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A framework for choosing the right sourcing region for your products

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Filip Norrström & Tora Andreasson

Abstract

The impact of the sourcing department has gotten more and more attention in the past couple of decades. This has resulted in numerous frameworks and scorecards to guide companies through different sourcing decisions. This interest in sourcing has grown side by side with the increased globalisation and outsourcing. Therefore, relevant measurable criteria have moved from a supplier-oriented level, toward scorecards that evaluate countries and even larger regions. However, the current framework on a regional level is difficult to use for a specific company to obtain a diversified strategy for its products. Therefore, the purpose of the master thesis was to develop a framework to support the decision-making of which geographical regions Cake should source different products and components from. An abductive research strategy with both quantitative and qualitative data was used to develop the framework. In-depth interviews with industry experts, a senior lecturer, and companies were conducted, together with weekly workshops with the case company. This resulted in a framework consisting of three phases with a strategy that connects all phases. The developed framework was applied to Cake and resulted in a recommendation that indicates where each product category should be sourced and what categories need more focus from the sourcing department. This recommendation was also combined with a suggestion for how the framework should be continually updated to be operationally usable in the future. Finally, further improvements and possible next steps for the company were presented.

Keywords: Electric motorcycle, Global sourcing, Sourcing framework, Sourcing scorecard, Strategic sourcing

Abstrakt

Den inverkan som inköpsavdelningen har på ett företag har fått mer och mer fokus under de senaste decennierna. Detta har resulterat i ett flertal ramverk och scorecards för att vägleda företag i olika inköpsbeslut. Intresset för ämnet har vuxit parallellt med den ökade globaliseringen. På grund av detta har relevanta och mätbara kriterier förflyttats från att hanteras på leverantörsnivå, till scorecards som utvärderar länder och även större regioner. Det nuvarande ramverket på en regional nivå är dock svårt att praktiskt använda för ett specifikt företag för att få en diversifierad strategi för sina produkter. Därför är syftet med examensarbetet att utveckla och designa ett ramverk för att stödja beslutsfattande av vilka geografiska regioner som Cake bör köpa in olika produkter och komponenter ifrån. En abduktiv forskningsstrategi har använts för att samla in både kvalitativ och kvantitativ data för att utveckla ramverket. Intervjuer har genomförts med experter inom branschen, en universitetslektor och företag har genomförts samt veckovisa workshops tillsammans med Cake. Detta resulterade i ett ramverk uppbyggt av tre faser samt en strategi som agerar genomgående genom alla faser. Ramverket applicerades på Cake och resulterade i en rekommendation till företaget som angav i vilken geografisk region som varje produktkategori ska sourceas ifrån samt vilka kategorier som kräver ytterligare prioritet av inköpsavdelningen. Rekommendationen kombinerades med ett förslag på hur ramverket kontinuerligt bör uppdateras för att kunna vara operativt användbart i framtiden. Slutligen presenterades ytterligare förslag till förbättringar och potentiella nästa steg för företaget.

Nyckelord: Elektrisk motorcykel, Globalt inköp, Ramverk, Scorecard, Strategiskt inköp

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Abbreviation

3D-Portfolio Matrix	Three Dimensional Portfolio Matrix
CR	China Region
CSR	Corporate Social Sustainability
EA	East Asia
EV	Electric vehicle
GS-Framework	Geographical Sourcing Framework
GS-Scorecard	Geographical Sourcing Scorecard
MEA	Middle East & Africa
MSA	Mid-South Asia
NAm	North America
NWE	North-West Europe
OC	Oceania
PPM	Purchasing Portfolio Matrix
R&D	Research and Development
RFP	Request for Proposal
SAm	South America
SEA	South-East Asia
SEE	South-East Europe
SPM	Supplier Potential Matrix
TCO	Total cost of ownership
TW	Taiwan

1. Introduction

The chapter Introduction introduces the topic of sourcing and the importance of a well-grounded sourcing strategy to give a brief background to the master thesis. Further, the purpose of the project and delimitations are presented , before the case company is introduced.

1.1 Background

Today the business climate has become more competitive than ever (van Weele 2014). Therefore, supply chain management and purchasing departments have gotten more attention since their impact can be seen throughout the company. A well-functioning supply chain management can have a considerable impact on the company's performance from operations to the strategic position. This is visible in the sales turnover of purchased parts and services which contributes to approximately half of most companies' total spending. A crucial part of the purchasing process is supplier selection (Van Weele 2014). This process is central to the success of a company and contributes to reducing the risk, enhancing the value for the purchaser, and developing successful supplier relationships (Çankaya 2020, Taherdoost and Brard 2019). Therefore, a company needs to have a clear sourcing strategy that can build a supplier base with efficient and constructive supplier relationships (Van Weele 2014).

Due to the increasingly competitive market and the reduced political and economical obstacles, the world has become more globalised with a growing number of suppliers. This has strongly influenced companies' sourcing strategies (Senft 2014, Thiruchelvam and Tookey 2011). Historically, manufacturing and services have been moved abroad to low-cost countries to lower the costs. However, global outsourcing has changed and is now a part of the sourcing strategy to exploit the experience and knowledge of different countries (Senft 2014, Van Weele 2014). With the increased globalisation, new possibilities but also challenges have risen. A company with global sourcing has to understand and adapt to differences in policies, laws, culture, etc. as well as understand the increased logistic challenges with a global supply chain (Senft 2014).

Electric vehicle (EV) manufacturers have seized a lot of ground, especially in the US and UK where electric vehicle manufacturers have gained considerable market share and the demand has drastically increased (Kalaitzi et al. 2018). Some EV manufacturers have grown into big enterprises. However, there are still many EV companies that are classified

as start-ups and small to medium-sized enterprises (SMEs) (Kalaitzi et al. 2018). These smaller companies' supply chains are currently not fully established and are rapidly changing. Therefore, they can not replicate the well-established supply chain of a combustion engine automotive manufacturer. Therefore, EV companies in the start-up or SME segment need to focus on their strategic sourcing and supply chain establishment (Kalaitzi et al. 2018).

There is currently plenty of literature on different supplier selection methods and criteria. The literature varies a lot with different analytical approaches and hybrid models with different well-established methods (Taherdoost and Brard 2019). There are also various indexes and scorecards regarding the best countries to manufacture in (Aleksandrova et al. 2021, Deloitte 2016, KPMG 2021, Schwab 2019, SolAbility 2021, UNIDO 2020, U.S. News & World Report LP 2022, West and Lansang 2018). However, this current literature aims to select a specific supplier or rank countries from a very broad perspective. If a company aims to explore the supplier possibilities of bigger geographic areas, for a more specific product, the literature is less comprehensive.

1.2 Case Company Cake

Cake 0 emission AB is an SME (European Commission n.d. a) that was founded in 2016 which are selling and producing electric lightweight motorbikes with a high focus on design and sustainability (Cake 2022a). Further in the report, the case company will be mentioned as ‘Cake’. Cake aims at contributing to accelerating reaching a zero-emission society by both inspiring electric transportation, but also to increase the life cycle of the products. This includes both ensuring the motorcycles can be recycled, but also to ensure the motorcycle is built with as recyclable materials as possible, to begin with. Additionally, all components are manufactured for the specific model of the vehicle, and to simplify the maintenance of the motorbikes, they are designed and assembled modularly. This enables each modular part to be replaceable and hence avoid the need of replacing more than the defective part on an otherwise functioning motorcycle (Cake 2022b).

Since Cake produces and manufactures electric motorcycles, this is the industry the company is operating in. The electric motorcycle industry is predicted to have a large increase in market share in the upcoming years. The industry is expected to deliver 6 193 thousand units during 2027, which represents a growth of 33,1 % CAGR (MarketsandMarkets 2022). The increase is driven by higher demand for sustainable transportation

(GlobeNewswire 2022a) in combination with increased costs associated with petroleum products (MarketsandMarket 2022). The growth will mainly be connected to the Asia Pacific region with both the demand for sustainable alternatives as well as the presence of key market players. There will also be significant market growth connected to North America and Europe (Fortune business 2022, MarketsandMarkets 2022). Some large key players within the motorcycle industry also operate within the electric motorcycle industry, e.g. Harley-Davidson and Wuyang Honda (Fortune business 2022). At the same time, some specific electric motorcycle companies have been established, e.g. Vässla, Tromox, and Cake (Cake 2022c, Tromox 2022, Vässla 2022).

1.3 Problem Definition

Cake is planning to expand from its current 1,500 yearly manufactured vehicles (Werin 2022) to 50,000 vehicles per year in 2025 (Lernstad 2021). The expansion will be achieved through a combination of a growing market, an extended product range, a geographical expansion, as well as a growth in the number of manufactured vehicles. Cake also aims to improve and establish a sourcing plan that is functional in parallel to this expansion. This includes improving its delivery flexibility to its customers, decreasing the working capital and increasing gross margin. To reach these goals, Cake will need a clear and established sourcing strategy to avoid rapidly increased procurement costs with the growth rate.

1.4 Purpose

The purpose of the master thesis is to create a framework to support the decision-making of which geographical region to source different products and components from.

1.5 Delimitation

The project was delimited to the sourcing strategy to create a holistic sourcing plan. Therefore, the more operational procurement phase with specifics on e.g. purchased quantities and quotation processes with suppliers will be excluded from the master thesis. Furthermore, the sourcing evaluation has been limited to the company's first-tier suppliers due to the time limitation and complexity of looking at more tiers in the supply chain. The Framework is also limited to the evaluation of regions. Hence, the thesis does not investigate specific suppliers that operate in the specific industry. To limit the scope of the framework, a make-or-buy decision has been excluded in the thesis as well as a multi or single-sourcing strategy.

1.6 Target Group

The target group of the master thesis is the case company and other similar SMEs that are interested in improving their global sourcing strategy. The master thesis is conducted within Mechanical Engineering with master studies in Logistics and Production Management. Hence, the master thesis is aimed at other students conducting master's degrees in engineering. It has been assumed that the reader has basic knowledge of purchasing and production management.

1.7 Disposition of Master Thesis

Introduction
The chapter Introduction introduces the topic of sourcing and the importance of a well-grounded sourcing strategy to give a brief background to the master thesis. Further, the purpose of the project and delimitations are presented , before the case company is introduced.

Methodology
The chapter Method describes the chosen method of the master thesis. The method is structured following the Research Onion (Saunders et al. 2019) for a structured and fully covered methodology. The chapter also includes motivation for the choice of method in each layering of the Research Onion.

Theoretical Frame of Reference
The chapter Theoretical Frame of Reference covers the relevant theoretical foundation as well as inspirational models and frameworks. This involves establishing the theory on the sourcing strategy, connected frameworks and scorecards, as well as global sourcing.

Results and Analysis
The chapter Results and Analysis includes results of data collection and analysis of the results. The chapter further explains the foundation of the designed framework and how it is practically used, before a final recommendation based on the framework is presented.

Discussion
The chapter Discussion is critically discussing the findings and results of the conducted research. The framework is also validated by reconnecting to the seven criteria presented by Grey (2021). Finally, further improvements and possible next steps for the case company are discussed.

Conclusion and Contributions

The chapter Conclusions and Contributions reconnects to the purpose of the framework and ensures that it is fulfilled before the contributions from the conducted research are presented.

2. Methodology

The chapter Method describes the chosen method of the master thesis. The method is structured following the Research Onion (Saunders et al. 2019) for a structured and fully covered methodology. The chapter also includes motivation for the choice of method in each layering of the Research Onion.

It is common that a case study emerges from a current problem or to address a question. To solve this, researchers start to think of what data is needed to investigate and solve the potential problem or question and how this data later should be analysed (Saunders and Tosey 2013). Saunders and Tosey (2013) argue that these decisions lie within the last stages of a research design. Saunders and Tosey (2013) use a model called the *Research Onion* (Figure 1) to illustrate the crucial layers of decisions that have to be aligned and thought through to obtain a well-developed and trustworthy research design. In the following chapter, each layer of the Research Onion will be further described.

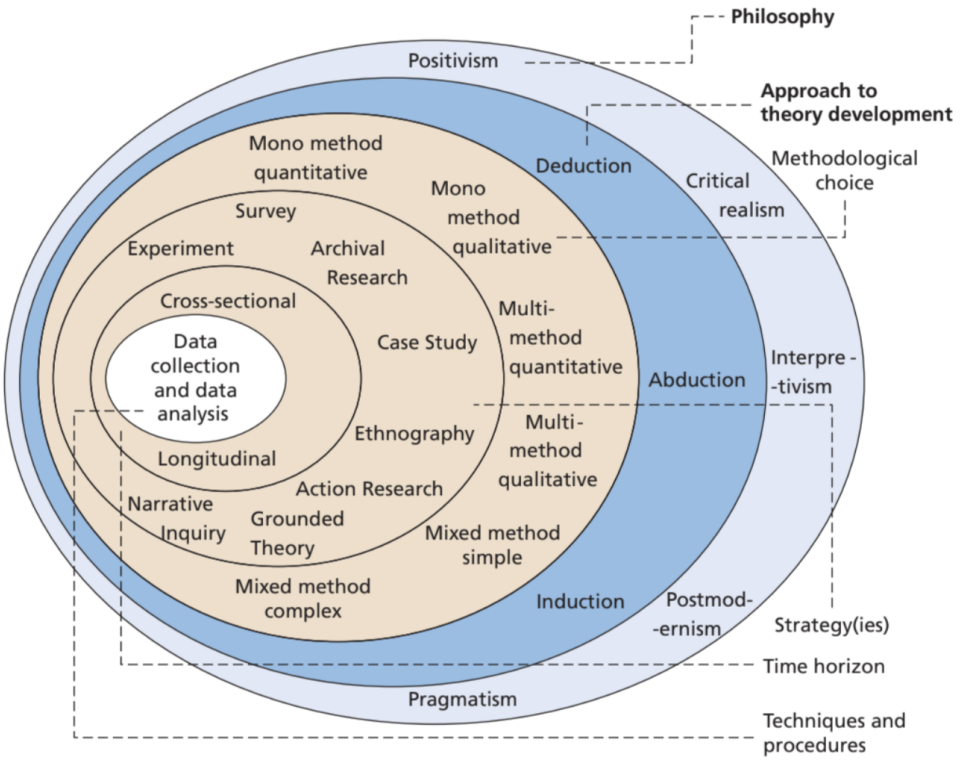

Figure 1. The Research Onion (Saunders et al. 2019)

2.1 Research Philosophy

The first step in developing the research design is to understand how the researcher views and interprets the surroundings and how potential assumptions are reasoned. A positivist philosophy is grounded in numerical and quantitative data that is measurable and leaves very little to be assumed or interpreted. This method is commonly used for research that involves big volumes of data to analyse. The positivist philosophy is partly applicable to this study. However, there are some areas within the presented study that need qualitative data which require more interpretation and qualified assumptions (Saunders et al. 2019).

The realism philosophy, similarly to positivism, is associated with scientific inquiries. The realism philosophy is often divided into direct and critical realism. The direct realist argues that what is observed is the absolute truth while the critical realist believes that what we see and experience needs to be further investigated and that senses often deceive the individual (Saunders et al. 2009). Therefore, the critical realist often analyses an experience in two steps. First, it has to be understood what is first witnessed, then understand the relationships and underlying reasons that influence the situation. This is the reason that the critical realism philosophy often is combined with a mixture of quantitative and qualitative data gathering (Saunders and Tosey 2013). Due to these reasons, the purpose of the study was reasoned to be best combined with a critical realism philosophy.

2.2 Approach to Theory Development

During the case research a substantial amount of both qualitative and quantitative data was gathered and a broad literature review was conducted. To execute these in a structured manner with a motivated logic, two different research approaches were considered, inductive and deductive, which are illustrated in Figure 2.

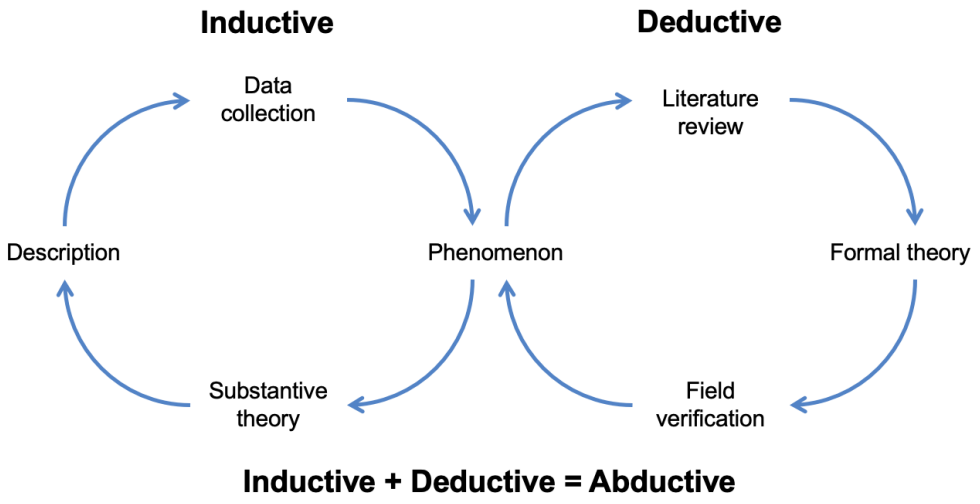

Figure 2. Illustrative explanation of the abductive approach (Woodruff 2003)

The deductive approach is commonly used when the conducted research is theory testing. This approach starts with a structured literature review which is then followed by data gathering. This approach provides the researcher with numerous hypotheses that later can be tested. To ensure reliability in a deductive research approach, a structured methodology is often used. The inductive approach on the other hand starts with the data collection. This approach can give the researcher a deeper understanding of the current situation (Saudners et al. 2019). This can be beneficial since it can guide the literature review toward the actual research. Inductive research is considered to be more open-minded which results in an analysis and solution that is applicable for the specific situation since it is not as set in previous literature, as with the deductive approach. Despite these two approaches being presented as separate paths, it is argued that being strict deductive or inductive is difficult. Therefore, a combination of the two is widely used in management research and is called the abductive approach. This approach allows the researcher to combine the two approaches, depending on the situation at hand (Saunders et al. 2019).

Since the aim of the study was to investigate the case company, it was reasoned that data collection was needed early in the process to understand the operation and current situation at the company. This early data collection was combined with a literature review to obtain current knowledge within certain areas that were used as a basis further in the process. Therefore, the abductive approach was chosen. This is also aligned with theory since an abductive approach is considered to be appropriate to critical realism.

2.3 Methodological Choice

The next layer of the Research Onion highlights the importance of structured and motivated data gathering and if it should be qualitative, quantitative or a mixture of both. When choosing the methodology, the chosen philosophy and approach were considered. Each of these data categories involves several different data collection strategies. Qualitative data can be collected by conducting e.g. interviews or observations, while quantitative data could be collected using surveys or numerical data. If a mono method is chosen, only one data collection strategy within either the quantitative or qualitative strategy is chosen, while the multiple-choice includes several different data collections that are connected to either qualitative or quantitative data. Further down on the right branch in Figure 3, the mixed methods are presented. These combine both qualitative and quantitative data collection methods. The difference between a mixed-method and a mixed-model is that when using the mixed-model, qualitative data is quantitatively analysed and quantitative data is qualitatively analysed (Saunders et al. 2009). These methods are also commonly known as mixed-method simple and mixed-method complex (Saunders and Tolsey 2013).

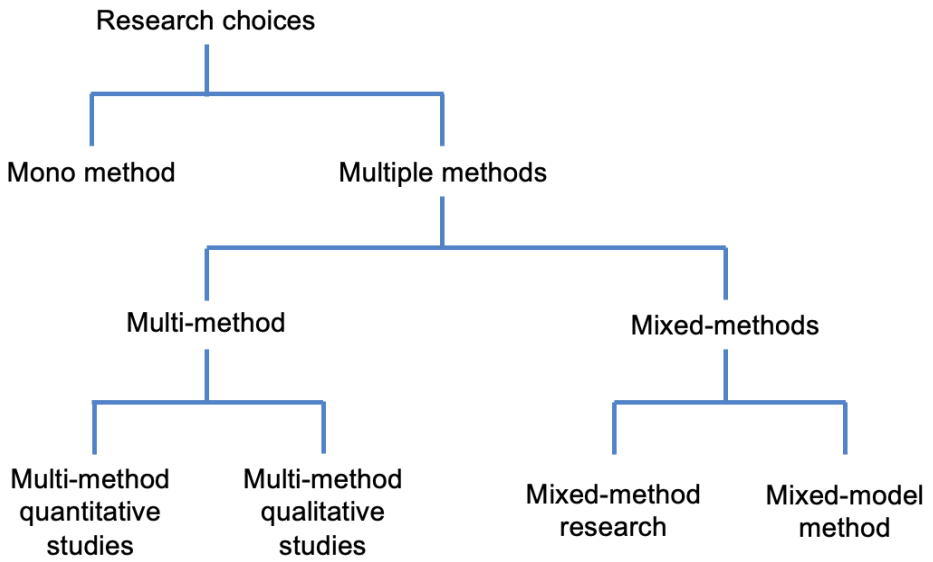

*Figure 3. The different research choices (*Saunders et al. 2009*)*

Due to the philosophy of this research being decided as direct realism, it is argued that several different research choices could have been applicable. Regardless of the chosen method, it needed to be well matched to the conducted research (Saunders et al. 2019). Due to the access to quantitative data and the need to deeply investigate the operating environment at the case company, both quantitative and qualitative data were deemed necessary

for a satisfactory result. Qualitative data were gathered through data collection, to be converted into quantitative data in the ranking process of the framework. The combination of qualitative and quantitative data suggested a mixed-model research.

2.4 Research Strategy

Following the layering in the Research Onion the research strategy that was decided was specified based on what type of research that was conducted. The chosen strategy of the research aimed to fulfil the purpose of the study, but did not exclude using parts of other strategies. Aspects that were considered when choosing the strategy were the existing knowledge in literature, timeframe, and the available resources for the project (Saunders et al. 2009).

The chosen research strategy was a case study as it aims to analyse and answer the questions ‘what?’ and ‘how?’. Hence, the case study strategy was suitable since various data collection methods were used in combination with each other. A case study differs from the survey strategy, where the survey strategy is where the research process is within a controlled context and the exploration is limited by the variables that data will be collected. Since the data collection for this master thesis was unlimited to any factors, the case study was more suitable for the research (Saunders et al. 2009).

Yin (1994) identified four different strategies within the case study methods related to each other through the two-by-two matrix presented in Figure 4. The organisation that the master thesis was conducted within was the case company and the study also excluded analysis of other organisations. Hence, the master thesis was a single-case study design. The reason this design was determined to be the most suitable design is mainly due to the limited timeframe of the master thesis. Another reason was to enable the case study to focus on a greater understanding of the case company and aim for depth in the analysis, rather than include multiple organisations.

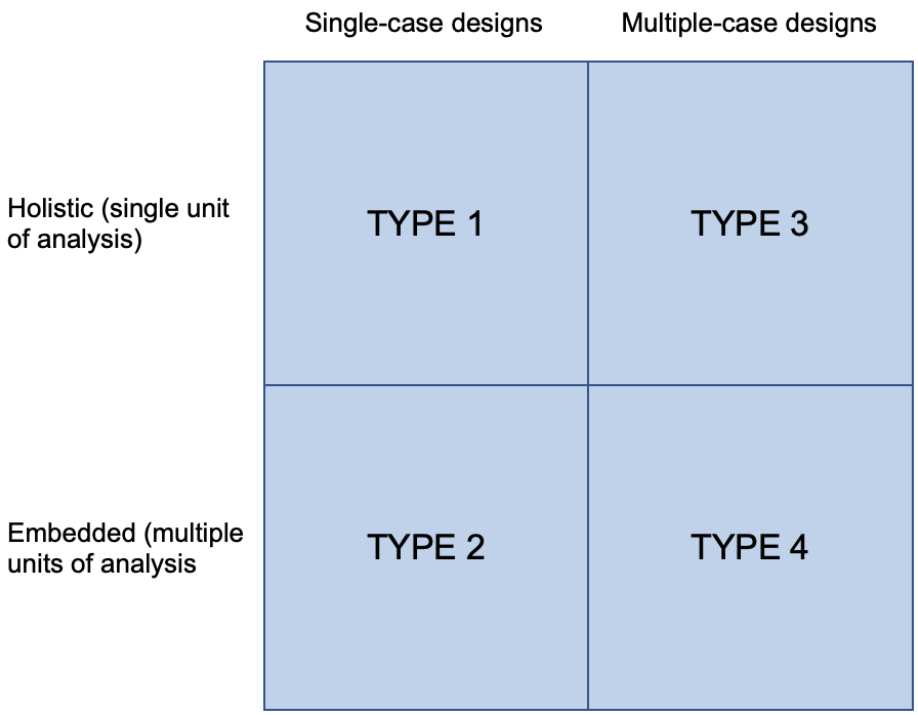

Figure 4. Basic types of designs for case studies (Yin 1994)

The second dimension in Figure 4 represents the number of units of analysis in the research. As the research included more than one unit of analysis, the second dimension in Figure 4 was defined as embedded. The context of the embedded unit of analysis was a smaller SME manufacturing company that sources products globally. The overall case was to define where the case company should source different products and materials from. The embedded unit of analysis was to design a framework to rank different geographical regions on the suitability of global sourcing. Since the research included multiple units of analysis, it validates the embedded dimension. In summary, the research strategy of the master thesis was an embedded single-case study, which is illustrated as TYPE 2 in Figure 4.

2.5 Time Horizon

The conducted research analysed the current situation at the case company and examined the suitable sourcing strategy for the existing product categories. Since the case company was in a ramp-up phase (Werin 2022), a snapshot of the current sourcing situation was the preferred strategy because of the company's constantly changing environment. This resulted in the cross-sectional time horizon (Saunders et al. 2009). Not only was the cross-sectional horizon better suited for the aimed research, but the other alternative of the longitudinal time horizon is also considered too time-consuming for the limited time scope of the thesis.

2.6 Data Collection

The following layer of the Research Onion is the data collection and analysis which is divided into primary data, collected by the authors and secondary data, the data collected from secondary sources. In this section, the collection and analysis of both the primary and secondary data are presented. The gathered data is providing an understanding of the case company, the purchasing strategy, and the theoretical frame of reference.

2.6.1 Primary Data Collection Method

The primary data includes interviews conducted by the authors to gather data for the research. The method used for the data collection was semi-structured and non-structured interviews to gather qualitative data that could support answering the questions ‘why’ and ‘how’, which are suitable for the case study research (Saunders et al. 2009).

Interviews
The qualitative data collection was conducted through interviews, both non-structured and semi-structured. A non-structured interview is defined as an interview where no questions are prepared in advance. A semi-structured interview is when a few questions are prepared in advance, but the rest of the questions are not prepared (Pollock 2020). This form of qualitative interview was chosen to understand the reasoning of the interviewee’s answers and opinions. The semi-structured interviews as an interview type should be chosen to ensure a possibility for the authors to build on and ask further questions depending on the interviewee's answers (Saunders et al. 2009). The non-structured interviews were conducted to understand the industry and the challenges of the research topic and to further be able to conduct a suitable interview guide with relevant questions for the semi-structured interviews. The semi-structured interviews followed an interview guide (Appendix A) where a few predefined questions were asked. In addition to the interview guide, questions that arose during the interview were further investigated to enable new insights.

The interviews were conducted in two phases, where the first phase was to understand the current industry challenges as well as the structure of the case company. The two areas were covered by the non-structured interviews with both industry experts and the case company. The second phase of the interviews was conducted in parallel with the development of the framework to get academic and industry insights into the framework design. During the interview, the framework was continuously changed and improved.

Interviewees

A summary of the interviewees that were interviewed is presented in Table 1 together with their role and motivation for the conducted interview. The criteria evaluated when choosing the suitable interviewees for the study were their area of expertise and availability for an interview. The aim was to cover the opinions of the interviewees from an academic point of view, as well as people working in the industry with experience and knowledge in the area of global sourcing. The purpose of the interviews was to understand what other industrial companies thought were important aspects to consider when choosing a supplier. Also, if there was any difference in the geographical region of where they choose to source a specific product category from. Another purpose was to iterate the current draft of the scorecard to ensure the final scorecard had been critically developed with many different perspectives and insights that could contribute to answering these questions. To fulfil the purpose of the interviews, the interviews were divided into internal interviews, expert interviews, and industry interviews.

Internally within the case company, the aim was to understand and clarify the current supply chain and the sourcing strategy. The internal interviews were also conducted to understand the case company and its product base. This was relevant to be able to develop and apply the framework and scorecard to the case company. This qualitative data collected was summarised and used in the development of the scorecard and framework. As a complement to the internal and external interviews, expert interviews were conducted to include the insight from a more academic perspective or a perspective not limited to a single company. These expert interviews were conducted with an interviewee who has experience in a lot of different companies or the academic perspective of sourcing. More information regarding the interviews and when they were conducted are found in Appendix B.

Table 1. Summary of the conducted interviews

Phase	Company	Interviewee	Role	Motivation
1st	Case Company, Cake	Robin Karlsson	Product Development	Understand the product development process and design choices of the motorcycles and bikes
1st	Case Company, Cake	Jonas Ahlstrand	Technical Service Manager Scandinavia	Understand how the technical team works to solve technical issues with the motorcycles and products
1st	Case Company, Cake	Ali Noke	Factory Manager	Understand the material flow and challenges in the factory.
Phase	**Industry Company**	**Interviewee**	**Role**	**Motivation**
2nd	Company X	Interviewee X	Purchasing Manager	Company operating in the relevant industry for electric vehicles. Purchasing manager to understand the sourcing strategy and process.
1st	Company Y	Interviewee Y	Marketing manager with experience in sourcing	The company operates in the bicycle industry. Experienced and well-known in the industry. Aim to understand the patterns and challenges of the standard bicycle components.
2nd	Company Z	Interviewee Z	Purchasing Manager	Company operating in the vehicle industry, both electric and non-electric vehicles. Aim to understand the sourcing challenges and processes in the industry for larger stakeholders (Company Z). Focused on different types of supplier relationships to have.
Phase	**Expert**	**Interviewee**	**Role**	**Motivation**
1st	Experienced in global supply chains	Mikael Jinglöv	N/A	To gather insights from an experienced perspective in the supply chain area, not linked to a specific company. Instead, experience within the supply chain from different geographical regions.
2nd	Linköping University	Uni Sallnäs	Senior Lecturer	To gather an academic perspective on sourcing with a higher focus on sustainability.

2.6.2 Secondary Data Collection Method

Secondary data is defined as already published information or data and includes both raw data and published summaries (Saunders et al. 2009). To complement the primary data, secondary data is gathered through literature review and data rankings.

To provide an understanding of the development and current availability of research on this subject, a history search was conducted. Figure 5 illustrates the increased number of published papers on Google Scholar with the phrase "Strategic Sourcing" and "Supplier Scorecard" anywhere in the text. For the "Strategic Sourcing" search, the word supplier was also included in the search while for the "Supplier Scorecard" search, the word sourcing was included. Figure 5 indicates that in the late 2000th century, both these phrases grew a lot in the literature. Even though the Supplier scorecard has grown more significantly. It is also evident that the phrases grew in popularity at approximately the same time.

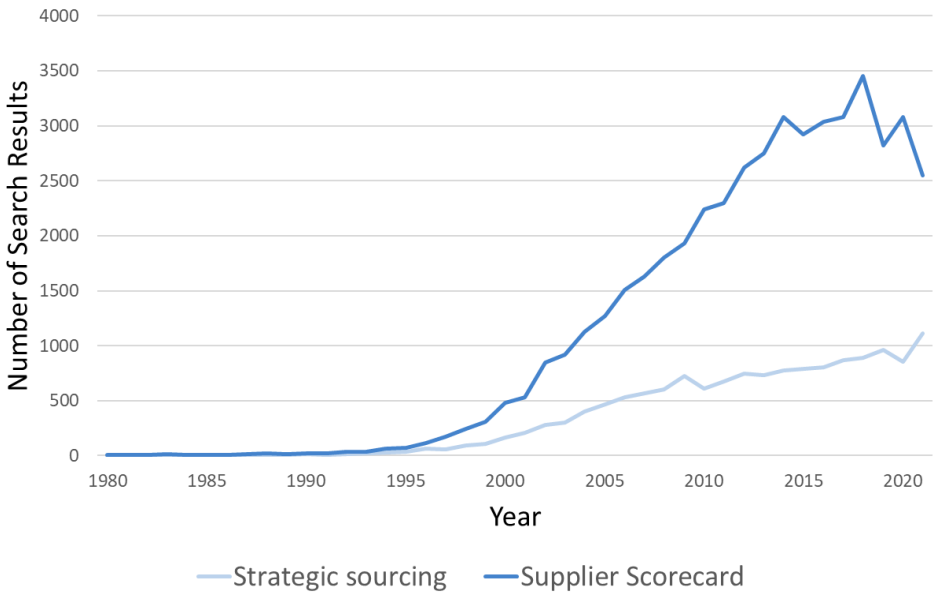

Figure 5 History search on 'Strategic Sourcing' and 'Supplier Scorecard'

As mentioned, the literature review was conducted using an abductive approach. A 1st literature review was conducted to understand the available information regarding the chosen subject and to understand how and where the master thesis would contribute to the subject. When the 1st research had resulted in the purpose of the study and relevant methods to use, the literature review moved to a 2nd literature review to build the theoretical frame of reference. This second literature review was the baseline to understand the gaps in the existing theory. These gaps were then used to understand what kind of information that was needed to be collected from

interviews. Additional to the literature review as secondary data, the framework and geographical regions are evaluated using existing rankings published on databases. This was considered the 3rd secondary data collection and gathered different rankings to evaluate different criteria in the framework.

2.6.3 Data Collection Tools

The gathered data, both primary and secondary, was collected through interviews and literature reviews. The tools that were used for the gathering of the data include both video communication tools, search engines and data analysis tools.

Main Search Engines
The main search engines that were used were Google Scholar and LUB Search. These platforms enabled the search for sources to be structured and comprehensive.

Microsoft Teams
Microsoft Teams was used as a video communication tool to enable interviews and meetings to be performed virtually. Microsoft Teams is used for the majority of the conducted interviews and workshops with the case company. The tool enabled interviews with interviewees that were located far away which broadened the possibilities for the included interviewees.

Microsoft Excel
The data analysis tool that was used was Microsoft Excel. It has been used both for managing provided data by the case company and as a platform for the development and designing of the ranking system included in the framework.

2.7 Data Analysis

The following section is presenting the data analysis covering both the primary and secondary data. Due to the chosen abductive research approach, the data collection and data analysis was conducted interchangeably in numerous different stages. However, to present the data analysis in a clear and structured manner, the data analysis is presented in two sections. The first one is regarding the method of the development and application of the framework. The second part describes the underlying validation criteria that have been used during the framework development.

The framework was developed and revised with the case company to fulfil the purpose of the study. To enhance the usability of the scorecard, it was later used as the main piece in a broader framework. The framework has been developed by applying information from the theoretical frame of reference and the gathered data from interviews. New versions of the framework were revised both with interviewees and the case company to ensure the usability of the framework.

When the first draft of the framework was developed it was applied to the case company. During the usage of the framework, its usability and scoring were analysed to further develop the lacking stages. This process was used to validate the framework. To apply the framework to the current situation at the case company, both qualitative and quantitative data were gathered and analysed. To score the developed scorecard, as a part of the framework, data rankings were chosen to represent different criteria. To ensure the secondary data was representing the geographical regions well, each chosen data ranking was required to have included a sufficient number of countries.

2.8 Credibility

The credibility of the study was ensured through research reliability, data validation and framework validation. The research reliability was fulfilled through the involvement of experts through interviews and the case company. The data validation regarding the interviews was ensured by double-checking the collected data with the interviewee to ensure the correct interpretation of what was said during the interview. Framework validation was ensured by fulfilling the seven criteria presented by Grey (2021) which is further explained in section 2.8.3.

2.8.1 Research Reliability

The whole thesis has been in collaboration with the case company through weekly workshops to discuss the development of the framework. In addition, the gathering of data has been done by interviewing experienced people within the global sourcing area. The result of the research was, therefore, to be considered reliable due to the involvement of experts throughout the whole process. The feedback and inputs mentioned by the case company as well as external interviews have been included in the framework. To ensure the authors' objectivity, the research did not consider the current sourcing which ensured that the final recommendation was not influenced by Cake's current sourcing.

2.8.2 Data Validation

The qualitative data collected through interviews has been validated through a combination with the literature review. During the interviews, one author was taking notes and the other was interviewing. A decision was made to not ask the interviewee if the interview could be recorded. This was decided to create an environment where the interviewee did not feel uncomfortable answering questions. A consequence of not recording was that some information during the interview could get lost or be misinterpreted when summarising the interview. To mitigate this risk, a summary of the interview was sent to each interviewee that confirmed that the data collected was correctly interpreted. The summary was a cleaned version of the qualitative data collected through notes taken during the interview.

2.8.3 Framework Validation

To validate the framework that was developed, a validation method presented by Grey (2021) was followed. According to Grey (2021), seven criteria should be included when evaluating a framework to ensure its possibility to achieve its purpose. During the development of the later presented framework, these seven criteria were applied.

1. **Comprehensiveness:** Does the framework include the full range of the targeted situation? Is the framework applicable for companies in similar industries and sizes?

2. **Utility:** Does the framework result in comprehensive information about an actual problem that is possible to act on? Is it possible to adapt the suggested actions to different situations?

3. **Validation:** Is the framework supported by empirical studies and observational data? Is it evident that the framework correctly advises or predicts possible outcomes in real-world cases?

4. **Clarity:** Is it easy to understand the framework? Is the used vocabulary and phrases familiar and common business terms? Is the complexity of a situation reduced to grasp the circumstances and ideas?

5. **Memorability:** Is the structure, design and language easy to remember and apply? Is the framework appealing to use?

6. **Integration:** Is the framework consistent and logical? Are the models and elements in a logical and cohesive order? If there are possible weaknesses, are they strengthened by other internal elements within the framework?

7. **Differentiation:** Does the framework combine and apply familiar models in a new way or is it a novel framework? Does the framework address decisions from a new perspective?

2.9 Overall Process for Thesis

To summarise the methodology of the thesis, the overall process for the thesis is summarised and presented. The methodology was designed using guidance from the Research Onion. The thesis was conducted by using a case research methodology and following an abductive approach. The choice of methodology was the mixed-model research due to the collected qualitative data that was converted into quantitative data. The strategy of the research was chosen as an embedded single-case study. Primary and secondary data were collected through interviews and a literature review in different phases.

The abductive research approach was used to have a balanced approach and track data literature review back and forth. This approach began with less structured interviews and meetings. This was conducted in parallel with the first more general literature review. Later in the process, semi-structured interviews were conducted in parallel with a secondary literature review to fill in any possible knowledge gaps. When the interviews were conducted and the framework was fully developed, a third secondary data collection was conducted to gather data rankings and rank geographical regions. To visualise the full process, a flowchart presents the overview in Figure 6.

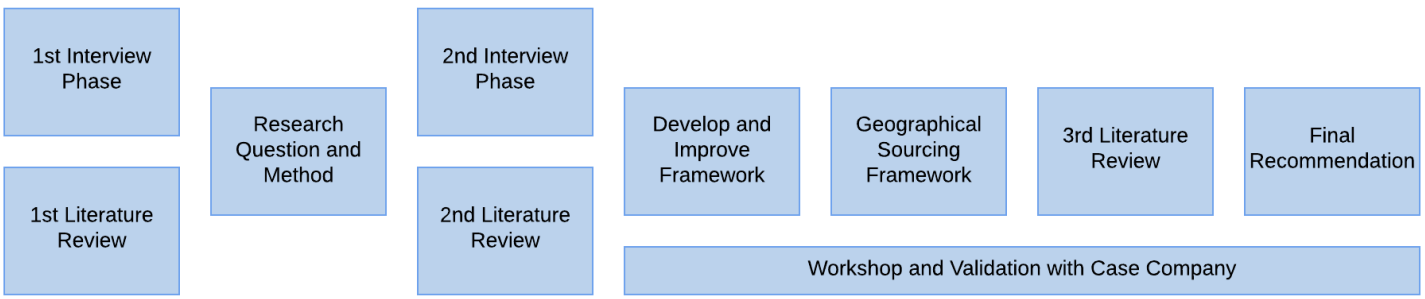

Figure 6. Overall flowchart of the thesis

3. Theoretical Frame of Reference

The chapter Theoretical Frame of Reference covers the relevant theoretical foundation as well as inspirational models and frameworks. This involves establishing the theory on the sourcing strategy, connected frameworks and scorecards, as well as global sourcing.

3.1 Overview of Theoretical Frame of Reference

To ensure that the presented solution is grounded on established theory and research, a theoretical frame of reference is included to support the master thesis. Figure 7 presents the three main parts that are included in the chapter. These parts ensure that the theoretical frame of reference covers different areas of relevance for the master thesis.

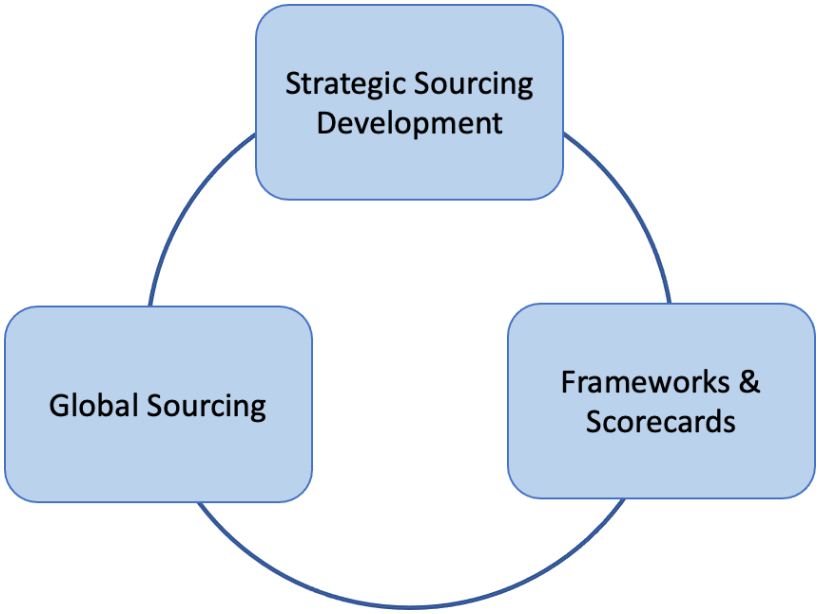

Figure 7. Overview of theoretical frame of reference

3.2 Sourcing Definition

For high technology companies, the cost of materials and components can account for up to 80% of the total cost of the final product. Therefore, thorough sourcing for the most optimal supplier could have a large impact on the company (Pal et al 2013). 'Sourcing' will be mentioned regularly in the report, therefore, the definition of the word needs to be clarified. Sourcing is defined as the utilisation of purchasing power to find the optimal values of goods and services that also aligns with the company's

business goals. Strategic sourcing focuses on the total cost of ownership (TCO), including aspects beyond the purchasing price. Further, strategic sourcing also includes optimising the sourcing process through market analysis and focusing on building supplier relationships (Fogarty 2019).

3.3 Global Sourcing

Between the years 1988 and 2007, the total exports in the world tripled and the foreign investments increased by 500 % (Grünig and Morschett 2012). There are numerous reasons for companies to expand their business in new countries. These can be that the local market is saturated and the company needs to find new customers, alternatively, the company wants to spread its risk and level demand if one region encounters a temporary slump. There are also some aspects of globalisation that are correlating to sourcing. With a more globalised market, companies can access lower raw material and labour costs, while at the same time gaining competent experience from specific regions (GEP 2022, Grünig and Morschett 2012). This new globalised supply chain has shortened the distance between countries and has strengthened the connections in the economy, communication, and culture. However, despite the advantages of globalisation, there can be drawbacks to the new international connections. The financial market crisis in 2009 illustrates that from an economic point of view, a financial crisis in one market can have a huge impact on the whole world (Senft 2014).

According to Senft (2014), 80 % of companies point to the reduction of labour costs as the main reason for global sourcing. However, studies have shown that countries with low hourly compensation produce less real value-added per hour. This indicates that routine components that require fewer skills could benefit from a location with lower labour costs, while more complex products that require more value-added manufacturing and skilled employees could be considered to be sourced from countries with higher labour costs (KPMG 2021). According to West and Lansang (2018), another highly prioritised criterion for SMEs are logistical and connectivity solutions. These criteria are considered to be a major obstacle for these SMEs and countries with higher transportation infrastructure are deemed to be prioritised in their supplier selection.

There are numerous examples of indexes and rankings for countries and regional areas that indicate aspects such as the well-being, environmental impact, openness for foreign business, the best manufacturing country, etc. (Aleksandrova et al. 2021, Deloitte 2016, KPMG 2021, Schwab 2019, SolAbility 2021, UNIDO 2020, U.S. News & World Report LP 2022, West and Lansang 2018). Senft (2014) has presented a ten-step framework to

evaluate global sourcing. The sixth step represents the country analysis where supply countries are evaluated to determine the most suitable supply country. Senft (2014) states that appointing a specific supply country that is ideal for all markets, customers, and companies is not possible. This is because of the difference between company strategies, product specifics, and customer demand. When evaluating countries it is also important to consider the development of different countries. The capabilities and specialisations of different countries can change quickly and in different directions (Senft 2014). With all this in mind, the most important criteria for choosing a country can be evaluated with what Senft (2014) refers to as a PESTE analysis, which is also known as a PESTLE or PEST analysis (PESTLE Analysis 2022). The PESTLE analysis consists of six parts: Political, Economical, Social, Technological, Legal, and Environmental. Each of these parts can be broken down into different criteria, examples of factors that the parts can consist of are represented in Figure 8.

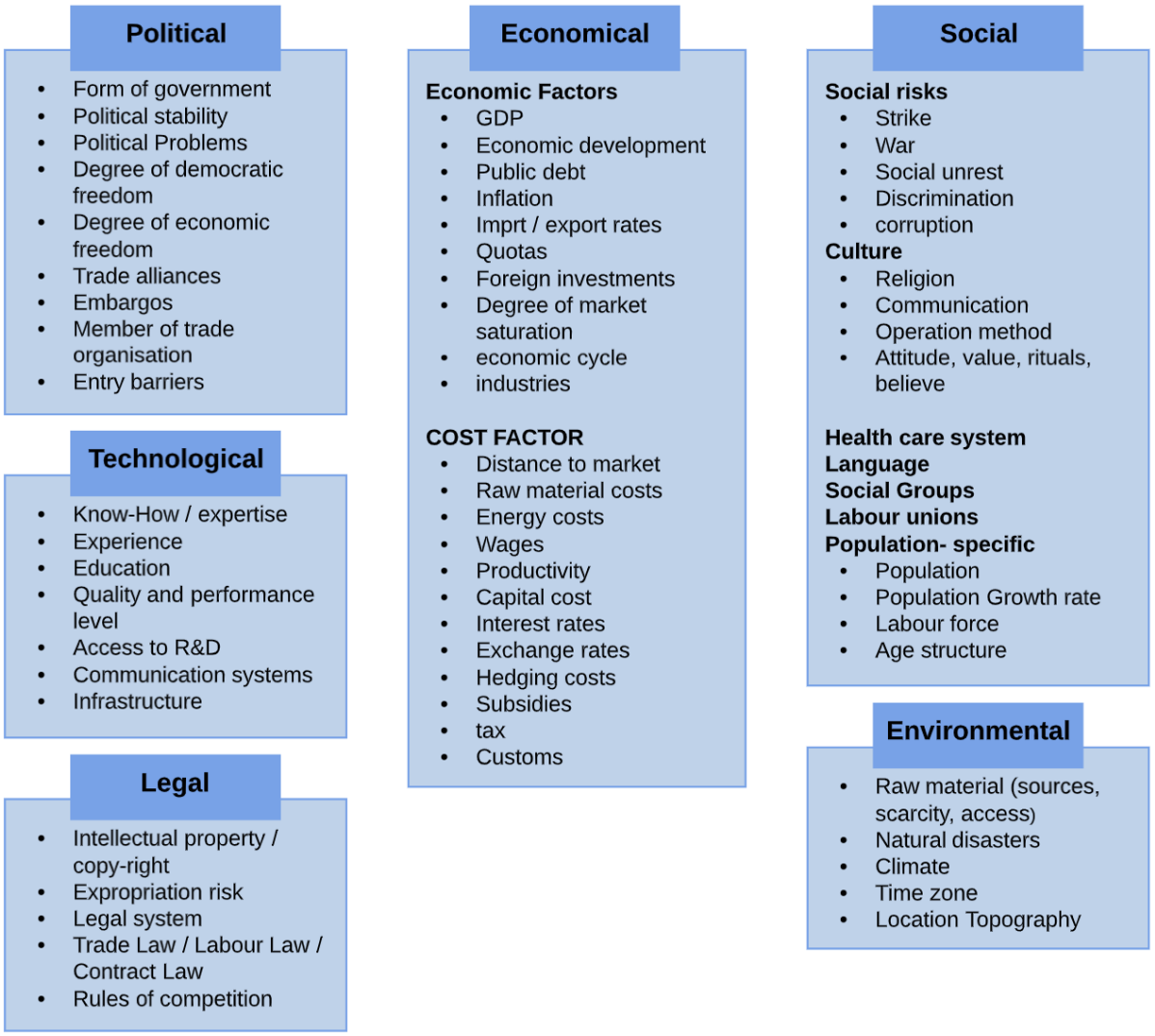

Figure 8. Examples of factors included in PESTLE analysis (Senft 2014, PESTLE Analysis 2022)

3.3.1 Corporate Social Responsibility

Corporate Social Responsibility (CSR) is the responsibility a company has to understand the impact their business has on society. CSR also includes the responsibility to mitigate and prevent any negative impact the business has. This includes the global supply chain and being aware of the supplier's impact as well (European Commission n.d. b). The complex multidimensional concept of CSR is often referred to as the three dimensions of the triple bottom line. These include the social, environmental, and economic dimensions and indicate that the decisions made by a company need to be sustainably evaluated through all three dimensions (Brandenburg et al. 2018). The sustainability aspect in the business environment has gotten more traction and the EU has decided that competitive sustainability will be a key policy during the future economic planning within the region (SolAbility 2021).

3.3.2 Covid-19 Pandemic

A global supply chain is fragile to disruption, which majorly includes political or social changes (PBS 2021). One recently occurred global disruption that affected the supply chains of the world majorly was the Covid-19 pandemic. The pandemic was caused by a novel coronavirus (nCoV) that in 2019 first was identified in a human. On March 11th 2020, the World Health Organization (WHO) announced the outbreak as a pandemic (WHO 2022). To reduce the spread of the virus, many countries closed their borders. This caused major disruptions in the global supply chains all over the world. The pandemic resulted in sudden challenges and changes in supply chains and brought light to vulnerabilities in supply chains during major disruptions (Harapko 2021). This global disruption has been a contributor to a nearshoring strategy for many manufacturing companies (Van Hassel et al. 2021).

3.4 Strategic Sourcing Development

The development of a sourcing strategy is often divided into different steps that cover the process from mapping the product characteristics to negotiating contracts with suppliers (Bozarth and Handfield 2016, Nguyen 2021, van Weele 2014). The strategic sourcing process aims to achieve long-term business improvements (Bozarth and Handfield 2016), cost savings, greater value-add, and time savings (Nguyen 2021). Bozarth and Handfield (2016) describe the development of a sourcing strategy in six steps, whereas A.T Kearney (Nguyen 2021) describes it in seven steps. The two descriptions mention similar components of the strategic sourcing

development but differ in the order the components of the process are presented. Due to the delimitations of the master thesis presented in section 1.5, the scope of the thesis excludes the negotiation process. Therefore, this section will rather cover the initial steps of the development of a sourcing strategy.

3.4.1 Map Current Sourcing and Spending

To design a suitable sourcing strategy, the purchasing patterns and requirements of the product categories are required to be identified. The first step in developing a sourcing strategy is to identify the company's current situation and opportunities (Bozarth and Handfield 2016, Nguyen 2021, van Weele 2014). To understand this, it is suggested to identify the profiling of the company's products and services, which includes spending, volumes, quantity, types, sizes, etc. (Nguyen 2021). A common analysis to understand the company's spending and identify current possibilities for improvements is through a spend analysis. The spend analysis is done to answer what product categories that stand for the majority of a company's spending, how the total spending is divided on various suppliers, and to identify spending patterns e.g. across different locations (Bozarth and Handfield 2016, van Weele 2014).

3.4.2 Categorise Products and Analyse Industry

It is crucial to understand the company's current supply base (Bozarth and Handfield 2016, van Weele 2014). A suggestion to achieve this is to map these by conducting a purchasing portfolio analysis (Bozarth and Handfield, 2016, Nguyen 2021, van Weele 2014), i.e. using the PPM (Kraljic 1983) further explained in section 3.5.1. The aim of profiling both internally and externally is to understand the company's needs and requirements internally, as well as understand the industry and the existing supplier base and its characteristics. Internal category profiling aims to map the product and components and categorise them into suitable categories to get a more detailed picture of the products in the company. The profiling of the product category aims to understand the aspects of a particular sourcing category that could have an impact on the company's sourcing strategy. Externally, an industry analysis aims to identify any trends to impact the industry, i.e. supplier availability, technological trends, negotiating power, etc. (Bozarth and Handfield 2016). Nguyen (2021) also emphasises the importance of understanding the industry and products to determine the suitable strategy and understand the business impact of each category. The aimed supplier relationship needs to be defined, as well as the type of contract aimed for. Aspects to include in this process are global vs. local sourcing, single vs multiple sourcing, type of relationship and contract with the supplier, etc.

which should be considered before searching for suppliers (Van Weele 2014). Bozarth and Handfield (2016) also mention the make-or-buy decision to decide if a product is suitable to be insourced or outsourced as well as a total cost analysis to understand the major costs connected to a specific product, the direct and indirect. This is analysed for calculating and understanding the most cost-efficient way to source the product category. The total cost analysis includes identifying which additional costs that drive the total cost of the product, e.g. transport costs or trading taxes (Bozarth and Handfield 2016).

3.4.3 Supplier Selection

The next step included is the supplier selection phase where the decision-making process of evaluating suppliers is included. The company needs to evaluate potential and current suppliers to identify the most suitable one for a new product, which is a difficult task since the criteria often include both qualitative and quantitative evaluation criteria. Some qualitative criteria that could be included in the evaluation are process and design capabilities, management capability, financial condition and cost structure, and long-term relationship potential. (Bozarth and Handfield 2016). By establishing the company's business goals and deciding on the minimum requirements for the company, the suppliers that are considered should be evaluated on the most suited criteria for the established requirements, the company's capability, and resources (Nguyen 2021). When evaluating suppliers on both qualitative and quantitative data, a multicriteria decision model is suitable. The evaluation process of identifying the key criteria and scoring them, allows users to stay objective and comprehensive in the decision of the supplier selection phase. Additionally, managers will often make an effort to ensure as many ratings as possible are backed up with hard data (Bozarth and Handfield 2016).

3.5 Frameworks and Scorecards

The purchasing department has shifted from a traditional operational activity toward a strategic one (Rezaei and Lajimi 2019). With the more strategic approach, companies have moved from exclusively looking at cost and have started to look at other impactful criteria (Pal et al 2013). This strategic approach has resulted in different frameworks and scorecards that have been used to ensure profitable and effective supplier sourcing (Cox 2015, Kraljic 1983).

3.5.1 The Portfolio Approach

Kraljic published *Purchasing must become supply management* already 1983. In the article Kraljic presents the framework called the Purchasing Portfolio Matrix (PPM), presented in Figure 9, which is also known as the Kraljic portfolio (Van Weele 2014). Cox (2015) argues that the approach presented by Kraljic has been one of the most common approaches to structuring managerial actions. The fundamentals of the Kraljic portfolio are to assist the company with a clear two-by-two matrix that can guide the company towards a differentiated purchasing strategy (Van Weele 2014). In the PPM, it is argued that two dimensions influence the strategic decisions that need to be made when evaluating the purchase of a specific product or product group. First, the profit impact of the product should be evaluated. This can vary depending on the specific company but the profit impact can often be described as the cost of the material, profitability, the value-add impact, etc. The second criterion is described as the complexity of the purchased product. It can be time-consuming and challenging to pinpoint every single complex aspect connected to a purchase. Some of the main criteria mentioned in the literature are the level of advanced technology, number of suppliers available on the market, logistic challenges and risks, etc (Kraljic 1983, Van Weele 2014).

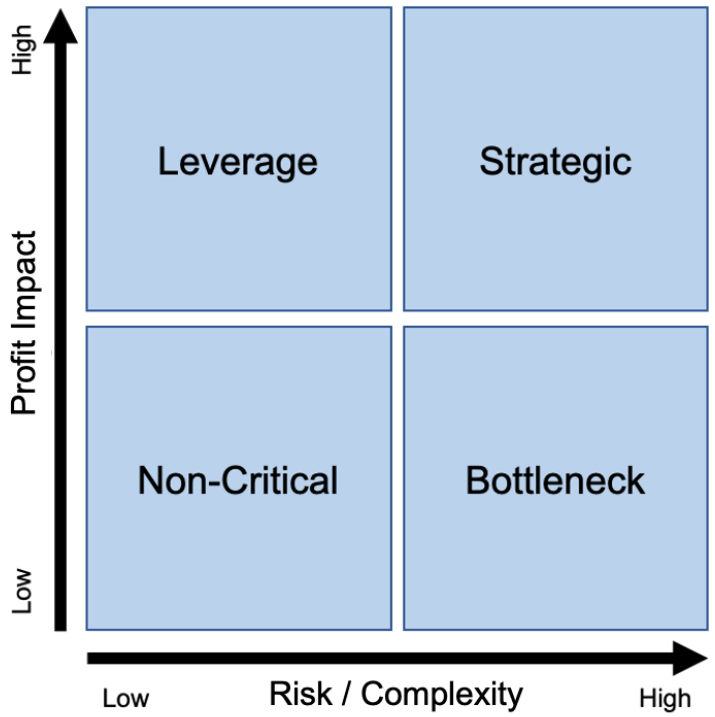

Figure 9. Kraljic's Purchasing Portfolio Matrix (Kraljic 1983)

When each product has been placed in the PPM, each quadrant has a few clear main tasks that should be executed. These tasks are linked to specific information for the products that need to be collected and should be involved in the decision. Due to the high complexity and profit impact, a strategic product needs top management support. Bottleneck and leverage items are argued to be decided on higher management level and medium level, respectively. Since the non-critical items have a low-profit impact and purchasing complexity, these decisions can be supported by low-level management (Kraljic 1983).

Despite the broad use and application of the PPM, the method is lacking in some aspects (Cox 2015, Rezaei and Lajimi 2019, Rezaei and Ortt 2012). Due to the increased complexity and the more strategic approach to sourcing, other characteristics have to take place. The characteristics of the supplier and its relationships are more important today than 40 years ago (Rezaei and Lajimi 2019). To cope with these new dimensions, Rezaei and Ortt (2012) proposed a new framework that included the supplier relationship approaches. The approach is called the Supplier Potential Matrix (SPM) and includes two dimensions: supplier capabilities and supplier willingness. The goal of the SPM is to provide a broader framework that segments the suppliers and highlights the relationship between supplier and buyer (Rezaei and Ortt 2012).

Rezaei and Lajimi (2019) summarise the two different matrices with the statement that the PPM focuses on the supply characteristics while SPM's main focus is on supplier relationships. Due to the need for both approaches, Rezaei and Lajimi (2019) have presented a combined matrix that is called the PPM-SPM. When combining these two matrices, the company can manage suppliers that supply the same product in different ways. Because a bottleneck product that is supplied from a supplier with high capability and willingness should be managed differently than a supplier with low capability and willingness (Rezaei and Lajimi 2019). Rezaei and Lajimi (2019) have compiled the criteria that, according to literature, are used to measure these four dimensions (Figure 10).

Figure 10. Criteria to measure the four dimensions (Rezaei and Lajimi 2019)

3.5.2 Supplier Selection Scorecard and Criteria

One of the most important sourcing decisions is supplier selection (Taherdoost and Brard 2014, Van Weele 2014). These sourcing decisions are often assisted by supplier scorecards. These scorecards are an effective method to evaluate different suppliers objectively with concrete data. The supplier scorecard can therefore evaluate numerous suppliers in a time-efficient manner and only assess the criteria that are important for a certain company (RFP360 n.d.). Despite the big selection of different strategies and models, there is no standardised method for each organisation, it is something that has to be tailored for each specific situation (Taherdoost and Brard 2014). To make the right supplier selection, the right criteria need to be identified and used. Historically, these criteria have evolved around the price but the increased complexity in the supplier market has led to a broader spectrum of criteria regarding quality, service delivery, risk, etc. The core strategy is still to lower the overall cost but is now represented by more factors than price (Senft 2014). Table 2 shows the criteria that Taherdoost and Brard (2014) have gathered from current literature.

Table 2. Supplier selection criteria (Taherdoost and Brard 2019)

Criteria	Definition
Quality	The ability of the supplier to meet quality specifications consistently which include quality features (material, dimensions, design, durability), variety, production quality (production lines, manufacturing techniques machinery), quality system, and continuous improvement.
Authors: Sarkar and Mohapatra 2007, Wadhwa and Ravindran 2007, Xia and Wu 2007, Shyur and Shih 2006, Chan and Kumar 2007, Jharkharia and Shankar 2007, Gencer and Gürpinar 2007, Wang et al. 2008, Yu and C.-C.T. 2008, Cakir and Canbolat 2008, Hsu and Hu 2009, Ustun and Demirtas 2008	
Delivery	The ability of the supplier to meet specified delivery schedules which include lead-time, on-time performance, fill rate, returns management, location, transportation, and incoterms.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006, Florez-Lopez 2007, Shyur and Shih 2006, Yu and C.-C.T. 2008, Ustun and Demirtas 2008, Wadhwa and Ravindran 2007	
Performance history	The performance history of the supplier in the financial, economic, social, organisational, and societal area.
Authors: Thanaraksakul and Phruksaphanrat 2009, Watt et al. 2010	
Warranties and claim policies	The superiority of the specified written guarantee that promises to repair or replace a product if necessary within a specified period and also the claim policy as a formal request for coverage or compensation for a covered loss or policy event.
Authors: Thanaraksakul and Phruksaphanrat 2009, Xia and Wu 2007	

Production capacity	The volume of products or services that can be produced by a supplier using current resources.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006, Xia and Wu 2007, Tahriri 2008	
Price	The price criterion includes unit price, pricing terms, exchange rates, taxes, and discount.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar, Mohapatra 2006, Florez-Lopez 2007, Xia and Wu 2007, Wadhwa and Ravindran 2007, Watt et al. 2010	
Technology and capacity	The technological capability of a supplier and ability to acquire new technologies and technical resources for research and development practices and processes.
Authors: Thanaraksakul and Phruksaphanrat 2009, Xia and Wu 2007, Chan and Kumar 2007, Jharkharia and Shankar 2007, Ustun and Demirtas 2008, Ha and Krishnan 2008, Bottani and Rizzi 2008	
Cost	The cost is a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred, and opportunity forgone in production and delivery of a good or service.
Authors: Shyur and Shih 2006, Chan and Kumar 2007, Jharkharia and Shankar 2007, Wang et al. 2008, Yu and C.-C.T. 2008, Cakir 2008, Ustun and Demirtas 2008	
Mutual trust and easy communication	The level of trust on the quality of the work provided by the supplier. And refers to the obligations owed between the buyer and the supplier. Easy communication is a simple exchange of information between the firm and the supplier.
Authors: Ustun and Demirtas 2008, Ha and Krishnan 2008, Bottani and Rizzi 2008	
Communication system	The communication system of the supplier includes information on progress data of orders.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006	
Reputation and position in industry	A ranking and reputation of a brand, product, or company, in terms of its sales volume relative to the sales volume of its competitors in the same industry.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006, Watt et al. 2010	
Supplier's profile	The superiority and reputability of the supplier's status, past performance, finance, certificates, and references.
Authors: Chan and Kumar 2007, Jharkharia and Shankar 2007, Gencer and Gürpinar 2007, Ustun and Demirtas 2008	
Management and organisation	The reputability of the supplier's management team and the efficiency of their decision making to resolve issues to be both effective and beneficial.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006, Watt et al. 2010	
Repair service	The ability of the supplier to restore something damaged, faulty, or worn to a good condition.
Authors: Thanaraksakul and Phruksaphanrat 2009, Florez-Lopez 2007, Xia and Wu 2007	

Attitude	The attitude of the supplier while you are in contact with them such as politeness and confidence.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006	
Risk factor	The risk factor is a measurable characteristic or element, a change in which can affect the value of an asset, such as exchange rate, interest rate, and market price.
Authors: Chan and Kumar 2007, Levary 2008	
Commercial plans and structure	The supplier's format statement of business goals, reasons they are attainable, and plans and infrastructure for reaching them.
Authors: Hsu and Hu 2009, Ha and Krishnan 2008, Bayazit and Karpak 2005	
Labour relations record	The supplier's relationship between management and its workforce.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006	
Geographical location	The geographical location of the supplier.
Authors: Thanaraksakul and Phruksaphanrat 2009, Sarkar and Mohapatra 2006	
Reliability	The supplier's quality of being trustworthy and dependable based on the references (buyers feedback), financial stability (capital, annual turnover), past and current business partners, company organisation and personnel, diversity of ownership, and cultural awareness.
Authors: Thanaraksakul and Phruksaphanrat 2009, Florez-Lopez 2007, Yu and C.-C.T. 2008	
Service	The ability of a supplier to provide intangible products including the customization (size, shape, colour, design, OEM, label service), minimum order quantity, communication (respond time, information, language), industry knowledge, flexibility, and response to change.
Authors: Chan and Kumar 2007, Wang et al. 2008, Yu and C.-C.T. 2008, Ustun and Demirtas 2008	
Process improvement	The ability of the supplier to identify, analyse, and improve upon existing business processes within its company for optimization and to meet new quotas or standards of quality.
Authors: Sarkar and Mohapatra 2006	
Product development	The ability of a supplier to modify an existing product or its presentation, or formulation of an entirely new product that satisfies a newly defined customer want or market niche.
Authors: Thanaraksakul and Phruksaphanrat 2009, Florez-Lopez 2007	
Environmental and social responsibility	The supplier's responsibility to use natural resources carefully, minimise damage, and ensure these resources will be available for future generations.
Authors: Bai and Sarkis 2010	
Professionalism	The supplier's competence or skill expected of a professional.
Authors: Thanaraksakul and Phruksaphanrat 2009, Shyur and Shih 2006	

Several of the presented criteria from Taherdoost and Brard (2014) are mentioned by Thanaraksakul and Phruksaphanarat (2009) who state that the most significant criteria are quality, delivery and cost. To draw this conclusion a literature study of 74 papers was conducted and each criterion was ranked depending on how many papers mentioned each criterion. The result from their conducted literature review was then compared with older rankings concerning the same criteria. In Table 3, Thanaraksakul and Phruksaphanarat (2009) present the three similar ranking approaches of different criteria. These selection criteria have been gathered from different contexts and industries in various countries with different opportunities and possibilities.

Table 3. Supplier selection criteria ranking (Thanaraksakul and Phruksaphanarat 2009)

Criteria	Year 1966	Year 1991	Year 2009
Quality	1	3	1
Delivery	2	2	2
Cost	6	1	3
Production Facility & Capacity	5	4	4
Flexibility & Reciprocal Arrangement	23	19	5
Technical Capacity & Support	7	6	6
Repair Services & Follow-up	15	11	7
Information Technology & Communication Systems	10	18	8
Financial Status	8	9	9
Innovation & R&D	-	-	10
Operating Controls	14	14	11
Quality Systems	-	-	12
Management & Organisation	13	7	13
Personnel Training & Development	22	15	14
Product Reliability	-	-	15
Performance History	3	10	16
Geographical Location	20	5	17
Reputation & References	11	8	18

Packaging & Handling Ability	18	13	19
Amount of past Business	21	22	20
Customer Relationship	-	-	21
Warranties & Claim Policies	4	23	22
Procedural Compliance	9	16	23
Customer Satisfaction & Impression	17	20	24
Attitude & Strategic Fit	16	12	25
Labour Relations Record	19	17	26
Economical Aspect	-	-	27
Desire for Business	12	21	28
Environmental & Social Responsibility	-	-	29
Safety Awareness	-	-	30
Domestic Political Stability	-	-	31
Cultural Congruence	-	-	32
Terrorism Risk	-	-	33

Literature regarding supplier selection criteria shows that there are numerous criteria used in different industries and countries and adds up to more than 60 generic criteria (Kar and Pani 2014). What can be seen from the literature is that the importance and mentioning of different criteria have changed over the decades (Thanaraksakul and Phruksaphanarat 2009). The frequency of mentioned criteria has changed with the new requirements and companies are demanding fast response and flexibility. The network has moved towards a global multi-layered network with new partners with new capabilities and requirements (Taherdoost and Brard 2019). Many similarities can be seen between the supplier selection criteria and the presented PESTLE criteria in Figure 8.

4. Results and Analysis

The chapter Results and Analysis includes results of data collection and analysis of the results. The chapter further explains the foundation of the designed framework and how it is practically used, before a final recommendation based on the framework is presented.

4.1 Interviews

The data collected through interviews are divided into the three areas of interviews conducted: Internal interviews with the case company, industry interviews, and expert interviews. In the following section, the qualitative data collected from the interviews are summarised.

4.1.1 Case Company Interviews

The market for fine mechanics and high cosmetic mechanics has ended up in Asia, due to their high competence within the area. The suppliers that currently can meet Cake's requirements on expansion capacity and high quality are the larger suppliers (Werin 2022). Disadvantages with these suppliers are that Cake is a smaller actor relative to the larger supplier which can cause Cake to be lower prioritised (Noke 2022, Werin 2022).

It is important to understand how the supplier will prioritise the business with Cake from the supplier's perspective. Additionally, the larger suppliers are not as flexible to sudden changes, which is a relevant aspect for Cake when developing and updating new models often. The suppliers are preferably chosen based on earlier experience, size, geographical focus, quality, possibility to ramp up, flexibility, etc. Cake has high requirements on the manufacturing techniques, design, producing smaller volumes and within a short timeframe. Furthermore, the lightweight construction and physical appearance resemble a bicycle. This influences the needed expertise and knowledge from the company's suppliers (Werin 2022).

When a motorcycle is updated with a minor change, this change is updated to the new standard. If the updates on a specific model are major, it becomes a new model. Service tries all the motorcycles to identify weaknesses and defects to improve the products. When a weakness is identified, the information is communicated to the supplier to solve the issue. Therefore, close collaboration and good communication with the supplier are of high importance for the company (Ahlstrand 2022).

Cake develops the product from idea to production and the majority of mechanics are developed inhouse. When designing the motorcycles, the assembly, production and sourcing processes are taken into consideration early in the process. To enable further optimisation of the motorcycles, more steps in the supply chain are required to be brought inhouse. A result is that the more of the supply chain Cake owns, the more workload is required from the company. When the competence is not existing inhouse, Cake outsources to partners with the required competence. The sourcing team takes over the process when there is a final prototype of the product that is verified and tested. The ramp-up capacity is crucial to enable the growth Cake is experiencing (Karlsson 2022).

Geographically, North America and Europe work similarly in terms of bureaucracy, laws and certifications. When aiming to introduce motorcycles to another market, it requires an understanding of the market regarding legislation, how to sell, how to produce, etc. (Karlsson 2022).

4.1.2 Industry Interviews

The supplier relationship is an important aspect that is crucial for the sourcing to work smoothly. If there is a lack of a relationship with the supplier, there is less motivation to support each other. The supplier relationship is even more important during uncertain times, such as the Covid-19 pandemic. The supplier relationship is crucial regardless of the product's importance to the business since the supplier relationship is fundamental for cooperation to function (Interviewee Z 2022). Flexibility and transparency are valuable characteristics of a supplier relationship. If there is a good supplier relationship, there is a greater possibility to prevent and solve quality issues. When evaluating the risk of sourcing from a specific supplier, it is crucial to understand why a supplier scores with lower credibility in an aspect instead of directly changing the supplier (Interviewee X 2022).

Customs duties are relevant to consider when analysing the transport. Currently, within the steel industry, it can be time-consuming to re-start the product cycle when the demand has decreased. This consequence was especially noticeable during the Covid-19 pandemic. Another material that is vulnerable in a sourcing perspective to supply constraints is semiconductors (Interviewee Z 2022). The technical knowledge of the supplier is important to ensure clear communication and understanding of the needs (Interviewee X 2022).

CSR is becoming more and more important within the manufacturing industry. There is a lot that is driven by cost, but in the end, the supplier that is chosen needs to have sustainability requirements and goals that are aligned with the company. It is not the supplier that guides the sustainability goals, that is decided by the company as a customer (Interviewee Z 2022). In the future, the life cycle analysis (LCA) and carbon footprint may become costs instead of only a sustainability aspect. Hence, these can be beneficial to consider directly when choosing a supplier (Interviewee X 2022).

As a bicycle manufacturing company, the majority of the production is an assembly of parts building the bike. A consequence is that the company becomes dependent on its suppliers because if there is only one part missing, the final product is unable to be finished. Since the bicycle industry is constantly designing and creating new models with adjustments from previous models, the changes require the company to place the orders of the new adjusted parts well in advance. When experiencing disruptions in the supply chains, as during the covid-19 pandemic, it causes the orders to end up far behind. When such disruptions occur, a great supplier relationship or a strong power balance position is not enough to solve constraints. This has affected the whole bicycle industry which has been widely affected by the pandemic. Currently, Asia produces the best parts for the bicycle, but the industry still requires to be observant to where else in the world it can be preferably sourced. "The outside world is a moving matter that is difficult to predict and it is necessary to always be flexible" (Interviewee Y 2022).

4.1.3 Expert Interviews

When conducting the expert interviews, the focus is not on how the sourcing was done at a specific company but rather with a more broad perspective. The expert interviews mainly focused on what the most important aspects were when choosing a geographical region to source from or when choosing a supplier.

When choosing a geographical sourcing area or supplier, the total cost is necessary to take into consideration and not only the purchase price. The sustainability aspect is important to consider and for a company in a growth phase, the integration of the sustainability aspects could be easier in this phase when the organisation is constantly changing. As a smaller company in a power balance relationship with a supplier, being innovative and creating ideas together with the supplier can motivate the supplier to prioritise the smaller company and benefit the supplier relationship (Sallnäs 2022). An important aspect to build a valuable supplier relationship is effortless communication. This is eased by working with suppliers that

communicate well in English as well as in a similar time zone as the company (Jinglöv 2022). More and more companies aim to move production or supplier base close to the company to mitigate risk factors and supply disruptions, such as the Covid-19 pandemic. Another reason for this development is to ensure sustainability at suppliers, where the validation of the supplier is easier to ensure in the immediate area (Sallnäs 2022).

It is beneficial to source larger amounts of components at the same supplier than to choose too many suppliers to source smaller amounts from to eventually create buying power. With this in mind, a backup supplier can be used as well to mitigate risks. It is also preferable to choose to source from a geographical area where a similar industry is already established to ensure subcontractors are close. Further, when evaluating large global regions, it is important to understand the differences within each region depending on the industry. Therefore, larger regions can be necessary to break down to evaluate their internal experience and knowledge. When evaluating these regions, it is crucial to look beyond the labour cost. Regions with higher labour costs are generally more industrialised. This can be beneficial for highly automated products. These more industrialised regions generally have a more developed logistics infrastructure, which is a crucial aspect of a global supply chain (Jinglöv 2022).

4.2 Introduction of Geographical Sourcing Framework

As presented in the literature review, there are currently several diversifying sourcing strategies for specific supplier selection processes that can be summarised as different portfolio approaches which can be scored on numerous criteria (Kraljic 1983, Rezaei and Lajimi 2019, Rezaei and Ortt 2012, Taherdoost and Brard 2019, Thanaraksakul and Phruksaphanarat 2009, Van Weele 2014). Similarly, some scorecards and strategies illustrate countries' different capabilities and knowledge (Aleksandrova et al. 2021, Deloitte 2016, KPMG 2021, Schwab 2019, SolAbility 2021, UNIDO 2020, U.S. News & World Report LP 2022, West and Lansang 2018). However, the supplier selection strategies are often not broad enough to get a holistic view of different geographical areas, and the scorecards that compare different nations are too broad and not applicable for a specific company or industry and do not provide the possibility to differentiate a company's different products. Therefore, it is currently difficult for an SME, ramp-up company within a specific industry, such as Cake, to use the current frameworks and scorecards that are available.

Based on the conducted study at Cake, the Geographical Sourcing Framework (GS-Framework) in Figure 11 was developed and aimed to provide the company with a clear and structured step-by-step approach to obtain a holistic and diversified sourcing strategy on a global level. Each phase will be further explained but the framework and its three phases could be summarised as follows. During the Product phase, each product gets mapped and grouped with similar products. Several product categories will then be presented and placed in a two-by-two matrix which is called the Three Dimensional Portfolio Matrix (3D-Portfolio Matrix) depending on the category's characteristics, Figure 12. Further, each quadrant in the 3D-Portfolio Matrix will be connected to a given strategy in the Approach phase. This strategy will then be applied to each category. The given strategy for each quadrant will also be implemented in the Scorecard phase. At this phase, several criteria will be ranked for different regions in the world in a scorecard that is called the Geographical Sourcing Scorecard (GS-Scorecard). These criteria will be influenced by the strategies that were applied in the Approach phase. Finally, different regions in the world will be assigned a given rank from the scorecard.

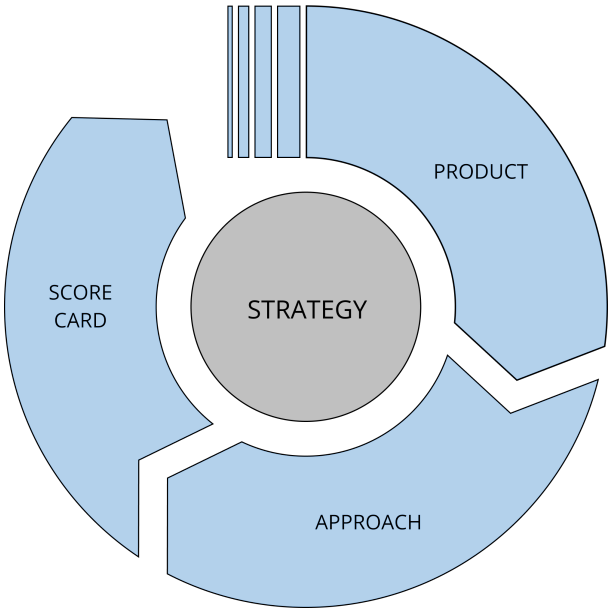

Figure 11. Geographical Sourcing Framework

4.2.1 Strategy Circle

Each phase in the GS-Framework has a couple of operational decisions and actions that will be performed. In the middle of the GS-Framework, the strategy circle is placed to illustrate that for each phase, there is a connected strategy that has to be decided before the operational actions can be carried

out. This strategy also flows through each of the phases and is therefore connected to all phases at the same time. The following sections will explain how each phase should be carried out and its connected strategy.

4.3 Product Phase

The first phase presented in the GS-Framework, Figure 11, is to define the products and their categories. This includes identifying and mapping each product's characteristics to decide on which product categories are suitable to use. The products which are assigned to the same categories must have similar characteristics, purchasing patterns, and spending.

To ensure structured and profitable sourcing the strategy should be focused on a portfolio strategy that enables diversified sourcing. The first phase of the GS-Framework aims to divide the products and components into product categories and then categorise them. Firstly, all products and components are divided into product categories. This is followed by a mapping of the categories' characteristics which is done in a portfolio analysis developed by the authors. The portfolio matrix used for the analysis is the 3D-Portfolio Matrix (Figure 12) which maps the categories based on three dimensions: (1) *Spend*, (2) *Complexity*, and (3) *Cargo Efficiency*, which are further explained in section 4.3.2.

4.3.1 Divide Product Categories

To be able to decide on suitable product categories, each component is evaluated on its characteristics to ensure similarities between the components in the same product category. To ensure this, the aspects considered to evaluate are spend, function, material, manufacturing process, sourcing process, etc. These aspects are crucial to establish an overall similarity within the product category to ensure that the three dimensions in the 3D-Portfolio Matrix are reasonably evaluated.

The categories used for Cake are already existent and provided by the case company and were used in the further steps in the GS-Framework. Therefore, the categories provided by Cake were not strictly divided in the same way as described, but are divided to ensure similar characteristics on the same principle. The product categories provided by Cake that are used further in the GS-Framework are presented in Table 4.

Table 4. Product categories for Cake

Product Categories		
Battery	Brakes	Cabling
Chargers	Connectivity	Controllers
Displays	Fasteners	Frames
Miscellaneous (Misc)	Motors	Other Electrical
Other Mechanical	Packaging	Plastics
Standard Components	Suspensions	Tires
Wheels		

4.3.2 Explanation of the 3D-Portfolio Matrix

With the product categories decided, the categories are to be mapped in a portfolio matrix. The portfolio matrix developed and used is presented in Figure 12. The three dimensions needed for the 3D-Portfolio Matrix are *Spend*, *Complexity*, and *Cargo Efficiency*. Figure 12 is presenting three example product categories, Category 1-3, to visualise the third dimension of Cargo Efficiency.

The y-axis in Figure 12 is representing the *Spend*, more specifically the percentage of spend for a product category of the total spending of the company during a specified time interval. The x-axis in Figure 12 represents the *Complexity* based on two aspects: a qualitative combination of the complexity of the products within the category and the perceived supplier availability. The *Complexity* dimension is evaluated on a ten-point scale based on a qualitative assessment of the two considered aspects of the dimension. The third dimension of the 3D-Portfolio Matrix is Cargo Efficiency which is represented by the size of the bubbles in Figure 12. This is calculated as an average of the volume in cubic metres (cm^3) and weight in kilograms (kg). The average is rescaled to a ten-point scale that is used for the third dimension in the 3D-Portfolio Matrix. The larger the bubble is, the less cargo efficient the category is considered to be. Likewise, the smaller the bubble is, the more cargo efficient the product category is.

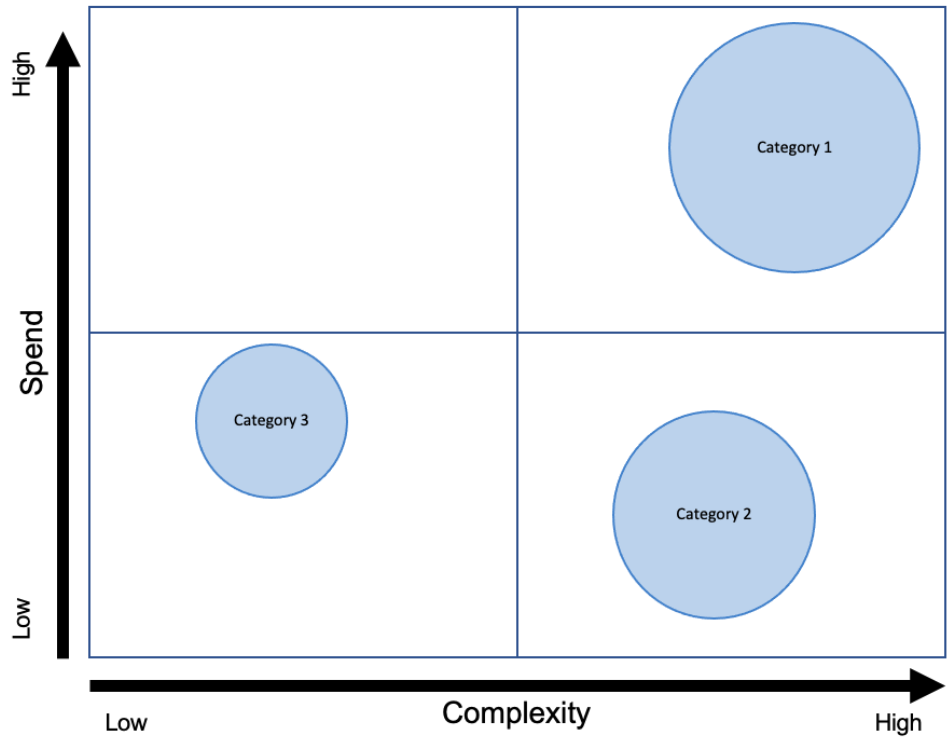

Figure 12. Three Dimensional Portfolio Matrix

With these three dimensions the matrix is creating four quadrants to differentiate the product categories, which are called Strategic, Non-Critical, Bottleneck, and Leverage. The 3D-Portfolio Matrix possesses similarities to different existing portfolio analysis matrices (Rezaei and Lajimi 2019), especially the well-known Kraljic PPM (Kraljic 1983). To suit the case company and the aim of the portfolio analysis, modifications have been made to the PPM.

The Kraljic PPM evaluates the importance of purchasing in the y-axis which includes the cost of materials, profitability, value-add, etc (Kraljic 1983). This dimension differs from the *Spend* dimension in the 3D-Portfolio Matrix since the *Spend* is only considering the actual spend. The reasoning for the *Spend* dimension being more suitable for Cake is that the profit impact of each product category is considered to be equally crucial. The fasteners are equally as important to the assembled bike as the battery is since the finished bike cannot be shipped if not all components are included. The *Complexity* dimension in the 3D-Portfolio Matrix is defined based on two aspects, the complexity of the products within the category and the supplier availability. This differs from the x-axis in the Kraljic PPM matrix since the Kraljic PPM considers the complexity of the supply market in numerous different aspects, instead of the complexity of the product and supplier availability in the 3D-Portfolio Matrix. Therefore, the *Complexity* axis is more narrow in the 3D-Portfolio Matrix and the related risk and sourcing

complications are later treated in the Scorecard phase. The third and most noticeable difference is the third dimension that has been added, *Cargo Efficiency*. This dimension is added to provide information visually on how easy the transport of the product category is. In Kraljic PPM, this aspect is rather included in the x-axis to describe the complexity of the supply market instead of as an own dimension (Kraljic 1983). The x- and y-axes are not influenced by the *Cargo Efficiency* dimension.

Due to the differentiation of the definitions of the axes in the 3D-Portfolio Matrix compared to Kraljic PPM, it is of high importance to clarify that there are as well differences in the strategies connected to each quadrant the matrix is creating. The names of the quadrants are equal to the Kraljic PPM, but it is important to clarify that they are not defined the same due to the different definitions of the axes. The exact definitions for the quadrants in the 3D-Portfolio Matrix are clarified in section 4.4.1.

4.3.3 Apply 3D-Portfolio Matrix on Cake

Given the definitions of the 3D-Portfolio Matrix in section 4.3.2, the portfolio analysis is applied to the product categories divided for Cake in the Product phase of the GS-Framework. The categories were presented in Table 4. The *Spend* dimension is calculated as a spend analysis on the total spending at Cake during 2021. The results are presented in Figure 13.

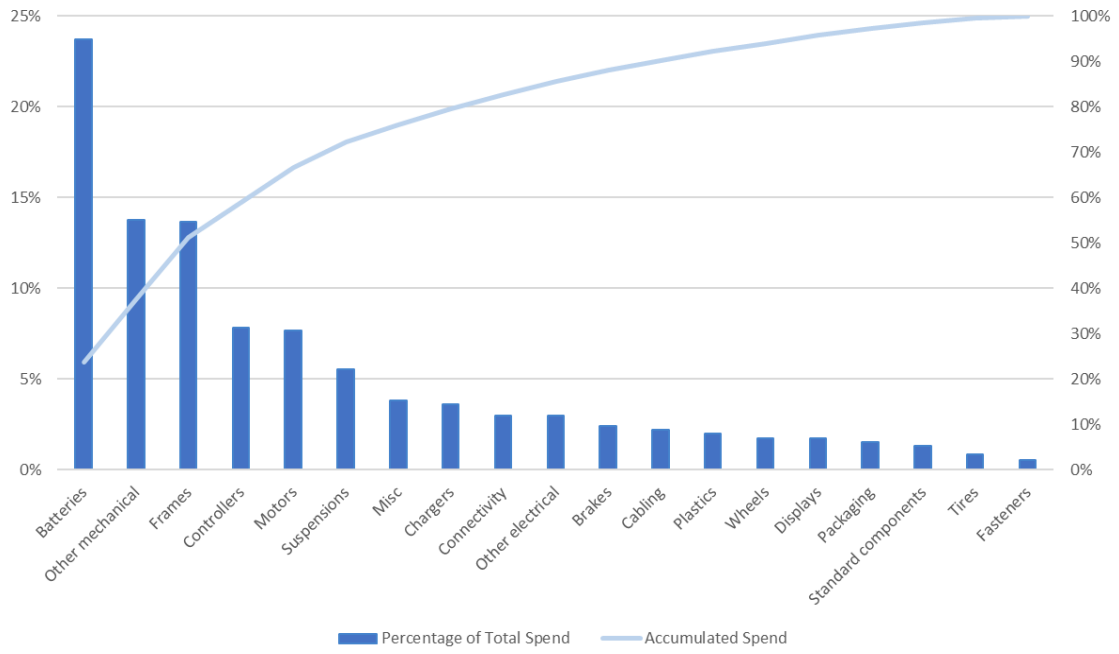

Figure 13. Spend dimension for product categories

The *Complexity* dimension is decided by qualitative assessment of the authors together with the case company during workshops. The results are presented in Figure 14.

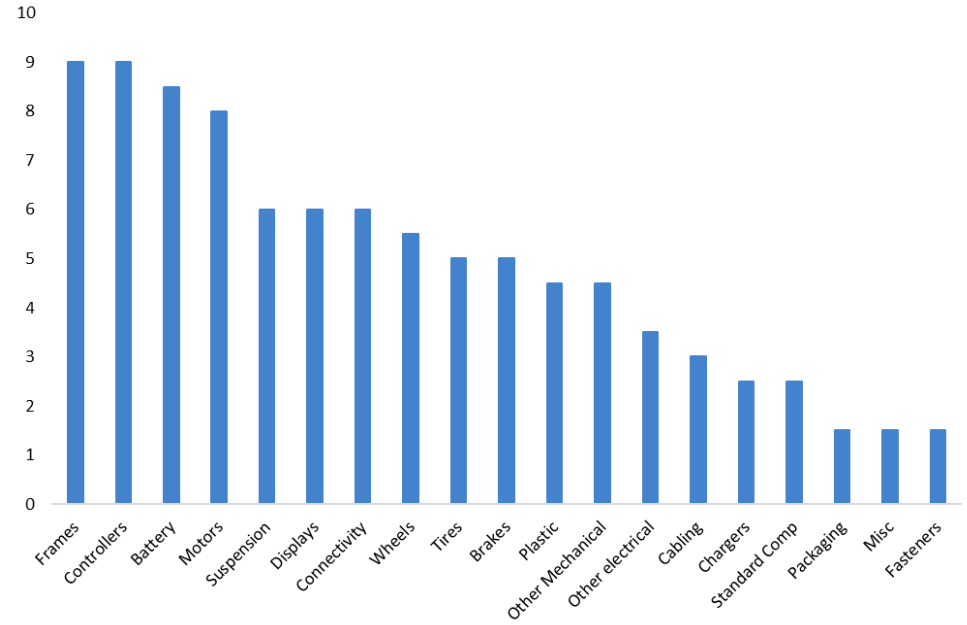

Figure 14. Complexity dimension of product categories

The *Cargo Efficiency* of the product categories is based on weight and volume data from the case company and is presented in Figure 15. The higher score the less cargo efficient and likewise, the lower score the more cargo efficient.

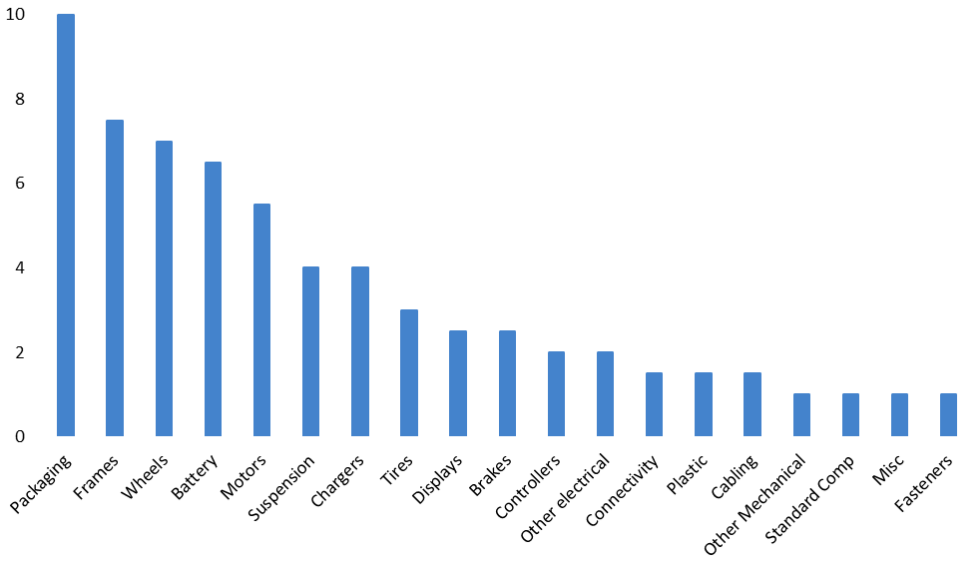

Figure 15. Cargo Efficiency dimension of product categories

Combining the three dimensions in the 3D-Portfolio Matrix results in the finished portfolio analysis presented in Figure 16. The boundaries between the different quadrants are asymmetrical, compared to the definitions of the 3D-Portfolio Matrix in Figure 16. The reasoning for this is settled during workshops with the case company and the authors to ensure a correct visualisation of the product categories.

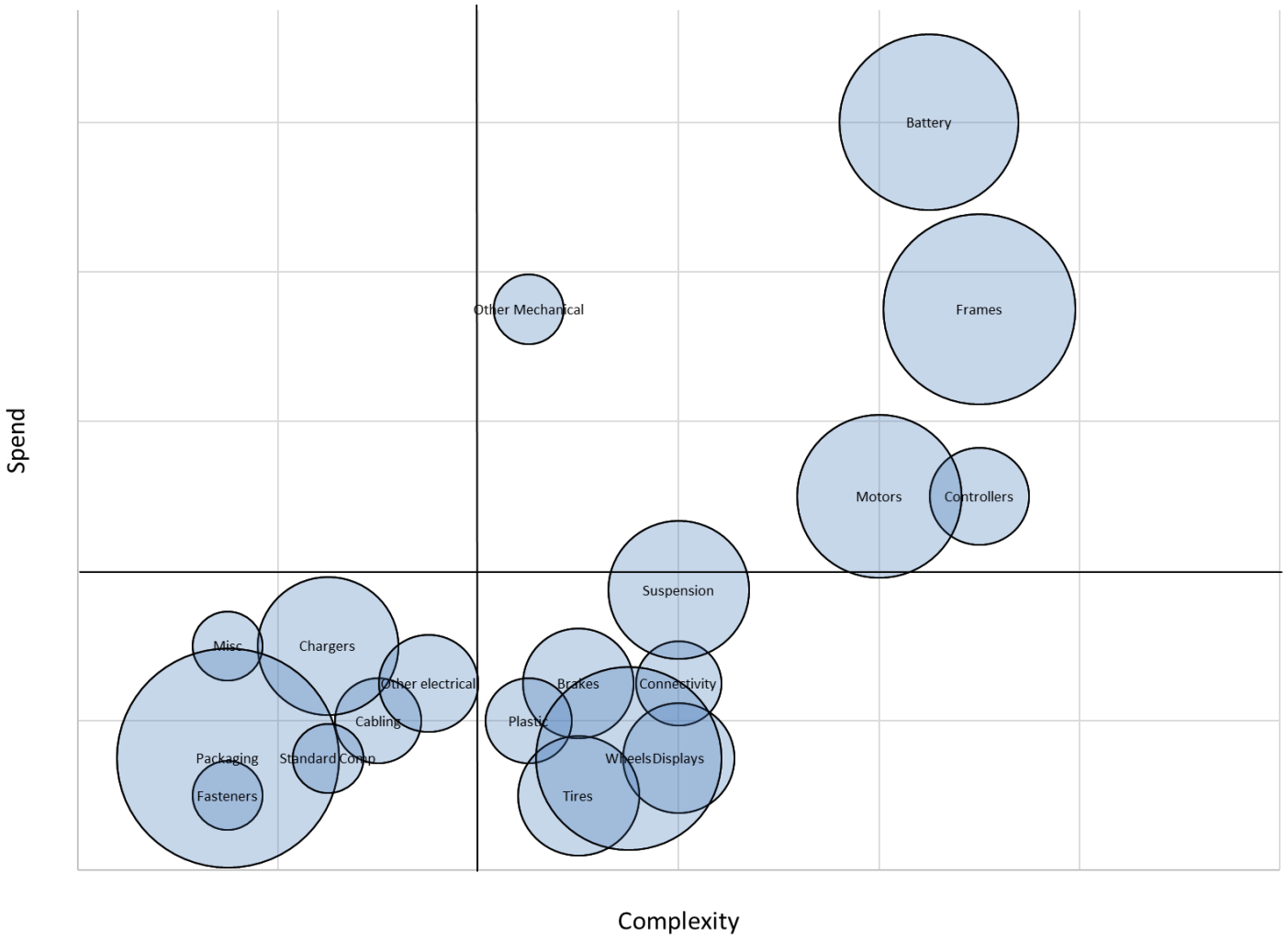

Figure 16. 3D-Portfolio Matrix mapping the product categories at Cake

4.4 Approach Phase

In the Approach phase, each product category will be connected with a specific approach depending on its placement and evaluation of the 3D-Portfolio Matrix. Each quadrant will be connected with a specific strategy to ensure that the category is profitably sourced and to ensure that the sourcing department prioritises the right categories. The cargo efficiency evaluation in combination with the placement in the matrix will also influence the recommended strategy.

4.4.1 Quadrants

With each product category mapped out and placed in the 3D-Portfolio Matrix with the presented axes, the matrix illustrates four different quadrants. Similar to the PPM (Kraljic 1983), these four quadrants are called Leverage, Strategic, Non-Critical, and Bottleneck. Some similarities can be found to the PPM (Kraljic 1983), however as mentioned, the axes in the 3D-Portfolio Matrix are different from the PPM axes. Therefore, the presented strategies for each quadrant are not the same as the strategies presented by Kraljic (1983). Each of the quadrants has a generalised situation based on the two axes. This results in a diversified strategy for each quadrant. Following are each quadrant explained and connected to comprehensive strategies, which are summarised in Figure 17.

Strategic
The Strategic quadrant represents the high spend and high complexity categories. The high spend indicates that these categories highly influence the total cost for the company. The high complexity in this quadrant reflects a smaller supplier availability for the affected product categories. Therefore, it is important to provide this quadrant with a high focus and a more time-consuming analysis could be profitable. This pressures the company to strive toward long-term relationships with its suppliers and ensure a stable supply chain. This is especially important for SMEs to ensure their priority from larger suppliers when there is a global shortage of disturbance (Interviewee X 2022). Because of the high complexity, these categories should also be sourced with high quality in mind to reduce costly repairs and return shipments.

Leverage
The Leverage quadrant represents product categories with a high spend for the company but the complexity is regarded to be low. Therefore, the supplier availability is deemed satisfactory and the products are less complex. A well-functioning supplier relationship is crucial with the global and complex sourcing networks. Therefore, the supplier relationship is

highly valued in the 3D-Portfolio Matrix for all its quadrants. However, the company can exploit its buyer power within this quadrant and should therefore focus on obtaining a high-quality product for a profitable price for these low complex products.

Bottleneck

Despite the low profit impact that characterises the Bottleneck product categories, these categories need a high focus from the sourcing department. For a company in the electric motorcycle industry, all components are crucial for the final product (Interviewee Y 2022). Therefore, Bottleneck product categories can not be neglected. Due to the complexity of these categories, it is crucial to ensure a stable supply. Similar to the Strategic products, this is connected with a strong supplier relationship to ensure a secure supply. In this quadrant, the sourcing department should consider alternatives for the product as well. This could be obtained by collaborating with the R&D department to understand if the product category could be changed to lower the complexity and at the same time ensure the functionality of the final product.

Non-Critical

This quadrant represents the most simple product categories which provide a low contribution to the company's profit. Therefore, these product categories should be applied with a standardised sourcing strategy. This quadrant would also benefit from a well-functioning supplier relationship that could benefit a seamless and standardised sourcing.

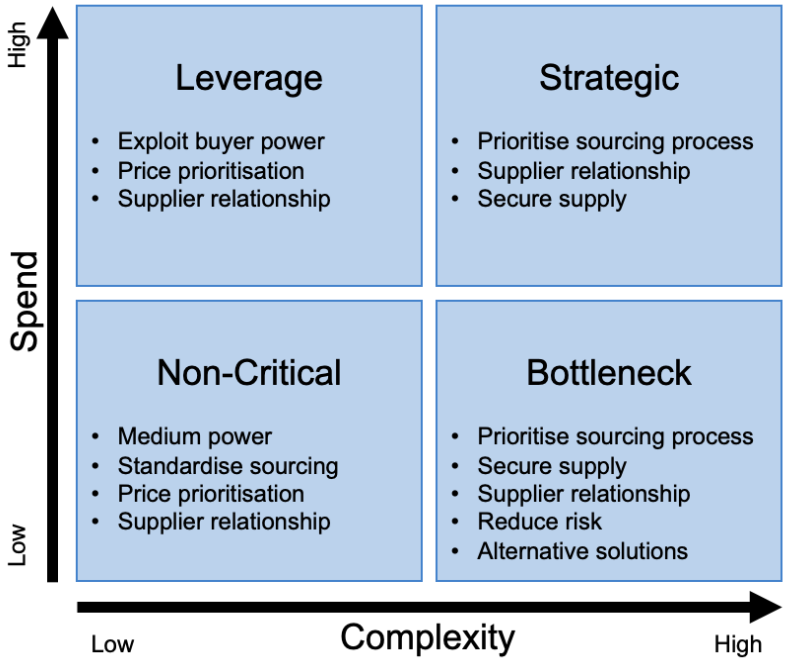

Figure 17. 3D-Portfolio Matrix with a summarised strategy for each quadrant

Each product category is now connected to a specific strategy and Table 5 summarises which quadrant each category is placed in. Notable is that there are no product categories placed in the Leverage quadrant due to the level of complexity of the categories with higher spending.

Table 5. Quadrant placement in 3D-Portfolio Matrix for all Product Categories

Strategic	Bottleneck	Non-Critical	Leverage
Battery	Brakes	Cabling	
Controllers	Connectivity	Chargers	
Frames	Displays	Packaging	
Other Mechanical	Plastics	Misc	
Motors	Suspensions	Other Electrical	
	Tires	Standard Comp	
	Wheels		

As mentioned, the presented quadrants and strategies can be seen as similar to the PPM (Kraljic 1983). However, one major difference is that the presented strategies have a higher priority toward supplier relationships throughout the matrix. This is because of the changing landscape over the past decades that have highlighted the need for a well-established supplier relationship to establish a secure supply. The supplier relationship is also even more important for an SME that has a lower bargaining power toward large suppliers and at the same time can build a long-term supplier relationship that can benefit both the company and its suppliers during the ramp-up phase (Interviewee x 2022, Interviewee z 2022, Rezaei and Lajimi 2019). Further, since the case company is in a ramp-up phase, categories may move within the matrix when their characteristics change during the expansion. Therefore, a well-established supplier relationship can follow the categories to other quadrants. The CSR impact is also of high importance in the current global supply chain (European Commission n.d. b, Interviewee X 2022, Sallnäs 2022). Therefore, the size of the product is seen as an individual dimension and the supplier relationship can also have high importance connected to the transparency with the company's suppliers to obtain a greater CSR effect (Sallnäs 2022).

4.4.2 Local or Global Sourcing

When each product category has been placed in a specific quadrant there is still one dimension left in the 3D-Portfolio Matrix, the *Cargo Efficiency*. As mentioned, large and heavy categories result in a large bubble in Figure 16. From both an economical and environmental aspect, bulky categories that have a low cargo efficiency should be transported the shortest possible distance. Therefore, some product categories should be further investigated to analyse the possibility of a local supplier. The definition of a local supplier is that Cake should look at collaborating with a supplier for each market region, which currently are Europe, North America, and Asia. However, for an SME, it is time-consuming and challenging to deal with suppliers in each market region for each of the product categories. Therefore, the 3D-Portfolio Matrix should be an advisory tool for this decision. Therefore, the cargo efficiency should be combined with the two axes of the 3D-Portfolio Matrix. Because a strategic category with high *spend* and high *complexity* is possibly harder to source from each region because these categories require more demanding sourcing criteria. Therefore, all strategic categories are recommended to be globally sourced. However, low *Cargo Efficiency* categories that are found inside, or close to, the Non-Critical quadrant are deemed more appropriate to further evaluate the possibility of a local supplier.

The strategy for a local supplier was qualitatively applied to the result illustrated in Figure 16. Therefore the bulky product categories packaging and chargers were decided to be locally sourced. Furthermore, the categories that are close to the Non-Critical quadrant were also closer looked at. This resulted in the wheel category scoring high enough to also be further investigated for a local supplier. The final recommendation for all categories is summarised in Table 6. The globally sourced product categories will be recommended to be included in the following presented scorecard, while the locally sourced products should then only focus on the three market regions.

Table 6. Global or Local Sourcing

Sourcing	Product Categories
Globally Sourced	Battery, Brakes, Cabling, Connectivity, Controllers, Displays, Fasteners, Frames, Other Mechanical, Misc, Motors, Other Electrical, Plastic, Standard Components, Suspensions, Tires
Evaluate the Possibility of a Local Sourcing	Chargers, Packaging, Wheels

4.5 Scorecard

When each product is placed into different categories and later placed in the 3D-Portfolio Matrix, each category needs to be scored to determine which geographical region the category should be sourced from. This is conducted in the third and last phase of the framework, the Scorecard phase. This phase is designed through two steps. First, each geographical region is decided. This is then followed by deciding what criteria that can be measurable on a regional level and represent the challenges and opportunities in a sourcing process. These two steps are then combined to deliver a comparable scoring for each geographical region.

4.5.1 Geographical Regions

To ensure a broad application and scope of the scorecard, 197 countries were included when dividing the geographical areas. These include 193 countries that are members of the United Nations (UN), two countries that are recognized by the UN but not members, which are the Holy See and Palestine, as well as two areas that are not recognized as sovereign states by the UN (Worldometer n.d.). These two areas are Taiwan and Hong Kong. Despite these two regions being considered to be a part of China by the UN, they have been seen as individual countries in this study. That is because of the differences in sourcing in these regions compared to China (Jinglöv 2022, Werin 2022). To enable the framework's adaptability to the industry, the regions have been divided with consideration to the case company's industry. Therefore, the motorcycle, electric vehicle, and bicycle industries have influenced the chosen regions. Table 7 summarises all of the eleven chosen regions, which can also be seen in Figure 18 with the abbreviation of each region. Appendix C further explains which countries are placed in each region.

Table 7. Decided geographical regions

Geographical Regions	
North America (NAm)	South America (SAm)
North-West Europe (NWE)	South-East Europe (SEE)
Middle East & Africa (MEA)	Mid-South Asia (MSA)
South-East Asia (SEA)	China Region (CR)
Taiwan (TW)	East Asia (EA)
Oceania (OC)	

The reason for the big difference in area and number of countries in each region is the maturity, expertise and experience within the industry in the regional area. This results in smaller regions where the industry is well established. As Figure 18 illustrates, the Asia area is experienced in this industry and therefore consists of more and smaller regions (GlobeNewswire 2022b, Interviewee Y 2022, Werin 2022, Workman 2022a). The difference in geographical area size is also reflected in how big the difference in the business culture and experience is (Jinglöv 2022, Werin 2022).

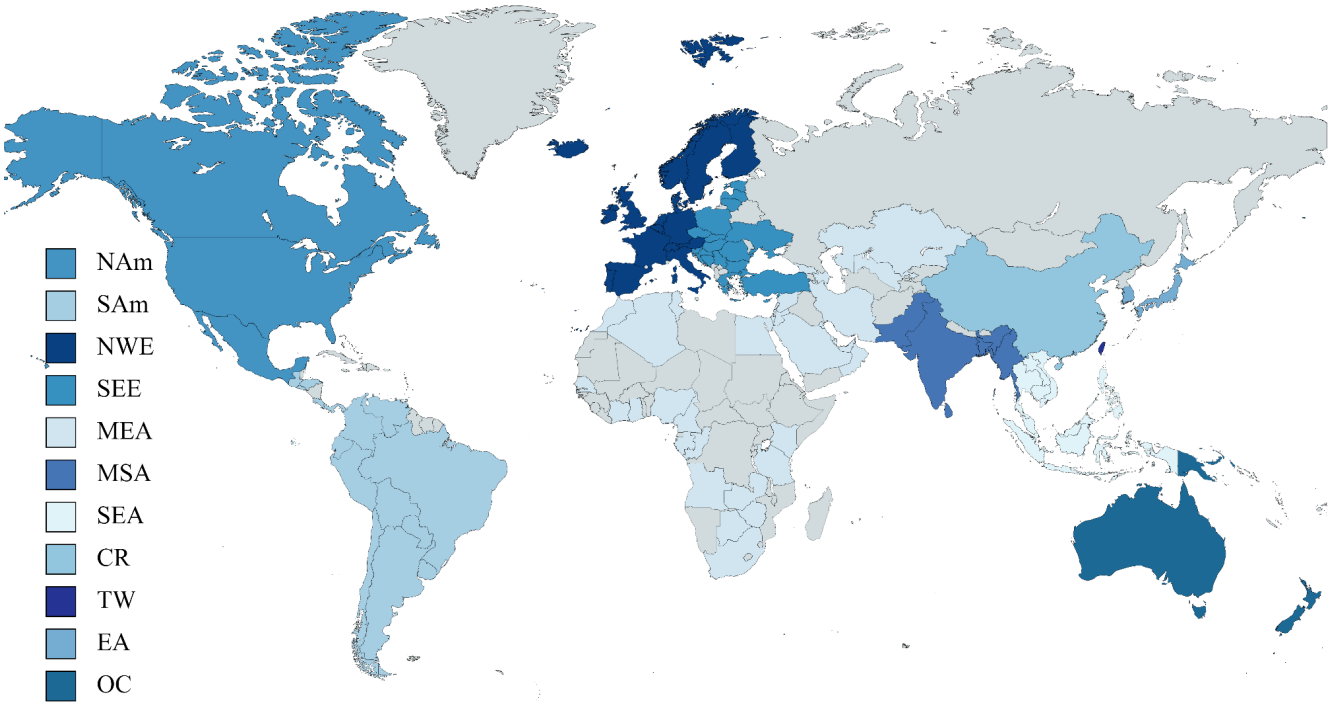

Figure 18. Geographical Regions

As Figure 18 shows, some countries are grey which indicates that they are not included in the evaluation process for the case company. The countries that are excluded from each region did not meet the certain approved level in one of the following three areas: (1) GDP (The World Bank Group 2022a), (2) Competitive Industrial Performance (CIP) (UNIDO 2020), or the country is excluded due to (3) current political reasons or the neglection of humanitarian rights to such an extent that the case company cannot operate in that country. Appendix C further explains which countries are included and excluded.

4.5.2 Define Criteria

When several defined geographical regions are established for the company, these regions need to be compared to possibly understand where a given product category is most suitable to source from. This comparison will be based on a given number of criteria that will be measured and compared between the regions. As can be seen from the literature review, there are currently many different criteria in numerous different areas both on a supplier and a geographical level. With all these different criteria and the possibility to gather plenty of data with today's technology, it can be easy for companies to strive towards measuring everything without a clear goal. Instead, each criterion should be measured with a clear and useful purpose.

The criteria in the GS-Scorecard provide the case company with a broad understanding of the possibilities and difficulties that may appear in the sourcing process. The criteria are also extensive enough to apply to similar companies. The six criteria that have been selected to cover the sourcing situation that the case company is facing are (1) Quality and Standards, (2) Supplier Relationship, (3) Risk, (4) Cost, (5) Supply, and (6) Sustainability. Each criterion will be scored based on quantitative rankings and surveys that represent the given criterion. Therefore, as can be seen in Table 8, each criterion is connected to several sub-criteria. Each criterion and sub-criterion will be further explained, but what is common for all criteria is that it only contains sub-criteria that are measurable on a regional level and can not be supplier-specific. Table 8 further illustrates that each sub-criteria impacts the criterion more or less depending on its assigned percentage weight.

Table 8. Criteria and sub-criteria for GS-Scorecard

Criterion	Internal Weight	Sub-Criterion
1. Quality and Standards	30 %	1.1 Manufacturing Infrastructure
	30 %	1.2 Industry Experience
	30 %	1.3 Skilled Labour Force
	10 %	1.4 Quality Management Systems
2. Supplier Relationship	40 %	2.1 Business Transparency
	20 %	2.2 Communication
	40 %	2.3 Ease of Doing Business
3. Risk	40 %	3.1 Economic Freedom
	40 %	3.2 Political Risk
	20 %	3.3 Natural Disasters
4. Cost	50 %	4.1 Manufacturing Cost
	50 %	4.2 Minimum Wage
5. Supply	40 %	5.1 Material Accessibility
	40 %	5.2 Transport Accessibility
	20 %	5.3 Lead Time
6. Sustainability	100 %	6.1 Sustainability Index

The criteria, sub-criteria, and internal weights are selected based on gathered literature and collected primary data. Each criterion and sub-criterion is validated and established through weekly workshops with Cake to ensure the practical usability of the criteria and sub-criteria. Following, each criterion and connected sub-criterion is defined.

Quality and Standards

Quality and standards represent the physical product. This will display which geographical regions that have the best ability to manufacture each product category with the highest quality. A high Quality and Standard rank will also ensure fewer return shipments of faulty products. The sub-criteria that can be assessed in a geographical area and contribute to the quality of the product are *Manufacturing Infrastructure, Industry Experience, Skilled Labour Force,* and *Quality Management Systems*.

The *Manufacturing Infrastructure* sub-criterion illustrates how well developed the infrastructure in a specific region is to ensure that the region

has the infrastructure to enable a functioning manufacturing in the country. This sub-criterion is measured with the Competitive Industrial Performance (CPI) Index (UNIDO 2020). The CPI Index measures and evaluates the countries by the two group indexes of (1) Manufacturing Value Added Indexes and (2) Manufacturing Export Indexes. The Manufacturing Export Index is useful to indicate that the manufacturing infrastructure is adapted for an international market.

Industry Experience is evaluating the experience each country has within the related industry for the product category. This sub-criterion, therefore, indicates that a given region has the knowledge and machinery to produce and export the specific product. Since the different product categories vary a lot in the needed knowledge due to the different characteristics, the ranking of this sub-criterion varies depending on the product category. Thus the sub-criterion is ranked in five industries that represent the: (1) bicycle, (2) electronic circuit, (3) electric motor, (4) lithium-ion battery (5) and cabling. Each industry is measured on the total export in US dollars for the given region. The product categories included in the different industries are presented in Table 9. The three categories that in the Approach phase were determined to be locally sourced are therefore not included in the Scorecard phase. The Misc product category is also excluded from a specific industry. This is because the characteristics of the category are too broad to be associated with a distinctive industry.

The ranking method for the *Industry Experience* is evaluated as a percentage of the total export within the geographical region. The largest export is scored 10 and the other geographical regions are scored based on the largest export using formula 1.

Table 9. Product categories divided into industries

Industry	Product Categories Included
Bicycle (Workman 2022a)	Frames, Other Mechanical, Suspension, Brakes, Plastic, Wheels, Tires, Standard Components, Fasteners
Electronic Circuit (Workman 2022b)	Controllers, Connectivity, Chargers, Displays, Other Electrical
Electric Motor (OEC 2020a)	Motors
Lithium-Ion Battery (Workman 2022c)	Battery
Cabling (Workman 2022d)	Cabling
No connected industry	Chargers, Misc, Packaging, Tires

$$Scoring(Region) = \left(\frac{Export(Region)}{Largest\ export}\right) \times 10 \qquad (1)$$

The *Skilled Labour Force* sub-criterion expresses how well-educated a region is. This also includes how well-established staff training is and how easy it is to find a qualified workforce in the region. Therefore, this sub-criterion is evaluating the skills of both the current and future workforce in the region. *Skilled Labour Force* is scored based on one of the pillars included in the global competitiveness index which is called "Skills of the current workforce" (Schwab 2019).

Quality Management Systems consists of the usage of different quality systems in factories and if the regions use and follow up on international standards, e.g. ISO standards. This sub-criterion illustrates both if a region is compatible with international standards, as well as a tool for an external business to ensure the standards of a region (Interviewee X 2022, Senft 2014). This has been measured on how many verified ISO 9001 certificates each region had in 2020 within the areas presented in Table 10 (Keen 2022). Formula 2 is used to calculate the scoring for *Quality Management Systems*.

Table 10. The scored ISO 9001 certificates

ISO 9001 certificate
Rubber and plastic products
Non-metallic mineral products
Concrete cement, lime, plaster, etc
Basic Metal fabricated metal products
Machinery and equipment
Electrical and optical equipment
Manufacturing not elsewhere classification
Transport, storage, and communication
Financial intermediation, Real Estate, Renting
Information technology
Engineering Service

$$Score(Region) = \left(\frac{Nbr\ of\ Certificates(Region)}{Highest\ nbr\ of\ certificates}\right) \times 10 \qquad (2)$$

Supplier relationship

To ensure a stable and reliable supplier it has become more and more important to develop long-lasting and stable supplier relationships. This criterion will also influence other criteria since a well-established supplier relationship can contribute to higher quality, a higher priority, and thus a more secure supply as well as reduced prices (interviewee X 2022). The supplier relationship is also deemed more important due to the global disruptions and the recent pandemic that has highlighted the importance of a close collaboration with the company's suppliers. The sub-criteria that contribute to the supplier relationship are *Business Transparency, Communication,* and *Ease of Doing Business.*

Business Transparency represents mutual trust between the company and the supplier. The sub-criterion indicates how willing suppliers in a specific region are to honestly communicate and share information. *Business Transparency* also measures how protected investors in the country are in terms of financial information and through disclosure of ownership. This sub-criteria is scored based on the business transparency index presented by The World Bank Group (2022b).

Communication is crucial to ensure that the day-to-day operation reaches a satisfactory level. This is an important sub-criterion for a company with a large global footprint and high technology components with heavy influence from R&D. Since a category quickly may need an update. *Communication* includes the three dimensions *Language*, *Internet Access*, and *Time zone*. The sub-criterion is calculated with a weighted score, where *Language* and *Internet Access* are both weighted at 40 %, and *Time zone at* 20 %. *Language* is scored based on the ability of understanding and communication in English. The evaluation is ranked by a comparison of skills in English in non-native English-speaking countries (Papadopoulos 2019). The native English-speaking countries are excluded from the ranking but automatically scored the highest. The *Time zone* is evaluating the time difference based on the Cake HQ in Stockholm, Sweden. *Internet Access* is measured as the information and communication technology (ICT) usage in every country (Schwab 2019). These three dimensions add up to a *Communication* rank.

Ease of Doing Business ranks the regulatory performance of economies in different countries. The ranking indicates the ease of doing business through a Doing Business indicator (The World Bank Group 2022c). This indicator represents regulatory best practices in the region. This enables the two parties to allocate their resources toward building a relationship instead of wasting time on regulatory issues.

Risk

In all supply chains and sourcing situations, different kinds of risks are always present and it can be difficult to predict their impact and probability. To ensure a well functioning and concise scorecard, the criteria are grouped into three risks, *Economic Freedom, Political Risk*, and *Natural Disasters*. There are many risks connected to the transportation of the products. These aspects are deemed to be partly covered by the supply criterion. And since Cake has a global market that may shift in the future, the transport risks are often more associated with a specific supplier selection. The risk criterion has therefore been determined to measure risks that can be scored for the actions inside a region.

Economic Freedom represents the right of every human to control their labour and property. The population of an economically free region is free to produce, consume, invest and work as they please. This sub-criterion ensures the company that its supplier is economically free to operate and make their own decisions. The sub-criterion is measured on the Economic Freedom Index (The Heritage Foundation 2022). This is an index that combines the rule of law, government fiscal policy, regulatory efficiency, and open markets.

The *Political Risk* of each nation is currently difficult to predict. Well-functioning democratic states can quickly be affected by external forces. Despite the difficult situation, it is crucial to understand the position the supplier has in their region. The *Political Risk* sub-criterion indicates the political stability of a region and is scored on an index that is calculated as an average of dimensions covering armed conflict, violent demonstrations, international tension, etc. (The Global Economy 2020). This illustrates the possibility that the government would be overthrown or destabilised by violent or illegitimate means.

Natural Disaster is considered to play a smaller but still vital role for a supplier region. The sub-criterion is considered to be less likely but with the risk of a large impact if it would occur. This sub-criterion is evaluated on the risk of the region being exposed to natural hazards including sea-level rise, floods, earthquakes, cyclones, and droughts. The risk of exposure is then scored based on the classification of the scoring presented in Table 11 (Aleksandrova et al. 2021).

Table 11. Scoring of sub-criterion Natural Disasters

Classification of Exposure	Score
Very Low	10
Low	8
Medium	5
High	3
Very High	1

Cost

As mentioned, the purpose of the scorecard is to make the correct decisions regarding the sourcing process to ensure the highest profit impact. Therefore, each evaluated criterion contributes to the costs that are associated with the sourcing process. However, the concrete cost to produce a product is measurable and influences the final total cost and is therefore presented as a specific criterion. The two sub-criteria for the cost are *Manufacturing Cost* and *Minimum Wage.*

Manufacturing Cost represents the region's ability to produce a component at a competitive price. This has been measured on the survey conducted by US News (US News & World Report L.P. 2022).

The *Minimum Wage* sub-criterion is measured by the lowest salary that is legal in each country for a working month (Country economy 2022). There may be a distinctive difference concerning the level of automation in the production for product categories in all four quadrants. Therefore, each category has gotten a qualitative assessment of the level of automation since this highly influences the labour cost for the production. Table 12 summarises how automated a category is and how this influences the impact of the *Minimum Wage.* The *Minimum Wage* for each country is calculated based on formula 3.

Table 12. Level of automation for the product categories

Level of Automation	Influence Min. Wage Score	Product Category
Low	100 %	Brakes, Cabling, Frames, Motors
Medium	70 %	Displays, Other Electrical, Standard Component, Tires
High	40 %	Battery, Connectivity, Controllers, Fasteners, Plastic, Suspension

$$Scoring(Country) = \left(\frac{Minimum\ Wage}{Highest\ Minimum\ Wage}\right) \times Influence \times 10 \quad (3)$$

Supply

To ensure a stable and reliable flow of goods, a supply criterion is deemed necessary for the GS-Scorecard. This is represented by the three sub-criteria *Material Accessibility, Transport Accessibility*, and *Lead Time*.

The *Material Accessibility* sub-criterion indicates if the region and its suppliers have accessibility to the material needed for each product category. Since many suppliers have long lead times and second and third-tier suppliers, this sub-criterion evaluates the availability of the material or component. Similar to the *Industry Experience,* this sub-criterion is divided into different material groups because of its main raw material. The different material groups are Rubber Tire, Plastic, Electrical Circuit, Steel, and Aluminium. Table 13 presents what category that consists of each material. There are also several categories that either are too broad to be assigned a specific material, or these categories have been decided to have local sourcing. Depending on the evaluated material, the score is calculated with formula 4. All regions are evaluated on the total amount of exported material in US Dollars.

Table 13. The main material for each product category

Material / Component	Product Categories
Aluminium (OEC 2020b)	Brakes, Frame, Other Mechanical, Suspensions,
Battery Cells (WITS 2022)	Battery
Copper (OEC 2020c)	Cabling, Motors
Electrical Circuit (Workman 2022b)	Connectivity, Other Electrical, Controllers, Display
Plastic (ICT 2019)	Plastic
Rubber Tire (Workman 2022e)	Tires
Steel (OEC 2020d)	Fasteners
No connected material	Chargers, Misc, Packaging, Standard Component, Wheels

$$Score(Region) = \left(\frac{Material\ Export(Region)}{Largest\ Export\ (Region)}\right) \times 10 \quad (4)$$

Transport Accessibility is a combination of different aspects that ensure that the region has the transport knowledge, quality and infrastructure to ensure an efficient and stable supply. This has been ranked by using the Logistics Performance Index (LPI) which is based on the six dimensions of efficiency, quality, ease of arrangement, competence, ability to track, and delivery accuracy. (The World Bank Group 2018).

Lead Time illustrates the time the shipment of goods takes for each of the case company's markets. This sub-criterion is weighted depending on where the company experiences its market share. The current market share is represented by 60 % in Europe, 30 % in North America, and 10 % in Asia. The market share is then combined with the assumption that a shipment within a continent takes one week while a shipment to another continent takes eight weeks (Werin 2022)**.** Each geographical region is then scored based on the lead time to each market region where the best region receives a score of ten and the worst region is scored one.

Sustainability

Social and environmental sustainability is a core value for many companies worldwide. Especially as an SME with a global footprint, it is essential to develop the company with sustainability as the main pillar from the beginning. The Sustainability criterion aspect is scored both on the social and environmental sustainability of the region. This is summarised in the sub-criterion *Sustainability Index*. It can be argued that economical sustainability should be a part of the sustainability criteria. However, it is deemed that this aspect is included from other aspects in the GS-Scorecard. Therefore, it is not included in the *Sustainability* criterion to ensure that aspects are not included multiple times. The sub-criterion is scored based on three of the dimensions in the Global Sustainability Competitiveness Index (GSCI). The dimensions included are Natural Capital, Resource Efficiency, and Social Capital (SolAbility 2021).

All the presented criteria and sub-criteria are summarised in Figure 19. The Figure also illustrates the included aspects for some of the criteria that are built up by a couple of indexes e.g. the *Communication* sub-criteria. Or the sub-criteria is divided into different export industries e.g. *Industry experience.*

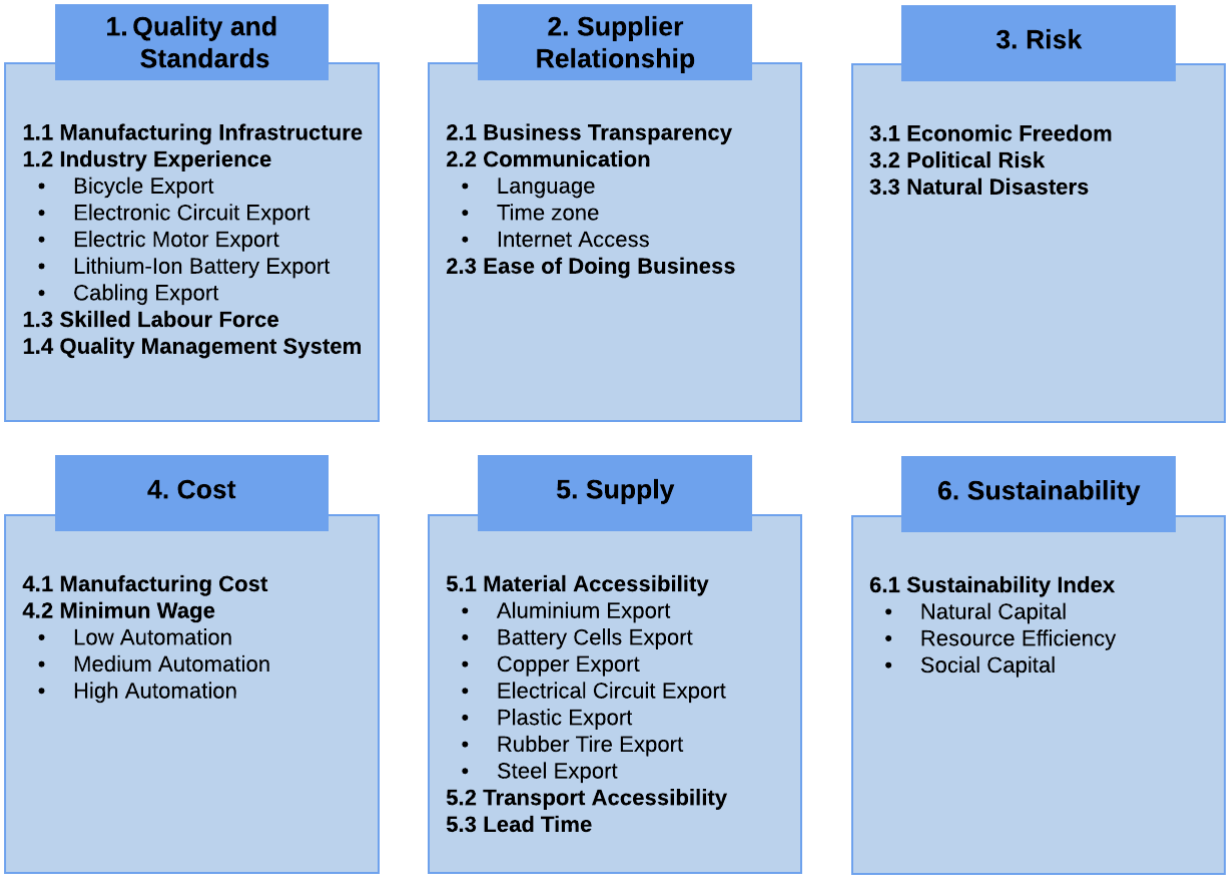

Figure 19. Summary of all criteria, sub-criteria, and included aspects within each sub-criteria

4.5.3 Strategy applied to the GS-Scorecard

The objective of the GS-Framework is to ensure a structured and diversified strategy for the sourcing department. To ensure this, each of the four quadrants in the 3D-Portfolio Matrix is assigned with specific percentage weights for each of the six defined criteria. Table 14 explains how these weights are divided between each quadrant. The purpose of these percentages is to reflect the sourcing situation that each product category finds itself in and what the main focus should be for each of the quadrants to ensure that the categories are sourced most profitably. The presented percentage weights is a qualitative assessment that has been established by evaluating the gathered literature which has been continually discussed with the case company during weekly workshops. The percentages have also been discussed in a workshop with fifteen employees of the case company's sourcing department. By assigning numerical weights for all criteria and sub-criteria, the user stays objective during the ranking of different regions (Bozarth and Handfield 2016).

Table 14. Percentage weight for each criteria

	Strategic	Non-Critical	Bottleneck	Leverage
Quality & Standards	15 %	10 %	10 %	20 %
Supplier Relationship	25 %	20 %	20 %	20 %
Risk	15 %	10 %	15 %	5 %
Cost	15 %	40 %	10 %	40 %
Supply	20 %	10 %	35 %	5 %
Sustainability	10 %	10 %	10 %	10 %
Total Weight	**100 %**	**100 %**	**100 %**	**100 %**

The sustainability aspect of the supply chain should never be de-prioritised. However, the product categories are not placed in a certain quadrant based on their environmental impact. Since the evaluation of how significant the environmental impact is for each category is a complex assessment. Therefore, each quadrant has been appointed an equal weight to the sustainability criterion.

4.5.4 Scoring

The percentage weights for each quadrant in Table 14 are then combined with the so-called internal weight for each sub-criterion that was presented in Table 8. This will result in a specific percentage Weight for each sub-criterion depending on what quadrant the product category is placed in. Table 15 illustrates an example when the product category Battery, which is classified as a strategic category, is placed on the scorecard and scored for the NAm region. When the category is evaluated, each of the sub-criterion is individually scored. This score is then multiplied by the weight for the sub-criterion. When each sub-criterion is scored, each criterion has been scored. Finally, each criterion score is summarised and presents the total score for the given region. It is then this total score that is compared between the regions to determine the most suitable region to source from.

To exemplify this, the calculations that are connected to the criteria 4. Cost (Table 15) is further explained. First, the Internal Weight is determined by the authors, which are 50% and 50% for the two sub-criteria *4.1 Manufacturing Cost* and *4.2 Minimum Wage*. These percentages are fixed independently on the quadrants. The Internal Weight is then multiplied for each sub-criteria by the weight of the criteria. Therefore, each sub-criterion is calculated as follows.

$$50\% \times 15\% = 7,5\%$$

Afterwards, each sub-criteria is individually scored based on the presented exports, indexes, etc. These scores are then multiplied by the sub-criteria new weight of 7,5% which results in calculating the sub-criteria and criteria as follows.

$$4.1\ Manufacturing\ Cost\colon\ 7,5\% \times 3\ points = 0,225$$
$$4.2\ Minimum\ Wage\colon\ 7,5\% \times 3\ points = 0,225$$

$$4.\ Cost\colon\ 0,225 + 0,225 = 0,45$$

When these calculations are performed for each criterion, each criterion score is summed and presents the final score. Each calculation can be followed in Table 15.

Table 15. Example of the product category Battery in the GS-Scorecard

Battery			NAm
Total Score			**6,62**
Internal Weight	**Weight**	**Criterion / sub-criterion**	
100 %	**15 %**	**1. Quality and Standards**	**0,99**
30 %	4,5 %	1.1 Manufacturing Infrastructure	5
30 %	4,5 %	1.2 Industry Experience	8
30 %	4,5 %	1.3 Skilled Labour Force	8
10 %	1,5 %	1.4 Quality Management Systems	3
100 %	**25 %**	**2. Supplier Relationship**	**2,05**
40 %	10,0 %	2.1 Business Transparency	8
20 %	5,0 %	2.2 Communication	7
40 %	10,0 %	2.3 Ease of Doing Business	9
100 %	**15 %**	**3. Risk**	**1,17**
40 %	6,0 %	3.1 Economic Freedom	9
40 %	6,0 %	3.2 Political Risk	7
20 %	3,0 %	3.3 Natural Disasters	7
100 %	**15 %**	**4. Cost**	**0,45**
50 %	7,5 %	4.1 Manufacturing Cost	3
50 %	7,5 %	4.2 Minimum Wage	3
100 %	**20 %**	**5. Supply**	**1,36**
40 %	8,0 %	5.1 Material Accessibility	7
40 %	8,0 %	5.2 Transport Accessibility	7
20 %	4,0 %	5.3 Lead TIme	6
100 %	**10 %**	**6. Sustainability**	**0,60**
100 %	10,0 %	6.1 Sustainability Index	6

Each sub-criterion is scored on a scale from zero to ten, where zero is the lowest score and ten is the highest. Some indexes and rankings do not match this scale and to ensure equivalent scaling of the scoring, every ranking is rescaled to ensure that the best performing region is scored 10 and the least

suitable receives a zero. Each sub-criterion's scoring that is not explicitly explained in section 4.5.2 is based on different rankings and indexes. These rankings have been rescaled with formula 5, where the lowest value of the original ranking is a and the highest is b. This ensures that each ranking receives an absolute score from one to ten.

$$Score = (Original\ Score(Country) - a) \times (\frac{(10-1)}{b-a}) + 1 \qquad (5)$$

The score that is based on a ranking of a geographical region is a combined average of the included countries within the region. Table 16 clarifies the calculation with the example of when the product category battery is scored in the region NAm, regarding the sub-criterion *Manufacturing Infrastructure* which is based on a ranking. Each score is rounded to the closest integer, regardless if it is based on export, ranking, or other values. All presented calculations are performed on each criterion, for each product category and ranks every geographical region.

Table 16. The product category Battery scored in NAm for Manufacturing Infrastructure

	USA	Canada	Mexico	Average	Score
1.1 Manufacturing Infrastructure	7,3	3,5	3,8	4,8	5

4.5.5 Analysis of the GS-Scorecard Results

Since the GS-Scorecard is considering differentiation depending on the category's placement in the 3D-Portfolio Matrix, the strategy for sourcing is integrated into the scoring. Despite this, the total score of the geographical regions at the top could be similar. If the difference between the highest score and the geographical regions ranked below is less than 0.25 points, the regions within the scope of 0.25 points are considered and further evaluated. The further evaluation is considering (1) if the geographical region is chosen for any other product category and (2) the *Cargo Efficiency* dimension. This promotes more than one product category to be sourced from the same region to minimise the spread of suppliers. Based on the requirements mentioned, the product categories that need to consider more than one geographical region are *Battery*, *Motors,* and *Other Electrical*.

Battery and *Motors* are both scored highly on both NWE and CR. Both geographical regions occur as the recommended regions for other product categories as well. Both *Battery* and *Motors* are scored high on the *Cargo*

Efficiency dimensions, causing the categories to be considered difficult to transport far due to the high volume and weight. The final recommendation to ensure a short distance to the main market is currently NWE, hence the final recommendation of *Battery* and *Motors* is NWE.

Other Electrical is scored with CR highest, but with SEA close behind. Considering numerous other product categories are ranked highest in CR, *Other Electrical* is recommended to be sourced in CR as well. The *Cargo Efficiency* score is below average and not causing any changes.

4.6 Final Recommendation

The recommendation of where to source each product category is presented in Table 17. The geographical regions that occur as recommendations are CR, NWE, EA, and the product categories recommended to be further investigated to be sourced locally. The recommendation is determined as the highest scored geographical region in the GS-Scorecard. Further, the product categories with several regions highly scored, have been considering the steps described in section 4.5.5.

Table 17. Recommended geographical region for each product category

Product Category	Highest Scored Geographical Region
Battery	NWE
Brakes	NWE
Cabling	CR
Chargers	Investigate Local Sourcing
Connectivity	EA
Controllers	EA
Displays	EA
Fasteners	CR
Frames	NWE
Other Mechanical	NWE
Misc	CR
Motors	NWE
Other Electrical	CR
Packaging	Investigate Local Sourcing

Plastic	NWE
Standard Components	CR
Suspensions	NWE
Tires	NWE
Wheels	Investigate Local Sourcing

4.6.1 Conclusions of the GS-Framework Results

When analysing the results presented in Table 17, summarising conclusions can be stated. The product categories within the electronic circuit industry in combination with a higher complexity are recommended to be sourced from EA due to the high industry experience in the area. The three product categories recommended in EA are placed in both the Strategic and Bottleneck quadrant in the 3D-Portfolio Matrix. Further, every category placed in the Non-Critical quadrant in the 3D-Portfolio Matrix that is not recommended to investigate local sourcing possibilities is recommended in CR. Therefore, the product categories with low complexity, low spend, and high cargo efficiency are the ones with the final recommendation in the CR. Every other product category is evaluated to be suitable for sourcing in NWE, hence close to the current main market for Cake in Europe. These are the product categories that scored highly on the *Complexity* dimension but are not dependent on the *Spend* since both remaining products in the Bottleneck and Strategic quadrants are recommended in NWE.

4.7 GS-Framework Summarised

The GS-Framework delivers an operational recommendation for where each product category should be sourced based on the three presented phases. The first recommendation is delivered after the Approach phase when it is decided if a category should be sourced locally or globally. The locally sourced categories should be sourced from one supplier per market region. This results in three different suppliers for the case company. The second and final recommendation is received after the Scorecard phase. Table 18 summarises the key takeaways for each of the three phases in the GS-Framework.

Table 18. Key takeaways for each phase in the GS-Framework

Product	Approach	Scorecard
Define the characteristics that the product categories should be based on.	Decide on which strategies to be generally applied to the quadrants.	Choose and define criteria and sub-criteria that represent the desired sourcing strategy and the applicable regions.
Define the profit impact on the axis, complexity axis, and cargo efficiency dimension.	Decide which product categories will have a local or global sourcing strategy.	Distribute the weight for each criterion and sub-criterion that reflect the strategy for each quadrant.
Place the product categories in the 3D-Portfolio Matrix, based on their characteristics	Categories that are deemed globally sourced are moved to the last phase.	Score each sub-criteria based on qualitative data and rankings.

The presented key takeaways for each phase in the GS-Framework should first be performed on a strategic level within the sourcing department of the company before it is used operationally. It is also important that the strategy is regularly updated for each phase. How frequently these updates should be performed can vary depending on the company and the global situation. For a large and established manufacturing company, the product categories are assumed to be relatively static and do not change characteristics or profit impact often. Therefore, the product categories should not be revised often. However, for an SME in a ramp-up phase as the case company, the characteristics of the products can change quickly depending on product development and the introduction of new components and parts. Therefore the product categories will have to be revised more often for these kinds of companies. Furthermore, for the GS-Framework to stay relevant, the whole framework has to be continually updated. This includes both the scores for each sub-criterion as well as the weighted percentages. As presented above, the dynamic world influences the requirements of both suppliers and customers. Therefore, the chosen criteria and sub-criteria also need to be continually updated to cope with these changes. These updates are something that both large and small companies have to take into consideration.

5. Discussion

The chapter Discussion is critically discussing the findings and results of the conducted research. The framework is also validated by reconnecting to the seven criteria presented by Grey (2021). Finally, further improvements and possible next steps for the case company are discussed.

5.1 Validity Assessment of GS-Framework

The validity assessment of the GS-Framework is conducted by mentioning both the strengths and weaknesses of the developed framework. The weaknesses are mentioned as possible improvements and include future perspectives, 3D-Portfolio Matrix, criteria in GS-Scorecard, and geographical regions.

5.1.1 Seven Validating Criteria

The GS-Framework was established to give the company a clear and structured model to perform a diversified sourcing strategy. As presented in section 2.8.3, seven criteria presented by Grey (2021) were taken into consideration during the development of the GS-Framework.

To ensure the *comprehensiveness* of the framework, a broad literature review was conducted to ensure different parameters to the presented problem. To ensure the applicability for companies in similar industries and sizes, interviews with external companies and universities were conducted. The *comprehensiveness* was also ensured by the close collaboration with Cake during the development of the framework.

The GS-Framework targets the real problem for many manufacturing companies of choosing a geographical location to source each of its product categories. With the dynamic global situation, the GS-Framework is developed with the possibility to modify different parameters to adapt the actions for different situations. This solution to act on actual problems ensures the *utility* of the framework.

The framework has been *validated* by conducting an empirical study at Cake where internal and external data has been analysed. The result of the Framework has also been assessed and validated by employees at the company. Further, the conducted research is conducted with a comprehensive credibility section.

Each of the three steps in the framework is thoroughly explained with common sourcing phrases. The framework can also be broken down into clear and concise bullet points as in Table 18 in section 4.7. Both the GS-Framework, 3D-Portfolio Matrix and GS-Scorecard are structured with short and common phrases and familiar and clear figures, e.g. the two-by-two matrix. The complex interpretations of similar frameworks have been broken down and presented to the user. Therefore, the GS-Framework is presumed to be *clear* and *memorable.*

The GS-Framework is presented with three individual phases that each includes several distinctive decisions on a strategic and operational level. Each phase is connected to its surroundings and is presented logically and comprehensively. With the presented order, each phase strengthens the other while each element still stands by itself. This structure indicates that the GS-Framework has been *integrated* in a structured manner.

Last, the GS-Framework has combined well-established frameworks and scorecards in a new manner which has resulted in a novel framework that has been influenced by the current challenges that the case company encounters. This causes the GS-Framework to be *differentiated* from current literature and frameworks.

5.1.2 Possible Improvements

Future Perspective
The framework and scorecard are designed so that the recommended geographical region is based on current data, hence losing some of the perspectives of the future. In section 2.5, the stated time horizon was described as a cross-sectional one capturing the recommended sourcing strategy as a snapshot of the current situation. Choosing a supplier and region to source from is not something a company should do regularly, since the company by that loses the relationship with suppliers and also it is a time-consuming and costly process. The reason for the framework to exclude the future perspective is to ensure the framework is complex enough to achieve a well-grounded recommendation, but also user-friendly to ensure Cake can practically use it.

3D-Portfolio Matrix
The 3D-Portfolio Matrix is developed with the three dimensions *Spend*, *Complexity* and *Cargo Efficiency*. The *Spend* and *Cargo Efficiency* dimensions are calculated on actual data, in comparison to the *Complexity* dimension that is qualitatively assessed. The *Complexity* of each product category was evaluated and decided by the authors together with the case company. Due to the dimension being subjectively assessed, the full scope

of the product category's complexity may differ if someone else got to interpret the *Complexity*.

Criteria in GS-Scorecard

Some of the chosen criteria could be argued to overlap and cover similar aspects. Additionally, some criteria could benefit from each other and may not be able to be completely separate from each other. One example of this is that the quality of a product could benefit from a well-functioning supplier relationship. To be able to create the GS-Scorecard, the complex aspects of sourcing are required to be generalised to be able to provide a holistic result. Additionally, the percentages of the main criteria varying depending on the placement in the 3D-portfolio matrix, influence the result majorly. To ensure and validate the percentage weights of each quadrant, the percentages are preferred to be applied to other companies as well. Hence a multi-case study is preferred to further evaluate the percentage weights that were qualitatively assessed by the authors together with the case company.

The criteria included in the GS-Scorecard were required to be evaluated on a regional level and not supplier-specific. The aim was to differentiate the criteria on a product level as well as much as possible, which was applied for only three out of 16 sub-criteria: *Industry Experience*, *Minimum Wage*, and *Material Availability*. To be able to keep the scoring of the GS-Scorecard to existing data rankings, it limited the possibility to differentiate other sub-criteria. Further, the sub-criteria *Material Availability* is calculated and scored based on the material export of the product category's main occurred material. Since the sub-criterion is based on the material export, the countries that import a lot of material and then export finished devices are not visible in this sub-criterion. The advantage of the chosen evaluation of this sub-criterion is that second-tier transports do not disappear in the GS-Scorecard compared to if the material availability instead was evaluated on the finished device export.

Geographical Regions

The geographical regions were divided considering the location of the electric motorcycle and bicycle industry. Therefore, the regions in Asia were divided into smaller ones. The scoring process in the GS-Scorecard was dependent on existing data rankings, which caused difficulties in the smaller regions which did not have as many data points or information available. The main example of this is the geographical region TW, which included Taiwan alone. The sub-criterion evaluated on the export of industry or raw material could become misleading when the export of TW alone is compared to the export of for example NAm. To ensure the geographical regions are better comparable, the size of the regions should have been considered in the division of the regions.

5.2 Assessment of Conducted Research

The presented framework and recommendation are based on rankings for countries as a whole. Therefore, the result illustrates how well a certain region is performing regarding the selected criteria. The criteria and sub-criteria have been selected to provide the case company with a broad evaluation. However, it could be argued that these sub-criteria are not representative of the specific industry and cover aspects that are less crucial for the case company. This aspect has been present throughout the scoring phase and resulted in a time-consuming scoring.

The collected data that provided the final ranking could have been collected and established earlier in the process. This would have given more time to validate the scoring and result with external interviews. Furthermore, a longer time horizon for the thesis would also have enabled further interviews with companies in other countries. The current interview data is based on Swedish experts and companies. This has occurred both because of the author's knowledge of Swedish companies and experts, as well as the reason that attempts for international interviews have been rejected. Therefore, the data could be considered to have a Swedish and western bias. Despite this fact, the performed interviews were deemed sufficient to cover the environment that the case company operates in since the company is considered a western company.

5.3 Proposed Next Steps

The result of the designed framework has delivered a recommendation that has been presented and discussed with several employees at the case company. Through these discussions, the result has been deemed satisfactory for the company and delivered an accurate and relevant result to a real problem. To ensure the GS-framework's adaptability and usefulness for companies in a similar situation and industry, it is proposed that the framework is applied in a multi-case study.

5.1.3 Further Development of the Framework

The framework achieved the objective of supporting the decision-making for the case company’s sourcing department. To enable a more granular analysis of the sourcing options, possible development of the framework would be to include a make-or-buy decision. This would ensure that the company gets a better understanding of which products are more profitable to produce in-house depending on their characteristics. This step would be applied in the Approach phase to ensure that all products are evaluated and

categorised but only categories that are deemed to be sourced are included in the Scorecard phase. To enable a make-or-buy decision, the framework would need to be integrated with the production and R&D departments of the case company.

With a longer time horizon, the framework could be further developed with a fourth step. The fourth step could present possible decisions and criteria on a supplier selection level. With the added step, the case company would be equipped with a step-by-step approach to find a suitable supplier within the geographical region that was recommended for each product category.

5.1.4 Next Steps for Case Company

The case company has received a holistic recommendation for each of its product categories that can enable a more strategically based selection of supplier regions. This recommendation is recommended to be further validated internally in the company to ensure the possibility to apply the recommendation. This validation will be performed by combining the recommendation with the employee's practical experience and knowledge within each region and product category. When the result of the GS-Framework is deemed accurate, Cake can move forward to investigate the possibility of a suitable supplier for each product category within the suggested geographical region.

6. Conclusion and Contribution

The chapter Conclusions and Contributions reconnects to the purpose of the framework and ensures that it is fulfilled before the contributions from the conducted research are presented.

6.1 Conclusions

The purpose of the thesis was to create a framework to support the decision-making process of which geographical region to source different materials and components by ranking the geographical regions for each product category.

The framework created is built up of three phases covering (1) mapping the product characteristics, (2) connecting each product category to an approach for sourcing, and finally (3) connecting the approach of the sourcing to the most suitable geographical region while using the GS-Scorecard. The GS-Scorecard ranks all geographical locations for every product category and thereby supports the decision-making. Therefore, the purpose of the master thesis has been fulfilled.

6.2 Contributions

The study has contributed to the academics with the novel GS-Framework that has combined current knowledge and literature to provide a framework that is broad enough to be applied to large geographical regions but sufficiently narrow to differentiate different geographical regions depending on specific product characteristics. The framework has been tested through a case study and thus contributed to the case company. The case company has received a thorough recommendation based on both theory and gathered data. Furthermore, the GS-Framework has contributed to similar SMEs by providing a public framework that is adaptable to a company’s specific requirements. Finally, the thesis has contributed to the author's knowledge and interest in global sourcing by combining theory from the university with the practical knowledge of the case company.

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Appendix A: Interview Guides

Includes the interview guides used in the semi-structured interviews conducted during the data collection phase.

Company Z

Introduction

- Brief introduction of your position at Company Z and other experience?
- What is your definition of 'Strategic Sourcing'?

Category Profiling

- Do you use some kind of categorization for your products?
    - If so, how are these categories segmented when applying your sourcing strategy?
    - Is this categorization optimal or are there any possible improvements?

Supplier Selection

- What does the sourcing strategy look like when introducing a new product/category?
- What departments are involved in the sourcing strategy? Planning and operational.
- Do you use any standardized KPIs during the audit process?
- How are CSR aspects evaluated during the sourcing process?
    - Goodwill, environmental impact, the work environment at the supplier, etc.
- Do you evaluate suppliers from specific regions in the world? Based on expertise, logistical infrastructure, or which other factors are evaluated highly? Differs in the product category?
- What would you say is the strategic reasoning for outsourcing/insourcing?

The power balance in the Industry

- How would you describe the power balance within the automotive industry?

- As a bigger actor in the industry, what would you say are the main opportunities and challenges in your situation?

Geographical Regions

- What are important aspects to take into consideration when choosing a geographical region to source from?

Scorecard

We would like your opinion on our very early draft for a sourcing scorecard that is based on
different aspects to choose a geographical area (we will show the SC during the interview).

- Do you have any recommendations for how to measure these aspects to ensure they are as quantified as possible?
- Is there any aspect you would have added?
- Do you see any major flaws with the current framework?
- Can we send this SC (which we will show during the interview) to you later in the process for you to fill out the "weight-percentage" according to your knowledge and experience?

Based on our discussion, is there anything you wish to add? Do you have any
recommendations of other companies or individuals that you think would help our research?

Linköping University

Introduction

- What is your professional experience, within and outside the university?
    - erfarenhet, på och utanför universitet
- What is the topic of your current research?
    - Vad fokuserar din nuvarande forskning på?
- What is your definition of 'Strategic Sourcing'?
    - Kort definition av strategic sourcing / inköpt

Strategic Sourcing

- What is the first step in the strategic sourcing process companies need to consider?
- Första steg i processen för strat inköp

    - What are the main challenges for companies during this process?
    - Vad är svårast för företag
- Could you mention the main aspects to consider when choosing the sourcing strategy?
    - Any aspects to rank higher?
- For a company with a weaker / stronger power balance towards the suppliers, would you modify previous answers?

Geographical location

- What regions would you divide the world in, from a sourcing perspective?
- What are important aspects to take into consideration when choosing a geographical region to source from? Both from a sourcing and a social perspective?
- When choosing a geographical location for sourcing, what are the main risks to be aware of? Is there any way of mitigating these risks?
- Could the geographical region affect if multi or single sourcing is preferred?

Scorecard

- What existing sourcing/supplier framework would you consider being most efficient?
    - Which one is the most applicable for choosing a region to source from?

We would like your opinion on our very early draft for a sourcing scorecard that is based on different aspects to choose a geographical area (we will show the SC during the interview).

- Do you have any recommendations for how to measure these aspects to ensure they are as quantified as possible?
- Is there any aspect you would have added?
- Do you see any major flaws with the current framework?
- Can we send this SC (which will show during the interview) to you later in the process for you to fill out the “weight-percentage” according to your knowledge and experience?

Based on our discussion, is there anything you wish to add? Do you have any recommendations of other companies or individuals that you think would help our research?

Company X

Introduction

- What is your name?
- Brief introduction of your position at Company X and experience
- Could you explain the difference between Y cell production and Y system production at Company X
- What is your definition of 'Strategic Sourcing'?

Category Profiling

- Do you use some kind of categorization for the products?
    - How are these categories segmented when applying your sourcing strategy?
    - Is this categorization optimal in your opinion, or is there any improvement?

New Supplier

- How is your sourcing strategy when introducing a new product or category?
- What departments are involved in the sourcing strategy? Both planning and operational.
- Does Company X use any standardized KPIs during the audit process?
- Do you evaluate suppliers from specific regions in the world?
    - In your opinion, do the regions have specific expertise?
- How are CSR aspects evaluated during the sourcing process?
    - Goodwill, environmental impact, the work environment at the supplier, etc.

Development of the Market A

- Could you describe market A today and how it has developed?
    - Is there any geographical area dominating?
- What are the major challenges and opportunities with market A?
- How do you believe the future of market A will develop?
- What have been the main challenges during your growth phase?
    - Has the sourcing strategy changed during the growth phase?

Scorecard

We would like your opinion on our early draft for a sourcing scorecard that is based on geographical areas. (We will show the scorecard during the interview)

- Do you have any recommendations for how to measure these aspects to ensure they are as quantified as possible?
- Is there any aspect you would have added?
- Do you see any major flaws with the current framework?

Based on our discussion, is there anything you wish to add? Do you have any recommendations of other companies or individuals for us to interview that you think would help our research?

Appendix B: Interviewees

Structured list of all interviewees that were interviewed, both semi- and non-structured.

Interview Group	Format	Date	Company	Name	Role
Case Company Interview	Non - structure	2022-01-25	Cake	Robin Karlsson	Product development
Case Company Interview	Non - structure	2022-01-25	Cake	Jonas Ahlstrand	Technical Service Manager Scandinavia
Case Company Interview	Non - structured	2022-02-15	Cake	Ali Noke	Factory Manager
Industry Interview	Non - structure	2022-02-17	Company Y	Interviewee Y	Marketing Manager with experience in sourcing
Expert Interview	Non - structure	2022-02-24	N/A	Mikael Jinglöv	Experienced in global supply chain
Industry Interview	Semi - structured	2022-03-03	Company Z	Interviewee Z	Purchasing manager
Expert Interview	Semi - structured	2022-03-04	Linköping University	Uni Sallnäs	Senior Lecturer
Industry Interview	Semi - structured	2022-03-14	Company X	Interviewee X	Purchasing manager

Appendix C: Geographical Regions

North America (NAm)

Included	Excluded
Canada	Bahamas
Mexico	Cuba
United States	Dominican Republic
	Haiti
	Jamaica

South America (SAm)

Included	Excluded
Argentina	Antigua and Barbuda
Bolivia	Barbados
Brazil	Belize
Chile	Dominica
Colombia	Grenada
Costa Rica	Guyana
Ecuador	Nicaragua
El Salvador	Saint Kitts and Nevis
Guatemala	Saint Lucia
Honduras	Saint Vincent and the Grenadines
Panama	Suriname
Paraguay	
Peru	
Trinidad and Tobago	
Uruguay	
Venezuela	

North-West Europe (NWE)

Included	Excluded
Austria	Andorra
Belgium	Liechtenstein
Denmark	Malta
Finland	Monaco
France	San Marino
Germany	
Iceland	
Ireland	
Italy	
Luxembourg	
Netherlands	
Norway	
Portugal	
Spain	
Sweden	
Switzerland	
United Kingdom	

South-East Europe (SEE)

Included	Excluded
Bosnia and Herzegovina	Albania
Bulgaria	Belarus
Croatia	Moldova
Cyprus	Montenegro
Czech Republic	North Macedonia
Estonia	Russia
Greece	
Hungary	

Latvia	
Lithuania	
Poland	
Romania	
Serbia	
Slovakia	
Slovenia	
Turkey	
Ukraine	

Middle East and Africa (MEA)

Included	Excluded
Algeria	Afghanistan
Angola	Armenia
Azerbaijan	Benin
Bahrain	Burkina Faso
Botswana	Burundi
Cameroon	Cabo Verde
Congo	Central African Republic
Côte d'Ivoire	Chad
Egypt	Comoros
Gabon	Democratic Republic of the Congo
Georgia	Djibouti
Ghana	Equatorial Guinea
Iran	Eritrea
Israel	Eswatini
Jordan	Ethiopia
Kazakhstan	Gambia
Kenya	Guinea
Kuwait	Guinea-Bissau

Lebanon	Holy See
Morocco	Iraq
Nigeria	Kyrgyzstan
Oman	Lesotho
Qatar	Liberia
Saudi Arabia	Libya
Senegal	Madagascar
South Africa	Malawi
Syria	Mali
Tanzania	Mauritania
Tunisia	Mauritius
United Arab Emirates	Mozambique
Uzbekistan	Namibia
Zambia	Niger
Zimbabwe	North Korea
	Palestine State
	Rwanda
	Sao Tome and Principe
	Seychelles
	Sierra Leone
	Somalia
	South Sudan
	Sudan
	Tajikistan
	Togo
	Turkmenistan
	Uganda
	Yemen

Mid-South Asia (MSA)

Included	Excluded
Bangladesh	Bhutan
India	Maldives
Myanmar	Nepal
Pakistan	
Sri Lanka	

South-East Asia (SEA)

Included	Excluded
Cambodia	Brunei
Indonesia	Timor-Leste
Laos	
Malaysia	
Philippines	
Singapore	
Thailand	
Vietnam	

Taiwan (TW)

Included	Excluded
Taiwan	

China Region (CR)

Included	Excluded
China	Mongolia

East Asia (EA)

Included	Excluded
Hong Kong	
Japan	
South Korea	

Oceania (OC)

Included	Excluded
Australia	Fiji
New Zealand	Kiribati
Papua New Guinea	Marshall Islands
	Micronesia
	Nauru
	Palau
	Samoa
	Solomon Islands
	Tonga
	Tuvalu
	Vanuatu