent on many different factors	No - this can vary and be subjective, data can not be guaranteed to be correct	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Relationship performance	Yes - a good relationship with suppliers is important to mitigate risks	No - customer's requirements are not related to this metric	Yes - supplier is responsible for their relationship performance	No - the data is not currently available	No - can vary too much and be dependent on many different factors	No - this can vary and be subjective, data can not be guaranteed to be correct	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Response time	Yes - important to ensure a high service level towards own customers	No - customer's requirements are not related to this metric	Yes - supplier is responsible for their response time	No - the data is not currently available	No - can vary too much and be dependent on many different factors	No - this can vary and be dependent on many factors, data can not be guaranteed to be correct	Yes - data can be analyzed before getting outdated	No - not simple to compile this information
Other metrics								
Volume development	Yes - important that agreements are followed and promised volume is actually purchased by the Company	No - customer's requirements are not related to this metric	No - the supplier is not responsible for how much the Company buys	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track
Carbon footprint	Yes - sustainability is a highly prioritized topic within the Group	Yes - customers can value sustainable products	Yes - the supplier is responsible for their carbon footprint	No - the data is not currently available	Yes - it is possible to compare over time	Yes - data could be reliable if available	Yes - data can be analyzed before getting outdated	No - not simple to compile this information, dependant on suppliers sharing
Cassations	Yes - important to not let products go to waste	No - customer's requirements are not related to this metric	No - supplier is not responsible for cassations	Yes - the data is currently available	Yes - it is possible to compare over time	Yes - data is reliable	Yes - data can be analyzed before getting outdated	Yes - simple to comprehend and track

Appendix E: Visualization of scorecard principles

This appendix visualizes the principles of the scorecard of the suggested solution. This is only a simple visualization and the scorecard can be adjusted to better align with what the Company prefers, the data limitations, and the software used. The scorecard is intended to be displayed in a single view, see 10. However, due to resolution limitations, it is first presented in two parts.

		Supplier ID: SHU005			Supplier Group: 1	
Metric	**Count**	**Performance**	**Score**	**Weight**	**Total point**	
Complaints		0		0,201	0	
Percent non-conformance	22	0,146666667	3	0,197	0,590551181	
Number of product deviations		0	0	0,164	0	
Service level - delivery date		0,875110783	0	0,222	0	
Service level - quantity		0,899482496	0	0,216	0	
SUM					0,591	
Orderlines this period		150				

Metric	**Explanation**
Complaints	The percentage of total delivered order lines that has received a complaint related to the supplier's delivered products.
Percent non-conformance	The percentage of delivered order lines where there has been a non conformity registered at the goods receipt.
Number of product deviations	The number of times where there has been a deviation compared
Service level – requested delivery date compared to actual delivery date	The percentage of order lines when the requested delivery date has not differed from the actual delivery date.
Service level – first confirmed delivery date compared to actual delivery date	The percentage of order lines when the first confirmed delivery date has not differed from the actual delivery date.
Service level – requested quantity compared to actual delivered quantity.	The percentage of order lines where the requested quantity has not differed from the actual delivered quantity.
Service level – first confirmed quantity compared to actual delivered quantity	The percentage of order lines where the first confirmed quantity has not differed from the actual delivered quantity.
Cassations	Value in money of products that has had to be cassated, bought from the specific supplier.
Spend per supplier	The total amount of money spent on each supplier.

Figure 8: Visualization of the principles of the scorecard, first half.

Metric	1 - Unacceptable		3 - Least 2 acceptable	5 - 4 Preferred	
Complaints					
Percent non-conformance	>0,25	0,25	0,2	0,1	0
Number of product deviations					
Service level - delivery date					
Service level - quantity					

Attribute	Importance (0-100)	Weight
Complaints	76,75	0,201444
Percent non-conformance	75	0,19685
Number of product deviations	62,5	0,164042
Service level - delivery date	84,625	0,222113
Service level - quantity	82,125	0,215551
SUM	381	1

Service Level	Importance	Weight	Performance	Point
Service level – requested delivery date compared to actual delivery date	84,25	0,497784	0,85	0,423117
Service level – first confirmed delivery date compared to actual delivery date	85	0,502216	0,9	0,451994
Service level - delivery date	169,25			0,875111
Service level – requested quantity compared to actual delivered quantity.	84,25	0,512938	0,88	0,451385
Service level – first confirmed quantity compared to actual delivered quantity	80	0,487062	0,92	0,448097
Service level - quantity	164,25			0,899482

Purchasing metrics	
Cassations	X
Spend per supplier	X

Figure 9: Visualization of the principles of the scorecard, second half.

Supplier ID: SHU005   **Supplier Group: 1**

Metric	Count	Performance	Score	Weight	Total point
Complaints					
Percent non-conformance	22	0.14666667	3	0.201	0.5905512
Number of product		0	0	0.164	0
Service level - delivery date		0.875110783	0	0.222	0
Service level - quantity		0.899482496	0	0.216	0
SUM					0.591

Orderlines this period 150

Metric	1 - Unacceptable	2	3 - Least acceptable	4	5 - Preferred	Attribute	Importance (0-100)	Weight
Complaints						Complaints		
Percent non-conformance	>0.25	0.25	0.2	0.1	0	Percent non-conformance	76.75	0.2014436
Number of product						Number of product	75	0.1968504
Service level - delivery date						Service level - delivery date	62.5	0.164042
Service level - quantity						Service level - quantity	84.625	0.221129
							82.125	0.2155512
						SUM	381	1

Performance

Service Level	Importance	Weight	Point	
Service level – requested delivery date compared to actual delivery date	84.25	0.49778	0.85	0.42312
Service level – first confirmed delivery date compared to actual delivery date	85	0.50222	0.9	0.45199
Service level – delivery date	169.25			0.875
Service level – requested quantity compared to actual delivered quantity.	84.25	0.51294	0.88	0.45139
Service level – first confirmed quantity compared to actual delivered quantity	80	0.48706	0.92	0.4481
Service level - quantity	164.25			0.899

Purchasing metrics

Cassations	X
Spend per supplier	X

Metric	Explanation
Complaints	The percentage of total delivered order lines that has received a complaint related to the supplier's delivered products.
	The percentage of delivered order lines where there has been a non conformity registered at the goods receipt.
Percent non-conformance	
Number of product deviation	The number of times where there has been a deviation
Service level – requested delivery date compared to actual delivery date	The percentage of order lines when the requested delivery date has not differed from the actual delivery date.
Service level – first confirmed delivery date compared to actual delivery date	The percentage of order lines when the first confirmed delivery date has not differed from the actual delivery date.
Service level – requested quantity compared to actual delivered quantity.	The percentage of order lines where the requested quantity has not differed from the actual delivered quantity.
Service level – first confirmed quantity compared to actual delivered quantity	The percentage of order lines where the first confirmed quantity has not differed from the actual delivered quantity.
Cassations	Value in money of products that has had to be cassated, bought from the specific supplier.
Spend per supplier	The total amount of money spent on each supplier.

Figure 10: Visualization of the principles of the scorecard, full picture.

119