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Improving supplier selection process in indirect purchases – Case Study

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Abstract

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Due to various sectors experiencing growth in outsourcing, firms, to achieve business success, need to recognise how increasingly critical it is to select the right suppliers and how important collaboration with them has become over the years. The question “How to improve the supplier selection process in indirect purchases of a company?” is answered in this paper.

A global automotive company's regional business unit, headquartered in the Finnish Capital Region, and comprising Nordic countries and the Baltic States, is used as the case study. Its supplier selection process was compared to several supplier selection processes elaborated on in the literature on the subject.

To collect and synthesise various perspective on the supplier selection topic, an exploratory research method was used, where purchasing- and supplier selection concepts were explained. Supplier selection criteria and methods were also examined. Empirical and problem-solving method was employed to address the inefficient/time-consuming supplier selection process in the case company. Utilising these approaches not only allows conclusions and recommendations to be based on evidence, but also to contextualise them with reference to relevant literature.

This study suggests that the case company's supplier selection process can be optimised by implementing a universal SOW (scope of work) document format for internal customers to fill in and deliver to the buyer when a purchasing decision is made. This would allow for clearance and transparency regarding what exactly is required by the buyer to proceed with the supplier selection process, and in turn, with the entire purchasing process.

An improved supplier selection model is proposed to address the shortcomings of the one the case company is currently utilising. Approval stages during the supplier selection process are to be either limited or eliminated, which allows for significant saving of time.

Keywords: indirect purchasing, supplier selection, supplier selection criteria and methods

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Glossary

| | |
|------|---------------------------------------|
| AHP | Analytical hierarchy process |
| AI | Artificial Intelligence |
| CSR | Corporate social responsibility |
| EP | E-procurement, electronic procurement |
| ERP | Enterprise resource planning |
| GP | Goal programming |
| GR | Goods receipt |
| JIT | Just-in-time |
| KPI | Key performance indicator |
| LP | Linear process |
| MCDM | Multi-criteria decision-making |
| MOP | Multi-objective programming |
| MP | Mathematical programming |
| MRO | Maintenance, repair and operations |
| NDA | Non-disclosure agreement |
| NN | Neural networks |
| PO | Purchase order |
| PPM | Purchasing process model |

| | |
|------|----------------------------------|
| PR | Purchase requisition |
| RFI | Request for information |
| RFP | Request for proposal |
| RFQ | Request for quotation |
| SCM | Supply Chain Management |
| SOW | Scope of work |
| SRM | Supplier Relationship Management |
| TBL | Triple bottom line |
| TCO | Total cost of ownership |
| TT&C | Trading terms and conditions |

1 Introduction

In one of the early papers about purchasing Lewis (1943: 249) stated:

“It is probable that of all the responsibilities which may be said to belong to the purchasing officers, there is none more important than the selection of a proper source. Indeed, it is in some respects the most important”.

This statement is supported by Smith (2019: 5), who underlines that “suppliers sit at the heart of almost every organisation’s activities and processes”.

Companies, to function properly, should secure a flawless flow of products and services, which is not possible if not for suppliers.

Supplier selection directly impacts the efficiency, quality, and success of companies across industries, and thus its importance cannot be overstated. Through effective supplier selection, firms can optimize supply chain operations, drive cost savings, ensure product quality, mitigate risks, foster innovation, and establish long-term partnerships.

By carefully evaluating suppliers based on a range of criteria, organizations can create a robust supplier base that aligns with their strategic objectives and contributes to their overall competitiveness and customer satisfaction.

Therefore, investment of time and resources in the supplier selection process is a strategic imperative for companies aiming to achieve competitive advantage, operational excellence and sustainable growth in today's dynamic business environment.

Supplier selection is a crucial aspect of procurement and supply chain management (SCM), and it's particularly important in today's rapidly evolving business environment for several reasons. At the time of writing this paper, there are at least three recent, widely known examples of how unexpected events can negatively influence the flow of products and services in companies - the COVID-19 pandemic that started in November 2019, the blockage of the Suez Canal by Ever Given, so-called ultra-large container vessel (ULCV) in

March 2021, and the Russian invasion on Ukraine which started in February 2022. These three events still affect the supply chains, causing delays. Many companies that relied on suppliers directly affected by the above-mentioned incidents had to search for alternative sources of products and services. Those who had a well-developed supplier network at the time had to, presumably, spend significantly less time and resources on finding said alternatives, compared to companies with limited supplier networks. All three previously mentioned cases exposed vulnerabilities in global supply chains, leading to disruptions in production, sourcing and distribution. Therefore, when choosing a supplier, more focus should be put on risk management, resilience and the ability of the suppliers to manage and recover from various disruptions.

Another reason is globalisation – supply chains are becoming increasingly complex and global with companies often relying on a network of suppliers from across the world. Attention should be given to selecting the right suppliers and ensuring alternatives for these, which in turn elevates the chances of the procurement of the goods being more effective and reliable.

Additionally, the technical development, and the emergence of the AI may dramatically change the way the supplier selection has been approached until now. Some tasks within the process may not require the human's involvement and thus the entire process may significantly change.

Furthermore, increased focus on ethical considerations, as well as compliance with different types of regulations results in companies needing to ensure that the suppliers they choose meet specific standards regarding e.g. adherence to legal requirements, labour practices, environmental impact, etc.

The examples above show that despite the supplier selection topic being already extensively researched, the room for improvement, and thus further research, remains.

2 Methodology

The paper consists of two parts – the literature review and the case study. Due to the wide scope of supplier selection, the study focuses only on topics that are relevant to the case study.

The objective of the theoretical background is to provide the reader with the necessary understanding of supplier selection as a part of the purchasing process. First, the concept of purchasing is explained. Since modern purchasing activities highly rely on digital technologies and the use of online platforms, e-procurement is also described. The company case is related to indirect purchasing. Therefore, a brief explanation of the term is provided. Next, the position of procurement in the value chain is presented and several purchasing process models are discussed. The theoretical part continues with the explanation of the concept of supplier selection; strategic considerations and process models are discussed. After that, the main stages of the supplier selection process, as well as selection criteria and methods, are elaborated on. Finally, supplier relationship management (SRM) is shortly explained.

The theory part of the study will answer the following questions:

- Why does a universal purchasing process not exist?
- Why does a universal supplier selection process not exist?
- What are the common criteria and methods used in the supplier selection process?

The methodology approach for this part is exploratory research; the source is secondary data collected by conducting a literature review. This approach was chosen to collect and synthesise various perspectives on the supplier selection topic provided by multiple authors that, in turn, allowed comparing the case company's supplier selection process with reference to these.

A global automotive company was chosen as the subject of this study. Since the supplier selection practices may vary between the company's regional business units, this study focuses on the company's local business unit, comprising four of the Nordic countries and the Baltic States. The case study describes the purchasing- and supplier selection process and their interrelation in the case company, within the scope of indirect purchasing. The objective is to determine the efficiency of the existing supplier selection process and to find ways of possibly optimising it.

The case study part will answer the following questions:

- What are the challenges faced during the supplier selection process?
- How to optimise the existing supplier selection process?

The methodology approach for this part is empirical and problem-solving; the source is primary data collected directly from the case company. This approach was chosen to address an actual issue the case company is facing, namely an inefficient/time-consuming supplier selection process. Utilising this approach allows conclusions and recommendations to be based on evidence and contextualise them with reference to relevant literature.

3 Purchasing/procurement

There is no one, comprehensive definition of procurement, purchasing or sourcing – instead, there are multiple opinions on what the above mean and comprise. One of the most basic definitions of the above-mentioned can be found in the Cambridge Dictionary (2022), according to which procurement is “the process by which an organization buys the products or services it needs from other organizations”, purchasing is “the activity of buying supplies for a company” and sourcing is “the act of getting something, especially products or materials, from a particular place”.

Van Weele (2018: 9) defines sourcing as “finding, selecting, contracting and managing the best possible source of supply” that an organisation needs at the time. Procurement and purchasing are often interchangeably used terms, and it depends on a personal preference which one is chosen. In the public sector, the term procurement is preferred, whereas many industrial and service companies favour purchasing. Both terms, however, are related to the entire purchasing process, starting from specification (establishing the need of a supplier) and ending with a final delivery and evaluation of the supplier’s performance.

The definition used by van Weele (2008: 7) states that procurement/ purchasing is:

“the management of the company’s external resources in such a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company’s primary and support activities is secured at the most favourable conditions covering the materials, information and money flows up to the point of consumption”.

Baily, Farmer, Cocker, Jessop & Jones (2015: 45-46) also use the procurement and purchasing terms without differentiating between the two. However, they emphasise that the purchasing function began to gain a more strategic role in the companies’ management during the 1990s, and the early 2000s marked the beginning of “procurement” and “purchasing” becoming nearly synonymous terms.

Similarly, Möller, Fassnacht & Klose (2006: 70), O’Brien (2018: 10-11), Peek and Verweij (2013: 7-8) and van Weele (2018: 4-10) point out the significant change in the role of procurement in an organisation context. Its function is no longer tactical, without influence on the overall performance, but has become one of the sources of the organisation’s competitive advantage, with significant impact.

The author of this paper acknowledges the above-stated views and decides to also use the procurement and purchasing terms interchangeably throughout both, the theoretical and case study, parts of the document.

3.1.1 E-procurement

Electronic procurement (e-procurement, EP) is a modern approach to conducting procurement activities using digital technologies and online platforms. It involves using electronic systems, such as the Internet and software applications, to manage various stages of the procurement process, including sourcing, ordering, and supplier interactions. E-procurement is characterized by its ability to streamline and optimize procurement activities by replacing traditional paper-based methods with digital solutions. One of the activities supported by e-procurement is supplier selection (Monczka, Handfield & Patterson 2021: 54).

De Boer, Labro & Heijboer (2002: 26) recognise the following six forms of e-procurement: e-MRO, web-based ERP, e-sourcing, e-tendering, e-reverse auctioning and e-informing. Two of these forms are particularly relevant when it comes to the scope of this thesis: e-sourcing and e-tendering. E-sourcing is a process of identifying new suppliers using the Internet technology. E-tendering allows sending requests for information (RFI), requests for proposal (RFP) and requests for quotation (RFQ) via the Internet and receiving responses to them the same way. At times, the analysis and comparison of the responses are also included in the e-tendering process (De Boer et al. 2002: 26-27).

The adoption of e-procurement offers several benefits. It can lead to cost savings through improved supplier competition and negotiation processes (Bartezzaghi & Ronchi 2003: 639-640; De Boer et al. 2002: 28-32). Additionally, e-procurement enhances transparency by maintaining a digital record of procurement transactions and interactions, which can reduce the potential for errors and unethical practices. E-procurement systems also contribute to better data analysis and decision-making by providing access to real-time information on, for instance, market trends, product availability, inventory levels, shipment status or supplier performance. By using electronic “marketplaces” buyers get instant access to multiple suppliers around the world and can compare their offerings in a simpler and less time-consuming way (compared to non-web-

based purchasing); maverick buying (unplanned/emergency buying) is also reduced (Barrat & Rosdahl 2002: 113). Moreover, e-procurement systems allow for the sharing of information on demand forecast data and production schedules, which enables collaborative planning between supply chain partners (Min & Galle 2003: 227-228).

3.1.2 Direct vs. indirect purchasing

Direct purchasing and indirect purchasing are two distinct categories of procurement that differ in terms of the goods or services being procured and their relationship to the organization's core operations.

Direct purchasing refers to the procurement of goods or services that are directly related to the organization's core operations and are used in the production of goods or delivery of services. These purchases are typically specific to the organization's industry or product line. Examples of direct purchasing include raw materials, components, machinery, equipment, and any other items directly used in the manufacturing or production process. The focus of direct purchasing is on ensuring the availability of quality inputs, timely delivery, and cost-effective sourcing to support the organization's production activities. The quality and reliability of the purchased items have a direct impact on the final product's quality and the overall competitiveness of the organization (Kim & Shunk 2004: 153-155; van Weele & Rozemeijer 2022:4-6). Van Weele and Rozemeijer (2022: 6) distinguish the following characteristics of direct purchasing: limited to large product assortment, limited and transparent number of suppliers, considerable to very large procurement turnover per supplier, considerable number of purchase orders, high order size, control level depending on type of production planning and decision-making being, dominantly, the task of engineering or manufacturing specialist.

Indirect purchasing refers to the procurement of goods or services that are not directly involved in the company's core operations but are essential for supporting its day-to-day activities and enabling smooth operations. These purchases are generally considered as overhead or non-production-related

expenses. Examples of indirect purchasing include office supplies, IT equipment, maintenance and repair services, marketing and advertising services, consulting services, utilities, travel, and other non-production-related expenses. These purchases are necessary to support the organization's administrative functions, marketing efforts, facility maintenance, and overall operational efficiency. Indirect purchasing focuses on factors such as cost optimization, supplier relationships, service levels, and overall efficiency in the procurement process. The emphasis is on obtaining the best value for money and ensuring that the company's support functions operate effectively (Kim & Shunk 2004: 153-164; van Weele & Rozemeijer 2022: 4-6). Van Weele & Rozemeijer (2022: 6) distinguish the following characteristics of indirect purchasing: very large product assortment, very large and not transparent number of suppliers, limited procurement turnover per supplier, very large number of purchase orders, small order sizes, control level limited, buying forecast- or project-related, and decision-making fragmented, varying with products or services, thus no single unit holding responsibility.

The ratio between direct and indirect procurement expenditure varies between industries and individual companies. Certain industries (e.g. manufacturing) are highly dependent on direct procurement, whereas others (e.g. service-oriented companies) rely on indirect procurement (Delke, Schiele & Buchholz 2023: 2-10).

3.2 Procurement as a part of the value chain

When defining the role and position of purchasing and supply function in companies, it is worth referring to Porter's value chain model from 1985. Porter (1985: 3) defined value as "what buyers are willing to pay" and pointed out that materials/products when passing through supply chain stages to eventually become the end product, gain value. Based on that, the said value chain model was developed. Porter divided the company's activities into primary and support ones, as seen in Figure 1 on the following page.

Part of Porter's model is profit margin – it is a way of recognizing that buyers are inclined to pay more for the combined value provided than for the sum of the costs of the individual components involved in the process.

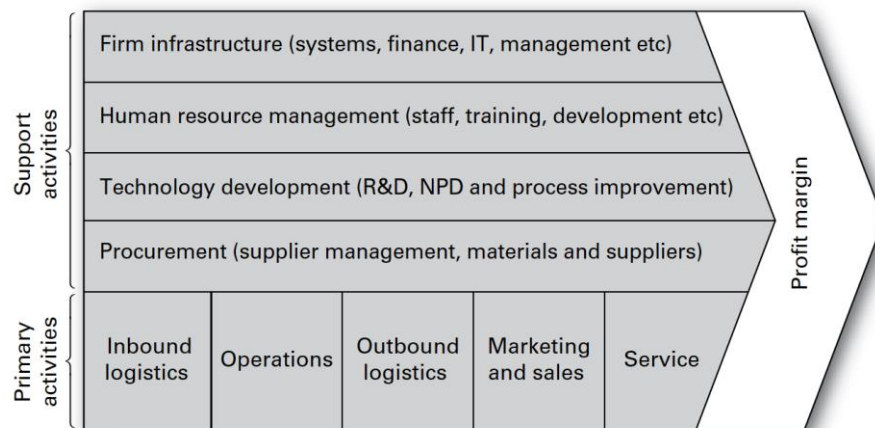


Figure 1. Porter's value chain model (O'Brien 2018: 300)

Purchasing, as seen in the model, is one of the support activities. The reason for this is that the purchased inputs may be related to both, primary and support activities (van Weele 2018: 4-6).

3.3 Purchasing process – models

The purchasing process includes all the steps that must be completed when a firm is acquiring materials, products or services (Monczka et al. 2021: 42).

Purchasing process model (further referred to as PPM) is a visual presentation of said steps. PPMs have become increasingly important in supply chain management due to being useful tools to help firms standardise, control and monitor their purchasing activities, ensuring that goods and services are obtained efficiently, cost-effectively, and according to the organization's objectives and needs (Bäckstrand, Suurmond, van Raij & Chen 2019: 1-2).

Current literature provides various models of the purchasing process. An overview of different types of PPMs has been provided by Bäckstrand et al. in 2019. Based on the literature review, supported by a survey, 73 distinct PPMs were identified and further classified as decision-making, tactical/operational, strategic or cyclical.

3.3.1 Decision-making process models

An example of a model that considers the decision-making process of purchasing is a model proposed by Rados (1970: 12). As can be seen in Figure 2, the purchasing process is viewed as a series of questions, where a further step depends on a decision made a step before.

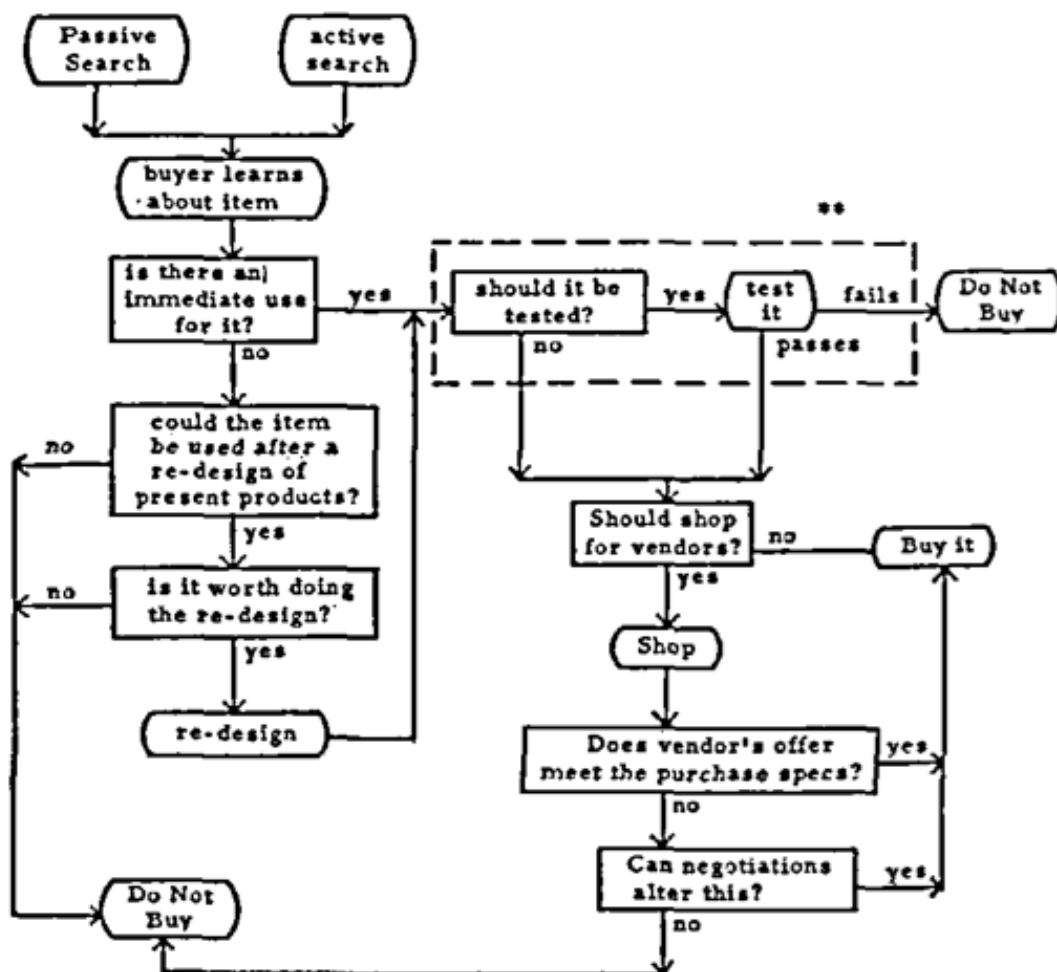


Figure 2. A decision-making process model (Rados 1970: 12)

The dotted line in the upper-right corner of the model encloses the test phase. In that phase, as seen in Figure 3 on the following page, more questions are posed, the answers to which eventually lead to a final decision on whether the firm should or should not purchase from the supplier in question.

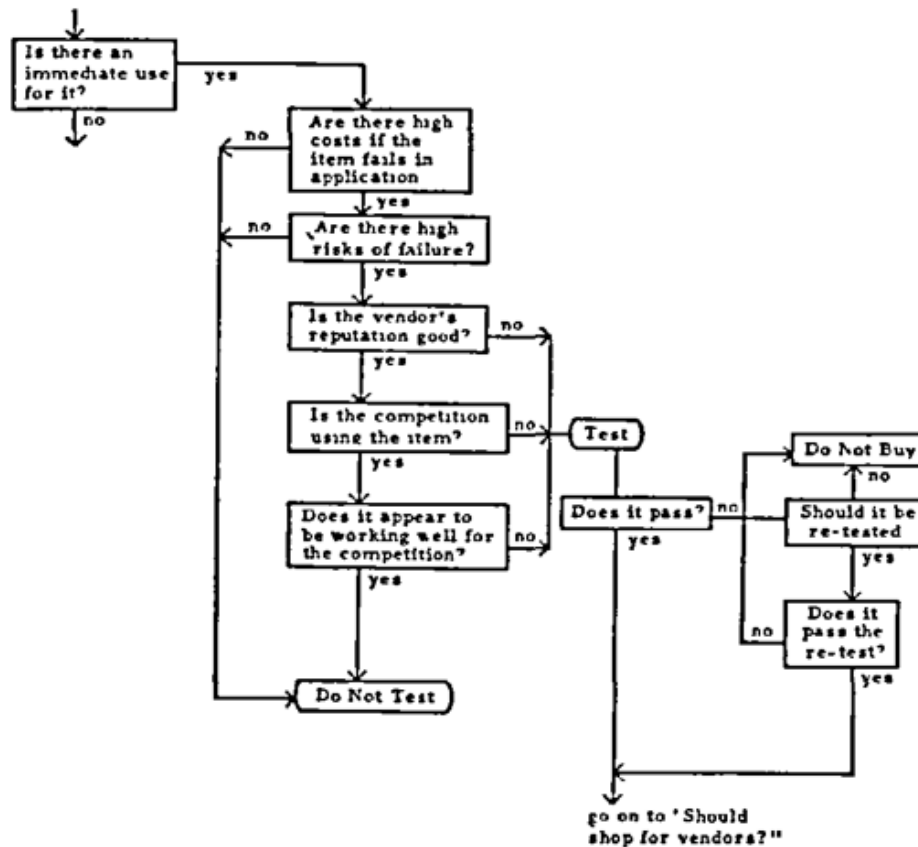


Figure 3. The testing phase of the decision-making process (Rados 1970: 13)

Other models that belong to the decision-making category “emphasize the flow of information and decisions in the purchasing process” (Schill 1978, as quoted in Bäckstrand et al. 2019: 3), and yet other ones focus on the decisions made by firms’ decision-making units, e.g. Palmer, Green & Ventura (1996: 22-29) model in which main stakeholders and the way they interact during the purchasing process are exhibited. Another example is a PPM proposed by Parikh & Joshi (2005: 1042-1061) where small purchases are made with the use of a purchasing card. Coyle, Bardi & Langley (2003: 41-49) on the other hand illustrate the purchasing process as a decision tree – the starting point of this model is a make-or-buy decision. After a series of questions related to the

future purchase and the potential supplier, the model ends with the post-purchase evaluation of the supplier's performance.

3.3.2 Linear process models

Linear process models tend to be the most common ones in the literature. The study conducted by Bäckstrand et al. (2019: 4) identified more than 50% of analysed PPMs to be linear. Furthermore, the majority of them are either identical representations of van Weele's PPM (see Figure 4) or are designed based on it.



Figure 4. A linear process model, example 1 (adapted from van Weele 2018: 28)

The model is a sequence of six steps, illustrating that the purchasing process starts with defining specification (i.e. making the make-or-buy decision) and ends with an evaluation phase. In this way, it is similar to the previously mentioned decision-making model proposed by Coyle et al. (see p. 11). Van Weele (2018: 28), contrary to Coyle et al. (2003: 41-49), proposes a sequence of steps/phases (instead of a series of questions) that are gone through during the purchasing process. The goal, however, remains the same – selecting a suitable supplier and evaluating its performance after the purchase is made.

As a comparison, Figure 5 presents the purchasing process model by Lysons & Farrington (2012).



Figure 5. A linear purchasing process model, example 2 (adapted from Lysons & Farrington 2012: 4)

It can be observed that there is a similarity between both linear PPM examples. The difference is mainly in the number of steps and thus the level of detail both authors go into when visualising the purchasing process. Additionally, though the steps are named differently, they generally correspond with each other to a significant extent. This statement is supported by Bäckstrand et al. (2019: 4), whose research concludes that linear PPMs tend to consist of either fewer or more steps than van Weele's model – they typically include between four and eleven steps.

It is worth noting, that the linear PPMs have certain weaknesses. Van Weele (2018: 32) identifies the following examples of them:

- make-or-buy decision is not included
- firm's most probably existing previous experience with buying goods and/or services is not reflected
- no track record of relationships with suppliers which the firm previously cooperated with
- no preparation phase for the new purchasing project.

3.3.3 Cyclical process models

The cyclical PPMs represent the purchasing approach that involves the repetition of the cycles or phases of the purchasing process adopted by a firm. In other words, after a sequence of steps has ended, the new/future purchasing process starts from the same step as previously. The cyclical purchasing process models allow ongoing evaluation and adjustment, ensuring that the firm adapts to evolving needs, market dynamics, and supplier performance. By focusing on continuous improvement, companies can optimize their procurement practices and achieve better outcomes over time.

Figure 6 on the following page presents the extended purchasing process model introduced by Van Weele. It is an outcome of the researchers noticing the insufficiencies and weaknesses of the linear PPMs. One of the first companies to adopt this model was IBM (van Weele 2018: 32).

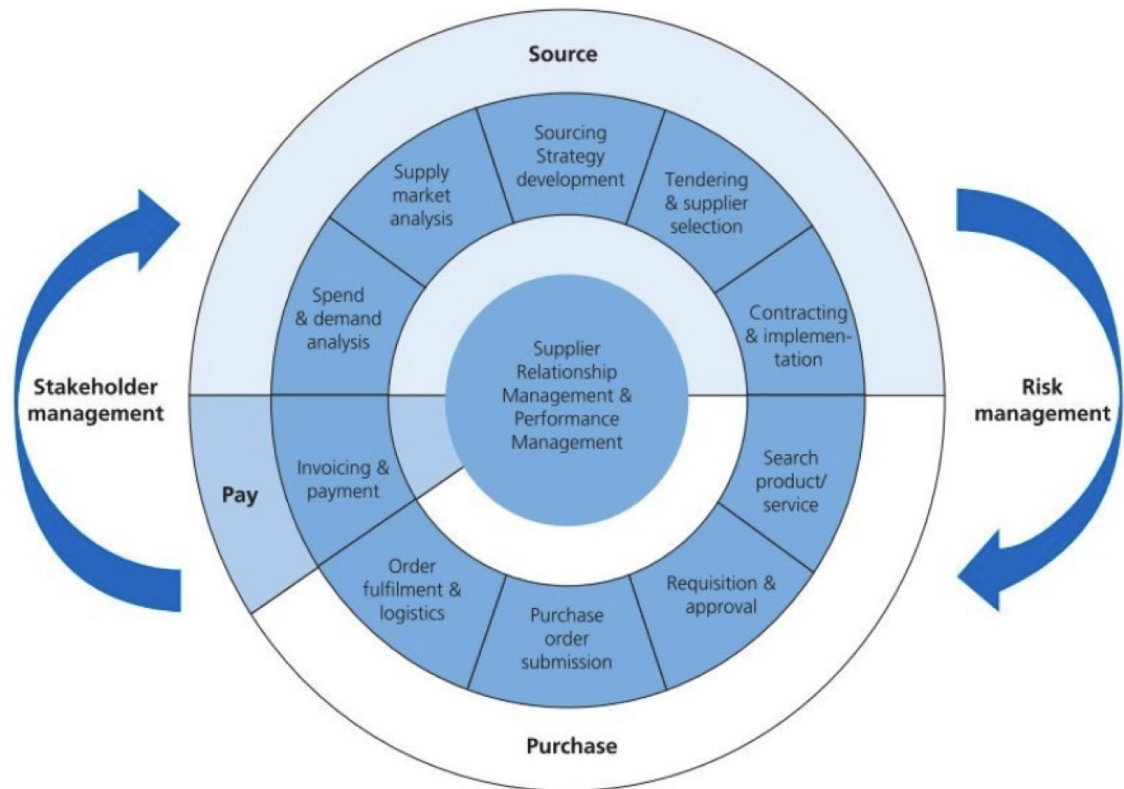


Figure 6. Extended purchasing process model (van Weele 2018: 33)

The above model identifies three different key processes: **source** (including e.g. spend and demand analysis, supply market analysis, supplier selection, etc.), **purchase** (including the search for a specific product or service, preparing, approval and submission of the purchase order requisition, as well as the order fulfilment and securing on-time delivery), and **pay** (reception, check and payment of the invoiced amount to the supplier, according to the payment terms agreed). Risk and stakeholder management are also part of the process.

An ongoing evaluation and adjustment which this model allows, leads to the improvement in the firm's performance. Furthermore, if the firm performs these activities better than competitors, it will often gain a competitive advantage (Monczka et al. 2021: 52-55).

It can be observed that cyclical PPMs are more complex than e.g. linear ones and thus are often used in more advanced purchasing projects, contrary to buying individual products and/or services.

3.3.4 Strategic process models

The study conducted by Bäckstrand et al. (2019: 5) recognises the Purchasing Excellence Framework, developed by Monczka in 1999, as the most prominent out of all strategic PPMs identified. Following Figure 7 is a reproduction of this model.

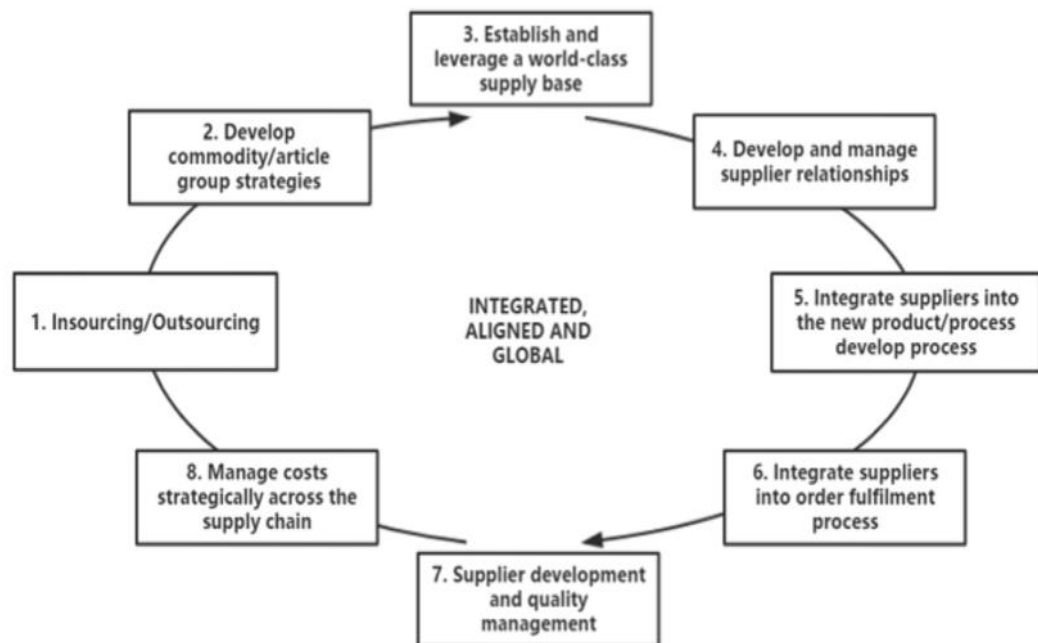


Figure 7. Strategic process model (reproduced by Bäckstrand et al. 2019: 6)

The focal point of this model is creating the long-term process of purchasing policy design and stresses the role of purchasing as an “integrated, aligned and global” part of the overall strategy of the firm (Bäckstrand et al. 2019: 5).

3.3.5 Hybrid linear-cyclical process models

Hybrid linear-cyclical process models are combinations of linear and cyclical approaches to the purchasing process. Linear models involve a step-by-step progression towards a final goal, while cyclical models involve repeating cycles of activities to refine and improve the process. The hybrid model combines the strengths of both approaches to create a more efficient and effective purchasing

process. An example of such a model, suggested by Bäckstrand et al. (2019: 7), is presented in the following Figure 8.

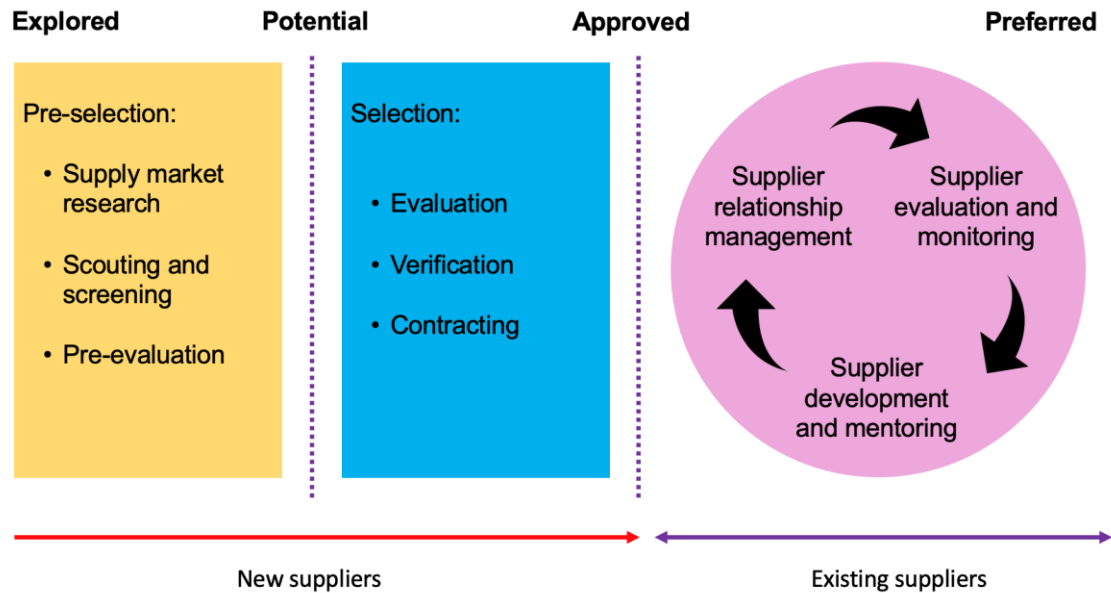


Figure 8. A hybrid linear-cyclical process model (adapted from Johnsen, Howard & Miemczyk 2014: 31)

The above model is an illustration of the strategic sourcing process proposed by Johnsen et al. (2014: 31), however, it clearly illustrates the potential hybridity of the purchasing process, and thus is used to explain the concept. As can be observed, the model consists of two streams of processes which are parallel and one cycle. The division of purchasing stages is done based on the status of suppliers. Suppliers, to become preferred ones (according to this model), need to pass several stages of approval. After this, their relationship with the purchasing company, as well as their performance and development, are managed continuously.

The above described several purchasing process models present various approaches to the topic. It is therefore a fact that one, universal model does not exist. This is because purchasing processes can vary significantly depending on several factors, including the industry, the organization's size or existing specific requirements. Additionally, purchasing processes are subject to continuous

improvement and adaptation to meet evolving business needs as well as market fluctuations and dynamics.

While there are similarities in purchasing processes across companies, the specific steps and activities involved can differ based on various factors. The complexity of the supply chain, the types of goods or services being procured, as well as the regulatory environment, can all influence the purchasing process. Moreover, the constant digital transformation and advancements in technology have significantly impacted purchasing processes. The use of e-procurement systems (briefly described in Sub-subchapter 3.1.1), supplier portals and automated workflows has transformed and streamlined the way organizations procure goods and services. As technology continues to evolve, so do the potential modifications in purchasing process models. Furthermore, various industries may require unique approaches to the purchasing process. For example, in highly regulated industries like aircraft engineering or biotechnology, additional steps may be necessary to ensure compliance with legal and quality standards. On the other hand, organizations in fast-moving consumer goods may prioritize agility and speed in their purchasing processes to respond quickly to changing market demands. Bäckstrand et al. (2019: 7) conclude that a situation where a single PPM would exist, is not even necessarily a desirable one, due to the pluralistic character of the purchasing field. It is in the company's best interest to develop a customized purchasing process model that aligns with its specific needs and goals.

4 Supplier selection

Supplier selection, as presented in Chapter 3, is a part of the company's purchasing process. Kim & Wagner (2012: 2864) define supplier selection as a decision-making process, the goal of which is to select the best possible suppliers from a prequalified group, based on previously established criteria. The main objectives of this process are reducing purchase risk, maximizing overall value to the purchaser, and developing closeness and long-term relationships between buyers and suppliers (Carter & Croome 2020: 160-171;

Monczka et al. 2021: Chapter 7; Taherdoost & Brard 2019: 1024-2034). In today's highly competitive environment, with the market situation constantly fluctuating and environmental pressure increasing, an effective supplier selection process is an extremely important contributor to a company's success (Humphreys, Wong & Chan 2003: 349-356; Tahriri, Osman, Ali & Yussuf 2008: 201-208). The responsibility of the firm's management team regarding the decisions affiliated with supplier selection is significant. The outcomes of said decisions are critical to a firm's profitability and, at the same time, competitiveness, due to the substantial revenue amount being spent on purchasing (De Boer 2001: 75-89).

Additionally, various authors (Bhutta & Huq 2002: 126-128; Ghodsypour & O'Brien 1998: 199-200; Monczka et al. 2021: 252) recognise supplier selection as one of the most critical processes in the purchasing and supply management function.

Therefore, it is essential to use appropriate criteria (see subchapter 4.4) and methods (see subchapter 4.5) to ensure that the selected suppliers meet the company's needs and objectives.

4.1 Strategic considerations in supplier selection

Koufteros, Vickery & Dröge (2012: 93-115) observed that, from the resource-based view, strategic supplier selection positively affects the buyer's competitive performance. The sourcing strategy phase of the purchasing process is vital as it sets the direction for how the organization will engage with suppliers and manage its supply chain. The selection of an appropriate sourcing strategy depends on various factors, including the organization's goals, market conditions, supplier capabilities, and risk considerations. The approach to this topic varies not only between the companies but also within the same company. The reasons for this include the nature of the purchased good or service, market fluctuations, corporate objectives, buyer preferences, project specifications, budget, time constraints, etc.

Several sourcing alternatives, as well as critical sourcing issues which need to be considered by the buyer, are described in the following Sub-subchapters.

4.1.1 Buying from manufacturer or distributor

A decision on whether to buy from a manufacturer or distributor is usually based on factors including the size of the purchase, the manufacturer's policies regarding direct sales, the extent of services required, etc. However, the current trends caused an increase in the role of distributors in providing buyers with low-cost solutions. The major reasons for this are: manufacturers not being able to (or deciding not to) handle a large number of transactions essential to selling directly, and buyers requiring more services than the manufacturers can provide. The reasons why distributors can offer competitive prices include marketing costs being spread over the variety of items they sell, savings in transportation charges when buying in truck- or carloads, etc. (Johnson, Leenders & Flynn 2011: 324-325; Monczka et al. 2021: 260-261).

4.1.2 Supplier's size

While analysing what needs to be purchased, the buyers need to consider whether the potential supplier will be able to fulfil all requirements in regard to the volume or variety of the sought goods or services. Thus, larger suppliers may be preferred, especially in a situation where the company decides to follow a strategy of selecting only one or a few suppliers. However, when the speed of delivery or flexibility are essential and are more important than price, the buyer may opt for a smaller supplier. Naturally, there are exceptions to the above generalisations, e.g. smaller-scale supplier may fill a niche in the market that the bigger one is either not able to or decides not to fill, in which case the smaller supplier is selected, regardless of factors like price, volume, delivery speed, etc. (Johnson et al. 2011: 326; Monczka et al. 2021: 263).

4.1.3 Local, national or global suppliers?

National and global suppliers may offer better prices and/or exceptional technical service, however, the local ones are usually more responsive to the buyer's changing needs and can also make frequent smaller deliveries economically. The emergence of JIT (just-in-time), quick-replenishment and

lean systems, followed by their increasing popularity, significantly favour the local suppliers, who can adhere to the buyer's needs much faster than the national or global ones. Community goodwill is another factor that may influence the choice of a supplier – the buying company's personnel and their families are provided with housing, schools, social life, etc. by the local community, to which the company "owes" (Johnson et al. 2011: 325; Monczka et al. 2021: 261).

4.1.4 Single, multiple, dual or cross sourcing?

Single sourcing supplier selection occurs when all buyer's needs are met by one supplier. It usually is a strategic process, designed to be long-term. Multiple sourcing supplier selection occurs when one supplier is not able to meet all buyer's demands. This process, compared to single sourcing supplier selection, is more tactical – the buyer purchases identical goods from various suppliers and therefore order quantities are split between them (Ghodsypour & O'Brien 1998: 200-201). Single sourcing benefits include optimum leverage and power over the supplier, the possibility to achieve economies of scale, better coordination, the ability to develop closer and stronger relationships, development of various value-adding programmes, such as process improvement, supplier stocking, etc. (Monczka et al. 2021: 261-262; Yildiz Çankaya 2020: 129-133). The disadvantages of single sourcing include increased supply risk if the supplier fails to deliver, limited capacity of the supplier, potential increase of prices in the short term, etc. (Bozarth, Handfield & Chandiran 2013: 223). Multiple sourcing benefits pointed out by Monczka et al. (2021: 261-262) and Yildiz Çankaya (2020: 129-133) include checking against price increases, active competition between the suppliers which in turn may positively affect their performance, improved assurance of supply, etc. On the other hand, the disadvantages include reduced supplier loyalty, different product attributes with varying quality, poorer supplier performance if the volumes in question are not enough to merit the supplier's attention, etc. (Bozarth et al. 2013: 223).

Alternatively, companies can choose cross-sourcing, which means that two suppliers with the same capabilities are used for delivering similar products or services. By opting for cross-sourcing companies lower the risk of supply disruption – if one supplier fails to deliver the goods or services, another supplier can be utilised. Another approach is dual sourcing, which occurs when two suppliers deliver the same product or service. The split of the business is, according to Bozarth et al. (2013: 223), typically 70% to one supplier and 30% to the other. By utilising dual sourcing, the volume benefits of single sourcing are combined with a lower risk of supply disruption attributed to multiple or cross-sourcing (Bozarth et al. 2013: 223).

4.1.5 Risk issues

During the supplier selection process companies face various risk issues which can have a significant impact on their business operations and performance. The risks which need to be carefully assessed and mitigated to ensure the selection of reliable and capable suppliers are related to, amongst others: financial conditions (e.g. financial stability of suppliers), quality and reliability, ethics and social responsibility, compliance with regulations, laws and standards, globalisation (which results in longer supply chains), reduced inventory (e.g. JIT and lean concepts), natural disasters (e.g. hurricanes, volcano eruptions), geopolitical issues (e.g. wars), epidemics/pandemics, etc.

4.1.6 Sustainability issues

Sustainability has become a critical consideration during the supplier selection process. This is caused by companies increasingly recognizing the importance of environmental and social responsibility in their operations. Integrating sustainability issues into supplier selection helps firms align their procurement practices with broader sustainability goals and ensure the selection of suppliers who demonstrate a commitment to sustainable practices. Sustainability issues include e.g. environmental impact, social and labour standards, diversity and inclusion, etc. To address sustainability issues during the supplier selection process, companies employ sustainability assessment certifications,

frameworks and supplier questionnaires. They also engage in dialogue with suppliers to understand their sustainability practices and collaborate on improvement initiatives (Carter & Rogers 2008: 360-387).

The sourcing strategy is a critical component of the purchasing process. It involves making decisions on how to acquire goods, services, or resources from external suppliers. The choice of sourcing strategy depends on various factors, including the organization's goals, market conditions, supplier capabilities, and risk considerations. Different sourcing strategies offer different benefits and risks. Organizations must carefully evaluate these factors to select the most appropriate sourcing strategy for their specific needs and objectives.

4.2 Supplier selection process - models

The supplier selection process is a vital activity in supply chain management. It involves identifying and evaluating potential suppliers to determine the best fit for the company's needs. The process typically comprises several steps, which may vary depending on the company's specific requirements. This means that one, universal model based on which companies would select suppliers, does not exist. Regardless of the approach taken, the objective of the process remains the same – reduction of purchase risk and maximisation of the overall value of selected suppliers to the company (Monczka et al. 2021: Chapter 7).

Figure 9 on the following page illustrates an example of the supplier selection and evaluation process model proposed by Monczka et al. (2021: 253). As can be seen, the process includes seven steps which form a cycle. The starting point of this process is the recognition of a need for a supplier, followed by the identification of key sourcing requirements and potential supply sources. In the next phase company needs to determine what sourcing strategy will be followed. After that, the number of potential suppliers is limited and the company needs to conduct a detailed review of selected evaluation criteria. When all the necessary information is collected, the most appropriate supplier is selected and agreement is reached.

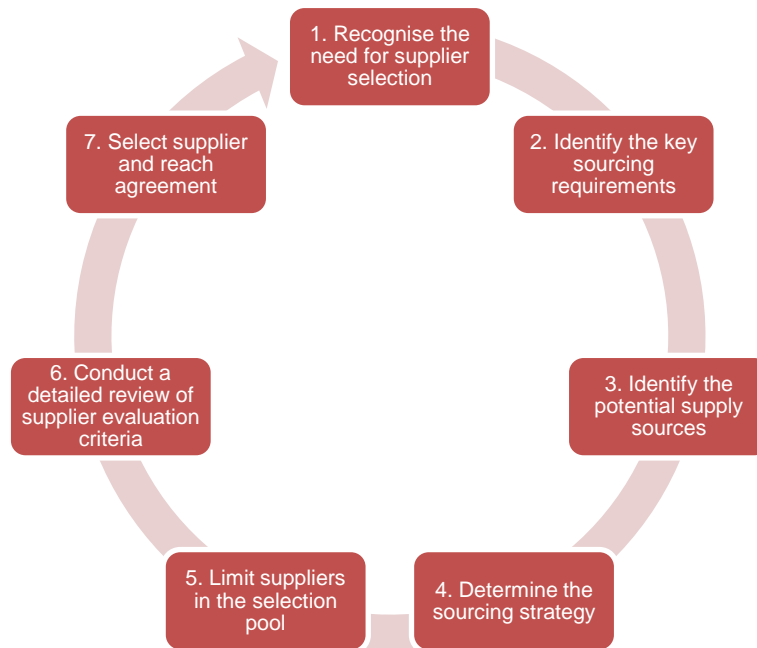


Figure 9. Supplier evaluation and selection process (adapted from Monczka et al. 2021: 253)

It is this paper author's opinion, that the initial two stages of the process introduced by Monczka et al., namely recognising the need for supplier selection and identifying the key sourcing requirements, are rather part of the purchasing process and are gone through before the actual selection phase.

As a comparison, the following Figure 10 depicts the supplier selection process described by van Weele & Rozemeijer (2022: 36-37). The process comprises three steps: preliminary qualification of suppliers and creation of "bidders list", preparation of requests for quotation followed by an analysis of received bids, after which supplier(s) can be selected.

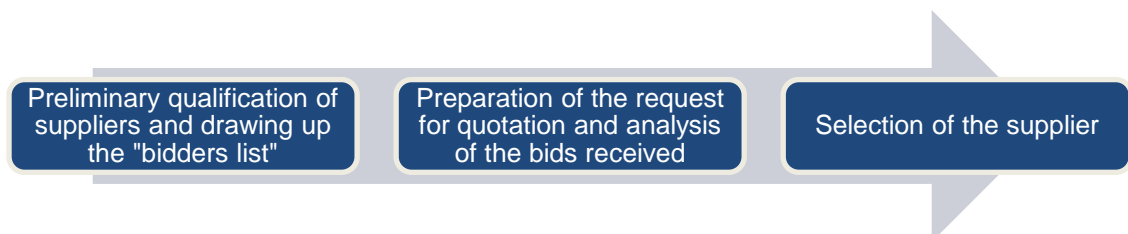


Figure 10. Supplier selection process (adapted from van Weele & Rozemeijer 2022).

It is worth noting that in the previous van Weele's work from 2018, the above-presented selection process included one additional step at the beginning - determining the method of subcontracting. The most probable reason for removing it is the fact that subcontracting methods are often established during the earlier purchasing process phase (namely specification), which precedes the actual supplier selection stage. Furthermore, specifications are often drawn with few potential suppliers in mind, which shows how intertwined the purchasing process steps are (van Weele & Rozemeijer 2022: 36-37).

O'Brien's (2019: 303) view on the supplier selection process is notably similar to the one of van Weele & Rozemeijer (see following Figure 11), except for the negotiations and contracting phases, which van Weele and Rozemeijer identify as separate steps of the purchasing process. As can be observed, the process comprises six steps: pre-qualification (during which suppliers who do not meet the basic requirements are eliminated), three evaluation phases (during which potential suppliers are requested to provide more information, audits and due diligence are performed, etc.), followed by negotiations and contracting.

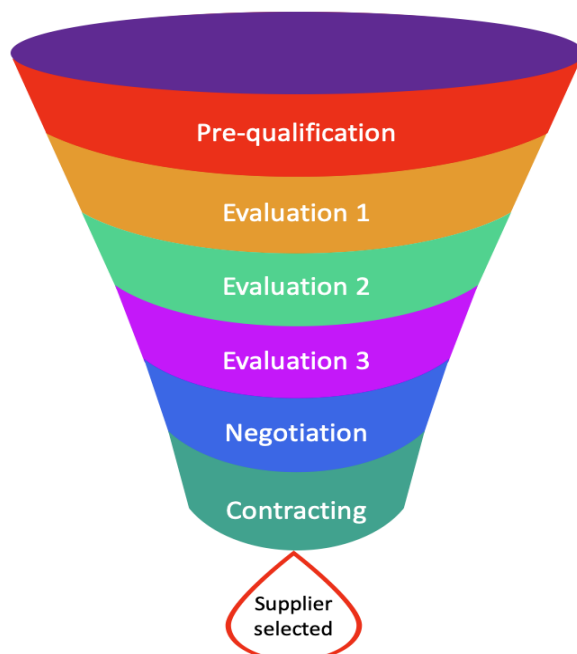


Figure 11. Supplier selection “funnel” process (adapted from O'Brien 2019: 303)

O'Brien (2019: 303-304) underlines that the aim of this process is not necessarily a selection of the final supplier, but can, instead, be used as a means of shortlisting the potential suppliers with which further negotiations will take place. How meticulously the entire process is conducted, depends on the company's objectives and strategy, the sought goods or services themselves, etc. It is this paper's author's opinion, that the contracting stage is rather a part of the purchasing process, and thus does not belong to the actual supplier selection phase.

Iloranta & Pajunen-Mohonen (2015: 235), similarly to O'Brien, incorporate the negotiation phase into the supplier selection process (see following Figure 12).

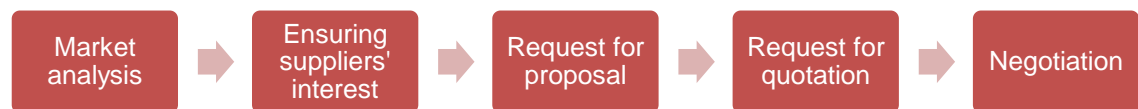


Figure 12. Supplier search and evaluation process (adapted from Iloranta & Pajunen-Muhonen 2015: 235)

What differentiates this model from the previously described ones is the step during which the buyer ensures the supplier's interest. Making sure that the supplier is interested is an important aspect of the supplier selection process due to its potential impact on establishing and maintaining mutually beneficial buyer-supplier relationships.

It is worth noting that regardless of which process model one examines, it rarely happens that all of the steps are gone through unless the case considers a first-time purchase of goods or services. Robinson, Faris & Wind (1967: 22-25) distinguished three types of purchasing situations, later referred to by van Weele & Rozemeijer (2022: 33-34):

- New-task situation – the company decides to purchase a completely new product/service from an unknown supplier.
- Modified rebuy - either the product/service or the supplier is unknown to the company.

- Straight rebuy – the company purchases a known product/service from a known supplier. It is the most common situation.

The above-described purchasing situations are considered in De Boer's (1998, as referred to by De Boer 2001: 77) supplier selection framework, depicted in the following Figure 13. De Boer's framework divides the supplier selection process into four stages shown in the vertical axis: problem definition (in other words deciding what exactly the company wants to achieve by selecting a supplier), formulation of criteria, pre-qualifying suitable suppliers and making the final choice. The horizontal axis represents the diversity of situations regarding the importance and complexity of the contemporary purchasing practice and has a significant impact on the company's supplier selection strategy.

| | New task | Modified rebuy (leverage items) | Straight rebuy (routine items) | Straight rebuy (strategic/bottleneck) |
|-------------------------|--|---|--|---|
| Problem definition | Use a supplier or not? | Use more, fewer or other suppliers? | Replacing the current supplier? | How to deal with the supplier? |
| Formulation of criteria | Varying importance One-off decision No historical data on suppliers available | Moderate/high importance Repeating decision Historical data on suppliers available | Low/moderate importance Repeating decision Historical data on suppliers available | High importance Repeating evaluation Historical data on suppliers available, yet very few actual selections |
| | No previously used criteria available Varying importance | Previously used criteria available | Previously used criteria available | Previously used criteria available |
| Qualification | Small initial set of suppliers Sorting rather than ranking No historical records available | Large set of initial suppliers Sorting as well as ranking Historical data available | Large set of initial suppliers Sorting rather than ranking Historical data available | Very small set of suppliers Sorting rather than ranking Historical data available |
| Choice | Small initial set of suppliers | Small to moderate set of initial suppliers | Small to moderate set of initial suppliers | Very small set of suppliers (often only one) |
| | Ranking rather than sorting | Ranking rather than sorting | Ranking rather than sorting | Historical data available |
| | Many criteria Much interaction No historical records available | Also: how to allocate volume? Fewer criteria Less interaction | Fewer criteria Less interaction Historical data available | Evaluation rather selection Sole sourcing |
| | Varying importance Model used once | Historical data available Model used again | Model used again Single sourcing rather than multiple sourcing | |

Figure 13. Supplier selection framework (De Boer 1998, as referred to by De Boer 2001: 77)

As can be observed, Kraljic's purchasing portfolio matrix developed in 1983 has been utilised to address said diversity in terms of profit impact and supply risk (see Figure 14 on the following page for reference).

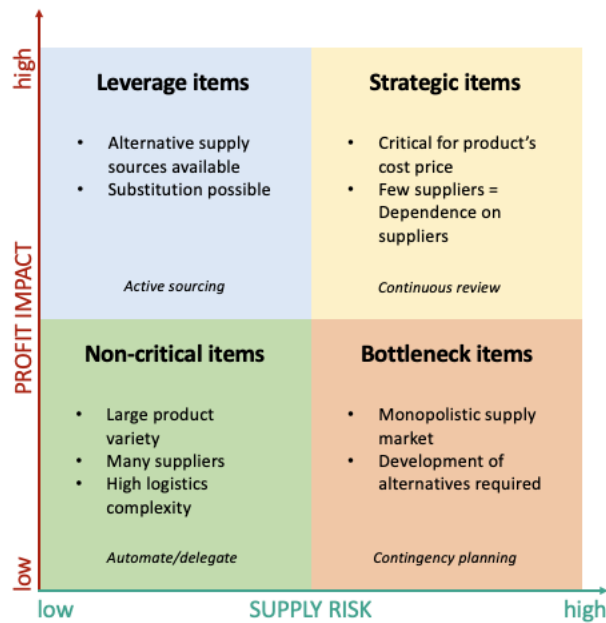


Figure 14. Kraljic's purchasing portfolio matrix (adapted from Kraljic 1983: 109-117; O'Brien 2018: 161-162; van Weele & Rozemeijer 2022: 106-110)

Supply risk is measured in terms of market structure, geographic distance, product availability (short- and long-term), number of potential suppliers available, cost of changing suppliers, available substitutes and inventory risks. Low supply risk occurs e.g. when a product can be purchased from many suppliers and costs of switching are low. High risk, on the other hand, occurs when there is only one supplier available. Profit impact is measured in terms of purchased volume, materials' cost, total cost and percentage of total purchase costs. The higher the amount of money or volume involved, the higher the potential profit impact (van Weele & Rozemeijer 2022: 106-110). Profit impact and supply risk are therefore the variables, the combination of which forms a two-dimensional matrix, consisting of four quadrants. **Non-critical (routine) items** have a low value per item and can be purchased from many suppliers; their handling, however, is more costly than the products themselves – according to van Weele & Rozemeijer (2022: 106-110), they constitute 80% of the procurement department's time and energy. **Leverage items** can be obtained from various suppliers and thus can be substituted if needed. These items influence the end-product cost price relatively strongly and are purchased in large volumes. **Strategic items** are critical for a product's cost price and

often have only one source of supply. Possible short-term changes of suppliers incur considerable costs. **Bottleneck items** are of relatively low monetary value, but they mostly can be obtained only from one supplier and therefore carry a high supply risk.

It is this paper author's opinion, that the problem definition as well as formulation of criteria described by De Boer are related to the supplier selection, however, these are rather part of the purchasing process and not the supplier selection phase itself.

The analysis of the several models introduced above shows that one, universal supplier selection process does not exist. This can be attributed to several factors. Firstly, supplier selection is a complex and multifaceted process that involves considering various criteria and factors. Different companies have different priorities, requirements, and preferences when it comes to selecting suppliers (Jana 2020: 66-67). For example, some organizations may prioritize cost-effectiveness, while others may prioritize quality or sustainability (Park, Okudan Kremer & Ma 2018: 590-601). Additionally, the specific industry and context in which the company operates can also influence the supplier selection process (Imran, Hameed & Haque 2018: 245-259). Furthermore, supplier selection is influenced by the specific goals and objectives of the company. For instance, companies that prioritize innovation may focus on selecting suppliers that are known for their innovative capabilities (Wagner & Bode 2013: 65-78). On the other hand, organizations that prioritize operational flexibility may prioritize suppliers that can adapt to changing market conditions. The specific goals and objectives of the company can vary widely, which, in turn, makes it difficult to develop a one-size-fits-all supplier selection process. Moreover, supplier selection is often influenced by the availability and accessibility of information. Organizations need to gather and analyse relevant information about potential suppliers, such as their capabilities, track record, financial stability, and reputation. However, obtaining accurate and reliable information about suppliers can be challenging, especially in global supply chains where suppliers may be located in different countries and operate under different

regulatory frameworks. The lack of standardized and easily accessible information can hinder the development of a universal supplier selection process. Additionally, the dynamic nature of the business environment and the evolving needs of companies further complicate the supplier selection process. The business environment is constantly changing, and thus companies need to adapt to new technologies, market trends, and customer demands (Imran et al. 2018). As a result, the criteria and factors companies consider when selecting suppliers may change over time. This dynamic nature of the business environment makes it difficult to develop a static and universal supplier selection process. Therefore, companies need to tailor their supplier selection process to their specific needs and context, taking into account various criteria and factors.

4.3 Main stages of the supplier selection process

The previous Subchapter 4.2. presents several authors' approaches to the "design" of the supplier selection process. As stated above, a universal model simply does not exist. Additionally, it rarely happens that all of the steps are gone through unless the case considers a first-time purchase of goods or services. Therefore, this paper's author decides to introduce the main stages of the supplier selection process by creating a hybrid model, based on the approaches presented in the previous Subchapter 4.2.

4.3.1 Identification of potential suppliers

The first step of the supplier selection process is the identification of potential supply sources and assembling so-called bidders' long list. Bidders' long list comprises suppliers which meet the prequalification criteria set by the buyer. Due to the volatile and fast-paced buying environment, this phase becomes a strategic issue in itself; buyers must possess expert knowledge of their industry so that they know where to look for a particular goods and services supplier (Benton 2021: 165-168). The tools and information sources used for this purpose are the company's supplier database including current and past

suppliers, online searches, e-catalogues, trade journals, sales representatives, local chambers of commerce, trade shows, professional associations and published information or potential suppliers themselves (Benton 2021: 167; Burt, Petcavage & Pinkerton 2010: 241-244; Johnson et al. 2011: 317-321; Monczka 2021: 255-260). Van Weele & Rozemeijer (2022: 37), note that bidders' long lists tend to comprise the suppliers which the company cooperated with in the past – these usually are the suppliers representing excellent past performance and thus having superb vendor rating score. Complex supply market research, due to being a costly and time-consuming process, is therefore typically done when the company faces a situation where no approved suppliers exist or when the company decides to implement some changes to the existing supplier database (Beil 2010: 2-6).

The outcome of the supply market research may influence the sourcing strategy, e.g. when the buyer discovers that there is a low number of potentially suitable suppliers available, there are no local suppliers, unforeseen changes to the budget occur, etc. This can be the reason that some companies prefer to first identify the potential suppliers and only then determine the supplier selection strategy.

4.3.2 RFI – request for information

After the potential suppliers have been identified, they will receive an RFI. An RFI is a document used by organizations to gather general information and a broad understanding of potential suppliers and their capabilities without requesting specific proposals or quotes. RFI allows buyers to evaluate the market, assess supplier qualifications, and gather information to support decision-making during the subsequent supplier selection phases (Cousins, Lamming, Lawson & Squire 2008: 61).

Some companies also choose to visit the potential suppliers or order an audit related to e.g. quality, safety or compliance. Visiting potential suppliers provides first-hand insights into their facilities, operations and practices, enabling companies to make informed decisions. Additionally, site visits can help identify

potential risks and evaluate supplier performance. To avoid excluding potentially valuable suppliers, overly restrictive criteria need to be, at this stage, avoided. Based on the information received, the company can select the most promising suppliers that fulfil the requirements defined at the earlier stages of the purchasing process. The outcome of this phase is assembling bidders' short list, typically including three to five prospective suppliers (Monczka et al. 2021: 264-268; van Weele & Rozemeijer 2022: 37).

4.3.3 Tendering process and ensuring suppliers' interest

After creating the bidders' short list, the company will send a request for proposal (RFP) or a request for quotation (RFQ) to all suppliers remaining in the pool. This process is referred to as closed tender. If the suppliers weren't previously pre-qualified, the process would be called an open tender. It is worth noting that sometimes companies use the RFP and RFQ as synonyms, which is, due to different circumstances in which these requests are utilised, incorrect (Cousins et al. 2008: 61).

An RFP is a document used to solicit comprehensive and detailed proposals from potential suppliers. It is typically used when the buyer seeks complex services, innovative solutions or specialized products, requiring suppliers to demonstrate their capabilities, technical expertise, and proposed approach. Additionally, it is used when the requested product or service does not exist yet (van Weele & Rozemeijer 2022: 37). The RFP provides suppliers with specific requirements, evaluation criteria, and instructions for submitting their proposals. Additionally, the RFP allows buyers to obtain detailed information from suppliers regarding their understanding of the buyer's needs, proposed solutions, pricing, delivery schedules and contractual terms. The RFP process facilitates a comprehensive evaluation of supplier proposals to identify the most suitable solution for the buyer's requirements (Ropp 2022).

An RFQ is a document used to solicit pricing information and quotations from potential suppliers. It is typically used for purchasing standardized goods or services, where the buyer already has a clear understanding of the required

specifications, quantities, and delivery terms. The RFQ focuses on obtaining competitive pricing from suppliers and may include additional terms and conditions that suppliers must adhere to when submitting their quotations. The RFQ process allows buyers to efficiently collect pricing information and then compare quotes from multiple suppliers. It streamlines the procurement process for standardized items, allowing buyers to make cost-effective purchasing decisions based on competitive pricing and other relevant factors (Kumaraswamy 2023).

During this stage, the company should also ensure the potential suppliers' interest. This allows the buyer to identify suppliers whose values, goals, and strategies align with their own. This alignment is crucial for establishing long-term partnerships and collaboration, facilitating joint efforts towards shared objectives. Additionally, considering the suppliers' interests helps build trust and commitment between the buyer and supplier. Suppliers who feel that their interests are acknowledged are more likely to be committed to fulfilling the buyer's requirements, maintaining open communication, and resolving issues in an effective and timely manner (Fawcett, Ellram & Ogden 2014). Moreover, suppliers' genuine interest in the buyer's success, results in suppliers being more inclined to invest in their capabilities and resources, as well as continuous improvement efforts. This interest can result in improved supplier performance, including product quality, on-time delivery, and responsiveness to buyer's needs (Li, Ragu-Nathan, Ragu-Nathan & Rao 2006: 107-124). Furthermore, suppliers' vested interest in the buyer's success is more likely to result in collaborative activities, such as sharing knowledge, ideas, and innovative solutions. This, in turn, can foster innovation, improve processes, and contribute to both parties' competitive advantage (Kocabasoglu, Prahinski & Klassen 2007: 1141-1160).

4.3.4 Review of received quotations

After the quotations have been received, they need to be compared and evaluated. Various methods and criteria are used to make an informed decision and select the most suitable supplier(s). These sets of criteria and methods vary

between companies but are also tailored to a particular purchasing situation. Some criteria, however, are commonly used by the vast majority of buyers; these include cost/price, delivery time and quality. More detailed information about the supplier selection criteria can be found in the following Subchapter 4.4. Examples of methods used during the supplier selection process are introduced in the Subchapter 4.5.

4.3.5 Supplier selection and reaching agreement

Selecting supplier(s), followed by reaching an agreement, are the final steps of the supplier selection process. Suppliers are either notified and awarded a contract, or, in more complex purchases, a negotiation phase takes place first. During this additional phase, the buyer and supplier(s) agree on specific details of the future purchase, delivery terms and conditions, etc. and only after that the contract is signed (Monczka et al. 2021: 276).

4.4 Supplier selection criteria

Supplier selection criteria refer to the specific factors or attributes that companies consider when choosing suppliers during the procurement process. These criteria help organizations evaluate and compare potential suppliers based on their ability to meet certain requirements and expectations. The selection criteria tend to vary depending e.g. on the industry, organizational goals, and specific project requirements.

Supplier selection criteria began to be a subject of research around the 1960s. Dickson (1966: 5-17) conducted a study on the matter by surveying purchasing agents from the United States and Canada. All respondents were members of the National Association of Purchasing Managers.

The following list includes 23 criteria that were identified by Dickson as potentially important during supplier evaluation; the criteria are listed according to their importance established by Dickson's study:

- quality
- delivery
- performance history
- warranties and claims policies
- production facilities and capacity
- net price
- technical capability
- financial position
- procedural compliance
- communication system
- reputation and position in industry
- desire for business
- management and organisation
- operating controls
- repair service
- attitude
- impression
- packaging ability
- labour relation record
- geographical location
- amount of past business
- training aids
- reciprocal agreement.

Quality criterion was identified as one of extreme importance to supplier selection. Factors including delivery, performance history, warranties and claims policies, net price, technical capability, as well as the financial position of the potential supplier were identified as criteria having considerable importance. The rest of the criteria were considered to be of average importance, except for the reciprocal agreement, which according to Dickson's study was of slight importance.

Dickson's work was later re-examined by Weber, Current & Benton (1991: 2-18), who analysed the articles related to supplier selection criteria published between 1966 and 1990. In their study, Weber et al. noticed that the interest in the supplier selection process was on a growing trend. Another observation was that nearly 65% of 74 reviewed articles discussed the usage of multiple criteria in the selection process. Selection criteria that were identified as most important at the time were (in order): net price, delivery, quality, production facilities and capacity, and geographical location. All of these criteria, except for geographical location, were earlier (in 1966) stated to have extreme or considerable importance.

It is worth noting that the early 1970s was the time when the just-in-time (JIT) manufacturing philosophy started to be applied in Japanese manufacturing companies and later spread around the globe (Banton 2023; Toyota 2023; Weber et al. 1991: 3). Some of the papers reviewed by Weber addressed JIT specifically and it occurred that quality, delivery, net price, geographical location, production facility and capacity were the criteria prioritised in JIT systems. As can be observed, both approaches discussed by Weber et al. (1991: 2-18) – the general and JIT-related – mention the same criteria but in different priority order. It is also worth underlining that both, Dickson (1966: 5-17) and Weber et al. (1991: 2-18), referred to *net price* in their research, however, the total cost of ownership (TCO) is nowadays used when quantifying all costs of a purchased item throughout its life cycle (Ferrin & Plank 2002: 18-29; Thiruchelvam & Tookey 2011: 442).

Verma & Pullman (1998: 739-750) noted that the studies of the above-mentioned authors, similarly to other studies published until 1998, rated selection criteria according to the managers' perception of the criteria's importance and not based on how the managers actually choose suppliers. The research that Verma and Pullman conducted shows that the chosen sample of purchasing managers perceive quality as the most important criterion – therefore consistency with the previous studies can be observed. However, the same managers, when actually choosing a supplier, find cost and on-time

delivery to be of higher importance than quality. An explanation for this discrepancy, according to the research's authors, is possibly caused by: inconsistency between operating practices and the strategic priorities in analysed companies, performance evaluation being more weighted towards the cost, supplier selection practice varying between industries and/or within different geographical locations, or too small size of the sample in terms of the number of respondents and industries analysed.

Cheraghi, Dadashzadeh & Subramaniam (2004: 91-108) conducted a research of supplier-selection-criteria-related academic papers to determine the possible changes on the matter (at the time), compared to Dickson's and Weber's findings. Articles published between 1990 and 2001 were analysed for this purpose. The findings indicated that previously determined selection criteria were still the most critical ones, but at the same time, factors like reliability, flexibility, consistency and long-term relationships were becoming relevant factors in the supplier selection process. On the other hand, criteria including packaging ability, operating controls, training aids, warranties and claims policies, as well as the desire for business were no longer (at the time) important in the context of supplier selection.

Further review and evaluation of supplier selection criteria and their importance to the supplier selection process was conducted by Thiruchelvam & Tookey (2011: 437-454). Articles published between 2001 and 2010 were analysed to conclude that price, quality and delivery remain to be the dominant criteria evaluated during the supplier selection process. In other words, it means that suppliers are expected to deliver the products and/or services of the right quality, at a reasonable price and within a scheduled time frame. Some other criteria identified to be of importance include production facilities and capacity, technical capability, management and organisation, financial position, repair service, geographical location and past performance. Thiruchelvam & Tookey (2011: 437-454), similarly to the previously mentioned Cheraghi et al. (2004: 91-108), noted that flexibility, reliability, continuous product development and improvement, as well as environmental and social responsibility, are evolving

criteria that gain importance due to continuous increase in the number of potential suppliers, or, in other words, due to competitive market.

It can be argued that excelling (at the same time) in all criteria is extremely difficult for suppliers; for instance, one supplier may offer inexpensive parts of below-average quality, whereas another supplier may offer superb quality parts but the delivery time is much longer compared to other possible suppliers. This consideration is highlighted in various papers discussing the topic, including the above-mentioned articles. Additionally, the importance of the criteria varies from one purchase to another, i.e. in some purchases delivery time is prioritised over price, quality may be more important than supplier's flexibility, etc. Furthermore, some criteria are quantitative (e.g. price, quality, etc.), while others are qualitative (e.g. service, flexibility, etc.), which further complicates the selection process; it is because not all criteria can be compared equally and without subjective judgement involved. As a result, purchasing managers often trade-off between the selection criteria, depending on, e.g. company's strategy or specific project requirements (Bhutta & Huq 2002: 126-135; Kawa 2010: 66-73). Selected supplier selection criteria are described in the following Sub-subchapters 4.4.1 – 4.4.6.

4.4.1 Price and total cost of ownership

Selecting suppliers solely based on the price used to be a common practice for many years. This changed when companies established the inefficiency of this approach and instead turned into a multi-criteria one that was more comprehensive (Pal, Gupta & Garg 2013: 2667-2673). Lysons & Farrington (2012: 418) define price as:

“a component of an exchange or transaction that takes place between two parties and refers to what must be given up by the buyer in order to obtain something offered by the seller”.

In other words, price represents the monetary value that a supplier charges for its products or services. Companies find price to be a key consideration because it directly impacts their expenses and profitability. Lower prices can

lead to cost savings for the organization, whereas higher prices can result in increased expenses. Therefore, organizations often compare the prices offered by different suppliers to identify the most cost-effective option (Ulaga & Eggert 2006: 119-136). Unit price (price of one unit) is a criterion that can be obtained from the supplier by sending an RFQ. After receiving responses to all RFQs sent to various suppliers, the buyer can compare unit prices with ease because the data is objective and comparable. Opting for suppliers offering lower prices might seem enticing due to immediate savings in the procurement budget. However, a sole focus on the initial purchase price can result in overlooking long-term cost implications, which in turn leads to potentially selecting a supplier that is not the most optimal in terms of the company's actual needs.

As stated before (see Subchapter 4.4, p.35), it is usually not the price but the total cost of ownership (TCO) that is nowadays used when quantifying all costs of purchased items throughout their life cycle (Cousins et al. 2008: 165-169; Ferrin & Plank 2002: 18-29; Thiruchelvam & Tookey 2011: 442). Figure 15 on the following page illustrates the concept of TCO.

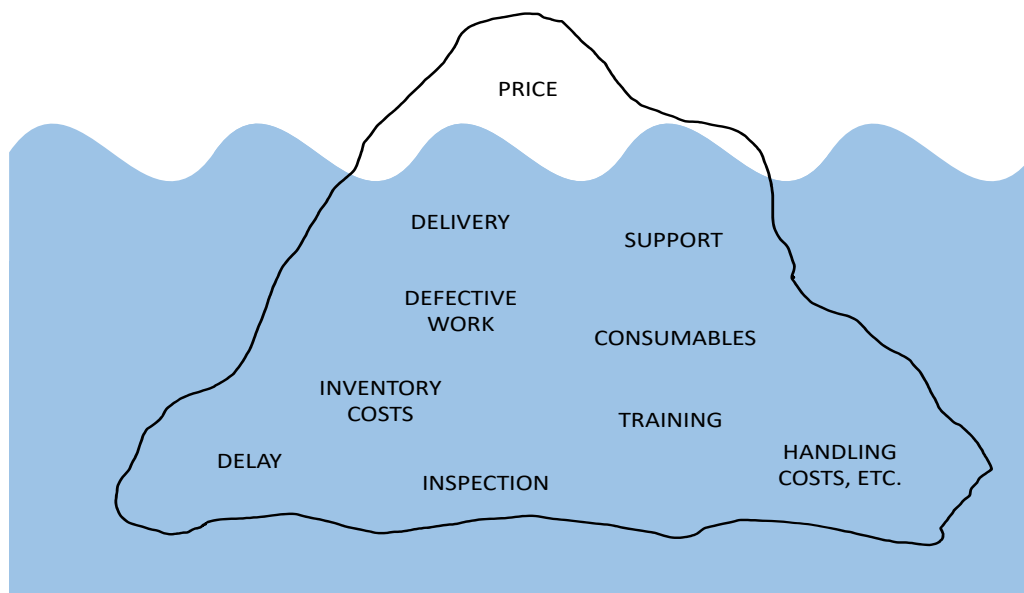


Figure 15. The price/cost iceberg (adapted from Baily et al. 2016: 26)

As can be observed, price is the most visible cost component. It is, however, important to take into account also the hidden costs associated with the

purchased item over its entire lifecycle and ownership period (Barbušova, Medvecká & Gašo 2019: 11). These hidden, purchase-related costs may include order placement and support costs, delivery, inspection and handling costs, costs incurred due to delays or defects of the purchased products, etc. (Baily et al. 2016; Cousins et al. 2008: 164-169). Additionally, it is important to take into account the exchange rates – these vary depending on the location of the suppliers and are subject to fluctuations, thus having a significant impact on the company's profit (Cousins et al. 2008: 164-169). The TCO concept can be utilised not only during the supplier selection process but can also set the foundation for supplier evaluation and certification. According to Bhutta & Huq (2002: 129), TCO not only “provides focus and a consistent message about what is important”, but also lessens the work.

4.4.2 Quality

Van Weele and Rozemeijer (2022: 241) favour the following IBM's definition of quality:

“Quality is the degree in which customer requirements are met. We speak of a quality product or quality service when both supplier and customer agree on requirements and these requirements are met.”

The above-mentioned requirements can relate not only to the technical properties of a product or service but also to delivery agreements, packaging instructions, user-friendliness and maintenance ease (van Weele & Rozemeijer 2022: 241).

According to Shil (2010: 63), nearly 98% of researchers find quality to be an important criterion in the supplier selection process. The emphasis on quality can be explained by its direct impact on the overall performance of the purchasing company's supply chain, as well as on that company's reputation in the market. By selecting suppliers that prioritize multi-dimensional quality, and, in particular, the ones that engage in continuous process improvement initiatives (e.g. Six Sigma, total quality management and ISO 9000 series of quality assurance standards defined by the International Organisation for

Standardisation), companies can ensure that their products meet the desired standards and specifications, which in turn positively impacts the end-customers satisfaction and loyalty (Thiruchelvam & Tookey 2011: 437-454).

4.4.3 Delivery

The term delivery refers to the process by which goods or services are conveyed from a source to a designated recipient. Christopher (1992, as quoted in Baily et al. 2015: 237-238) states that while price remains one of the critical criteria influencing buying decisions, the cost of time became another key determinant considered during the supplier selection process. The cost of time reflects the additional costs incurred by the customer while either waiting for the delivery or searching for alternatives.

The delivery performance is of significant importance in the context of JIT philosophy – due to reduced safety stock and lot sizes, suppliers are expected to deliver exactly to the schedule, more frequently and with smaller lot sizes (Cousins et al. 2008: 65). On-time delivery denotes the precise and punctual delivery of goods or services from the point of origin to the agreed destination, following predetermined schedules and deadlines. Adherence to said deadlines and schedules by suppliers enables the continuity of production, which in turn permits the continuity of sales and positively affects the level of customer satisfaction. On the other hand, failure to deliver on time, as pointed out by Baily et al. (2015: 240-241), harms the company's profitability or efficiency, which is a result of cash-to cash cycle being slowed down. The ability to deliver on time is particularly important in industries with time-sensitive operations, such as the automotive, medical and electronics industries. On-time delivery is typically measured as a percentage.

Lead time refers to the period between the placement of an order by a purchaser and the receipt of the ordered goods or services from the supplier. It encompasses the duration required for the supplier to process the order, produce or procure the requested items, and subsequently deliver them to the buyer. Lead time is measured in days and usually a range is given, e.g. two to

five days. Long lead time may be a sign of the supplier taking too many orders and therefore being inefficient. Additionally, longer lead times can necessitate higher safety stock levels to accommodate fluctuations and uncertainty in the supply chain, as well as to avoid stockouts. Shorter lead times, on the other hand, allow for leaner inventory levels as goods can be ordered closer to the time of need, which in turn leads to reducing carrying costs.

4.4.4 Flexibility

Flexibility refers to the ability of a supplier to adapt and effectively respond to changes in demand, product design, and other factors that may occur in the supply chain. Volume flexibility, recognised by Cousins et al. (2008) as one of the most important types of flexibility in the context of supplier selection, refers to the supplier having the possibility and will to change the ordered volumes without large penalties. Garwin (1993, as quoted in Cousins et al. 2008: 66) claims that volume flexibility is important in case of progressively uncertain environments, technological advancement and global competition. Selecting suppliers that are flexible with volume is particularly beneficial in circumstances of uncertain demand – buyers can avoid having to hold high levels of safety stock. Mix flexibility refers to the supplier having the possibility and will to change the mix of ordered products without large penalties. Suppliers with higher mix flexibility are better positioned to meet diverse customer demands, accommodate changes in product preferences, and respond to market fluctuations more successfully (Cousins et al. 2008: 66). Another type of flexibility is delivery flexibility which refers to a supplier's capacity to adapt and respond to changes in, e.g. delivery schedules, lead times, methods or locations in order to meet not only evolving customer needs and requirements but also market fluctuations and dynamics. Delivery flexibility is crucial in today's dynamic business environment, where customer expectations are constantly evolving, and suppliers need to be agile and responsive to stay competitive. Expansion flexibility is another type of flexibility that can provide a competitive advantage in supplier selection. It refers to the ability of a supplier to modify capacity and capability according to the arising needs (De Toni & Tonchia 1998, as quoted in Aydin & Ungan 2020: 237). Suppliers offering

expansion flexibility can help companies reduce launch time and cost for new products, as well as increase existing product lines or additional capacity. The ability of a supplier to provide flexibility in terms of modifying products or accommodating design changes requested by customers is referred to as modification flexibility. Modification flexibility was found to contribute to improved quality, delivery performance, and decreased price (Aydin & Urgan 2023: 235-253). As can be deduced, flexibility is a multifaceted and dynamic criterion. It contributes to the capability of supply chains to navigate disruptions, respond to demand volatility, and seize emerging opportunities. However, the implications of incorporating flexibility as a supplier selection criterion extend beyond operational considerations - flexibility can also foster collaborative relationships between suppliers and buyers, facilitating e.g. value co-creation and joint problem-solving.

4.4.5 Reliability

Reliability, within the context of supplier selection, refers to the consistency and dependability of a supplier in meeting contractual obligations and delivering products or services in an accurate timely manner and undamaged condition (Monczka et al. 2021: 679). It encompasses a supplier's capability to consistently adhere to quality standards, lead times, delivery schedules, and other commitments, thereby engendering trust and reducing the risk of disruptions within the buyer's supply chain. Additionally, reliability also encompasses the supplier's ability to maintain consistent communication and responsiveness. Effective communication and responsiveness are essential for addressing any problems or concerns that may arise during the procurement process. Suppliers who are reliable in respect of communication and responsiveness contribute to the overall efficiency and effectiveness of the supply chain.

4.4.6 Sustainability

The concept of sustainability is connected with the Triple Bottom Line (TBL) framework, which emphasizes the importance of considering not only economic

but also social and environmental factors in decision-making processes. The TBL is also known as the “people, planet, profit” philosophy.

The “people” aspect encompasses practices focused on providing fair labour conditions and a working environment that, in turn, allows employees to develop their competencies and skills. Common practices within this aspect include preventing child labour exploitation, maintaining a safe working environment, provision of fair salaries, contributing to the growth of the community and region in which the company and its suppliers are based by providing healthcare and educational facilities, etc. (Onyali 2014: 197; van Weele & Rozemeijer 2022: 18-19, 287-291).

The “planet” aspect refers to sustainable environmental practices and includes managing consumption of resources (raw materials, water, energy), emissions controls (e.g. lowering the carbon footprint), waste disposal, reuse of scrap and surplus materials, reverse logistics and adherence to environmental regulations (Onyali 2014: 197; van Weele & Rozemeijer 2022: 18-19, 287-291).

The “profit” aspect is related to a company’s financial performance and profitability over a longer period while considering its environmental and social responsibilities. It involves ensuring that sustainable business practices contribute positively to the bottom line by reducing costs, optimizing resource utilization, enhancing efficiency, and embracing new market opportunities. Generating sustainable profit requires the company to have an effective sales stream, service generating genuine value for which the customers are willing to pay, as well as a strategy focused on the highest possible return attained for the company, that is with revenue exceeding total costs incurred (Jackson, n.d., as cited in Baily et al. 2015: 498). Profitability improvement, as stated by van Weele & Rozemeijer (2022: 287-291), should take place with all stakeholders’ interests considered.

Sustainability as a supplier selection criterion involves a comprehensive assessment of a supplier's practices, policies, and performance regarding the above-described environmental stewardship, social responsibility, and

economic viability. It can be done by requesting certificates, audits, relevant reports, or other evidence of their legal adherence. Third-party tools or platforms that monitor and rate suppliers' compliance across different dimensions can be of use as well.

4.5 Supplier selection methods

Supplier selection is a critical process for organizations as it directly impacts the success of their supply chain. The selection of the right suppliers involves evaluating and choosing suppliers based on various criteria and factors. Several methods and techniques can be used to aid the buyers in identifying and ultimately selecting suppliers that align with the company's strategic goals, operational requirements, and value proposition. The selection methods vary in underlying principles and complexity, scope, catering to diverse industries, supply chain structures, and decision-making contexts. Moreover, a particular set of selection criteria may be accommodated by several methods (De Boer et al. 2001: 75-88) and several different methods can be combined to meet the specific needs of the buyer (Tahriri et al. 2008: 201-208).

One of the first papers discussing supplier selection methods was written by Weber et al. (1991: 2-18). As a result of their analysis, three categories of quantitative approaches to supplier selection were identified: linear weighting models, mathematical programming models, and statistical models. De Boer et al. (2001:75-84) differentiate five groups of methods, adding TCO models, and artificial intelligence (AI)-based models to the categories previously determined by Weber et al.

Özfirat, Taşoğlu & Memiş (2004: 292-301) distinguish five categories of the supplier selection methods: multiple-attribute decision-making methods, mathematical programming approaches, statistical/probabilistic approaches, intelligence approaches, and hybrid approaches.

An interesting approach to the classification of supplier selection methods was proposed by Jain, Benyoucef & Deshmukh (2009: 61-87) – three groups of

methods were identified: elimination methods, optimisation methods, and probabilistic methods.

It is worth noting that the methods used in the initial stages of the supplier selection process, such as problem formulation (make or buy? new or existing supplier? one or more suppliers?) and criteria formulation phases, are usually qualitative. Pre-qualification of suppliers and the final selection phases, on the other hand, are mostly performed by using quantitative methods (De Boer 2001: 75-89; Shil 2010: 58-70; Nowakowski & Werbińska-Wojciechowska 2012: 944-955). De Boer et al. (2001: 75-89) point out that previous (at the time) research on the supplier selection methods (including e.g. the above-described Weber et al. approach) focused mainly on the final stage of the process. Due to the abundance of methods available for different stages of the supplier selection process, it is also this paper's author's decision to introduce exclusively the methods related to the final stage of said process. An overview of selected methods is presented below.

4.5.1 MCDM methods

MCDM (multi-criteria decision-making) methods, as the name suggests, allow buyers (decision-makers) to systematically evaluate and compare various alternatives across multiple criteria. MCDM is particularly useful when there are quantitative and qualitative criteria involved, when there is no clear best choice, and when multiple decision alternatives need to be considered (Bozarth et al. 2013: 224).

An example of an MCDM method is the linear weighted average method in which a relative importance weight is assigned to each considered criterion. The buyer then rates the performance of suppliers concerning each criterion. The criterion importance weight is then multiplied by the performance rating. An outcome of this process is a weighted score. Weighted scores (of all criteria) are then summed and in turn, one aggregate weighted score for each supplier is obtained. The highest weighted score implies that the supplier achieving it is the best. The disadvantage of this model is the fact that assigning weights relies

on the buyer's judgement and intuition, and thus is subjective (Ordoobadi & Wang 2011: 629-630).

Several researchers suggest that linear weighting models are imprecise, i.e. it can be difficult to not only determine the score of a supplier on a criterion but also to establish the importance of some criteria precisely.

To deal with said imprecision, the use of the analytical hierarchy process (AHP) is suggested (De Boer et al. 2001: 82). In this method, instead of assigning point estimates for criteria weights as well as performance scores, a decision is decomposed into a hierarchy of criteria and sub-criteria. Thanks to that, buyers (decision-makers) are allowed to perform pair-wise comparisons to establish the relative importance of the relevant criteria and the performance of potential suppliers against each criterion. Ordoobadi & Wang (2011: 632) point out that the AHP method ignores the interdependencies among decision factors. Additionally, the result of the AHP analysis can be biased by the buyer favouring certain criteria and in a situation involving a large number of alternatives and decision factors, conducting the necessary pair-wise comparisons can be demanding time- and resources-wise (Ordoobadi & Wang, 2011: 632). The above-mentioned are not the only flaws of the AHP method; Munier & Hontoria (2021: 102) conducted an empirical study, supported by the opinions of 101 researchers and identified 30 shortcomings and drawbacks of the AHP method, including rankings' sensitivity to changes, ambiguity of pair-wise comparisons or incapacity to solve complex problems.

Another method used in supplier selection is fuzzy sets theory (FST), which allows decision-makers to handle uncertainty, imprecision, and subjectivity in the evaluation and ranking of potential suppliers. It allows a mathematically precise way of modelling fuzzy (uncertain) preferences, e.g. when setting weights of performance scores on criteria. FST can be integrated with other decision-making methods, e.g. FSP-AHP, developed by Morlacchi (in 1999) to evaluate small suppliers in the machine and engineering sectors (De Boer et al. 2001: 82).

4.5.2 Mathematical programming models

Mathematical programming (MP) models utilize mathematical techniques and algorithms to formulate and solve complex supplier selection problems. MP allows formulating the decision problem in terms of a mathematical objective function that afterwards needs to be minimised (e.g. minimise costs) or maximised (e.g. maximise profit) by shifting the values of the variables in the objective function (e.g. the amount ordered from supplier 1). MP models often consider only the quantitative criteria (De Boer et al. 2001: 83).

An example of an MP method is linear programming (LP). It is an optimisation method used to determine a way to achieve the best possible result, based on several requirements, represented as linear relationships. Talluri & Narasimhan (2003: 543-552) developed two LP models to minimise and maximise the performance of a supplier, according to the best target measures established by the buyer. The aim was to gain a comprehensive understanding of the supplier's performance. The goal of another LP model, developed two years later by the same authors, was to update the telecommunications company's supplier base by eliminating the underperforming suppliers and potentially replacing them with other ones.

Another example of an MP method is goal programming (GP). GP involves defining a set of objectives (e.g. cost, quality, supplier capacity and lead time), each associated with a desired goal. Relative priorities are then assigned to the objectives based on their strategic importance and an optimization problem is formulated; the objective is to minimize the deviations from the defined goals, subject to constraints, e.g. resource availability, budget limitations, etc. Karpak et al. (2001: 57-71), for example, developed a GP model to select and evaluate suppliers based on three goals: quality, cost and delivery reliability. The model aimed to determine the optimal number of ordered products, taking into consideration both the supplier's capacity and the buyer's demand constraints.

The multi-objective programming (MOP) method considers multiple conflicting objectives and aims to find a set of feasible solutions that represent the trade-

offs between these objectives. The application of MOP in supplier selection enables a comprehensive assessment of supplier portfolios, where diverse criteria and priorities are considered. Narasimhan et al. (2006: 577-603), for example, developed an MOP model for two purposes - to select the optimal suppliers and to determine the optimal order quantity. The criteria proposed to evaluate the performance of suppliers were: direct cost, quality, delivery, number of bids and indirect cost. Before the model was solved to optimality, the relative importance weightings of the five chosen criteria were predetermined; Narasimhan et al. (2006: 577-603) suggested the AHP method or buyer's judgment for this purpose.

4.5.3 Total cost of ownership models

Total cost of ownership (TCO) models serve as methods of selecting supplier(s) based on analysing all quantifiable costs that are incurred by the buying company over the purchased product's or service's lifecycle. This approach helps buyers in making informed choices by providing a holistic view of the long-term financial implications of supplier selection. The concept of TCO was explained in more detail in Sub-subchapter 4.4.1, pp.37-39.

4.5.4 Statistical models

Statistical models offer a systematic and data-driven approach for companies to assess and choose suppliers based on various criteria. These models, as the name suggests, use statistical techniques to analyse supplier-related data, helping organizations make well-informed decisions. By utilising statistical models and quantifying different attributes such as cost, quality, delivery time, and reliability, potential suppliers can be assessed objectively. For effective use of statistical methods, it is important to ensure the accuracy and reliability of data. An example of a statistical model which can be used in supplier selection is regression analysis. It is a method of showing the relationship between a dependent variable and one or more independent variables. The goal is to explain or predict the behaviour of the dependent variable. Therefore, it can be used to, for example, identify the criteria that are most influential in the process

of determining the suitability of a supplier for a particular company or a certain project. Another type of statistical tool used in supplier selection is Monte Carlo analysis; it is a technique used to model risk and uncertainty in data that allows forecasting outcomes based on random sampling. Monte Carlo analysis can be applied to e.g. estimate delivery times, identify potential risks and forecast procurement costs. By enabling consideration of various scenarios and multiple variables, this method results in realistic and more precise forecasts (Kołodziej 2023).

4.5.5 Artificial Intelligence (AI)-based models

AI-based methods refer to systematic approaches that integrate computational techniques rooted in AI to address complex problems and make informed decisions. Within the supplier selection scope, AI-based methods encompass an array of techniques implemented to enhance the efficacy and complexity of evaluating and choosing suppliers. These methods capitalize on AI's capacity to handle multifaceted data, recognize patterns, and generate insights that can be then used in the supplier selection process. An example of an AI-based method is Neural Networks (NN) which mimics the interconnected structure of human brain neurons. Therefore, NN is an array of connected input and output units where each connection has an associated weight. Through a series of weighted connections and activation functions, the network learns to derive significant correlations present within the data. The output layer subsequently yields predictions or classifications related to supplier suitability. This means that NN methods can be used to model complex nonlinear relationships and discern latent dependencies within various supplier attributes/selection criteria. NN adapt to evolving supplier dynamics by learning from historical data and generalizing this knowledge. However, they require substantial data for accurate training and parameter tuning (Chai & Ngai 2020: 1-16; De Boer et al. 2001: 83-84; Golmohammadi, Creese & Valian 2009: 252-256).

4.6 Supplier relationship management (SRM)

Supplier relationship management (SRM) serves as a crucial mechanism for companies to strategically manage and enhance their interactions with suppliers. SRM encompasses a range of activities aimed at establishing and maintaining effective relationships with suppliers to not only drive operational efficiency and achieve superior performance outcomes but also to mitigate risks by proactive monitoring and continuous assessment of supplier performance (Lambert & Schwieterman 2012: 337-338; Möller et al. 2006: 69-94; Park, Shin, Chang & Park 2010: 495-515). Lambert & Schwieterman (2012: 337) state that SRM is increasingly being viewed as “strategic, process-oriented, cross-functional, and value-creating for buyer and seller”. It is, however, worth noting that SRM is a relatively new, still developing concept. What supports this statement is the fact that before 2006 there was no overall framework of SRM, that would, according to Möller et al. (2006: 69-94), integrate e.g. buyer-supplier relationship, supplier selection and segmentation criteria (which are quite well researched already as “separate” concepts) and illustrate the way different suppliers are handled throughout the course of their relationship with buyers.

Various models are attempting to provide order and/or categorisation of the relationships between buyers and suppliers. Burt et al. (2003) propose three primary types of buyer-supplier relationships:

- Transactional - also known as arm’s length, where each party’s interest is limited to their well-being. A win of party A is a loss of party B and vice versa. Information between parties is not shared and the focus of the relationship is getting the best price.
- Collaborative - parties recognise the need for cooperation and interdependence. This in turn allows improvements in quality, technology, cost, time to market etc.
- Alliance - similar to collaborative, but the difference is the existence of what the authors call ‘collaborative trust’. Trust, as Dyer (2000: 38) states “is critical for partner success because without it suppliers and customers will spend considerable resources negotiating, monitoring, and enforcing inflexible contracts”. Burt et al. (2003) name the following benefits of alliances: lower total costs, reduced

time to market, improved quality, improved technology flow from suppliers, as well as improved continuity of supply.

5 Case study

The main purpose of the case study is to examine the case company's supplier selection process in comparison with the theoretical framework, which was presented in the former, theory-based, part of this study, and find ways to possibly optimize it. The scope is indirect purchasing.

The case company is a global automotive company. Its operations are divided into four regions, which are further divided into regional business units. Since the supplier selection practices may vary between these units, this study focuses on the company's local business unit, comprising four Nordic countries and the Baltic States. There are two buyers responsible for the purchasing within the following indirect spend groups: facilities, HR, MRO (maintenance, repair and operations), IS, IT, media and advertising, events, sales and promotion tools, printing, audits, consultancy and market surveys.

The author of this paper is a former employee of the case company and personally participated in the supplier selection process; once when a supplier (a travel agency) needed to be sought to organise the transportation and accommodation of the car dealers participating in the training event abroad, and the second time when an event agency needed to be contracted to assist in organising a promotional event (for the newly launched vehicles), held in one of the Nordic countries.

The data comes directly from the case company and was gathered through observation, and frequent cooperation with the purchasing department during the supplier selection processes for two independent projects that the author participated in. This method was used due to the character of the employment, where the author performed the relevant tasks under a supervision of both, the budget holder (internal customer) and the purchasing officer. The time frame of the data collection is 14 months.

5.1 Purchasing process

Figure 16 on the following page presents the model of the indirect purchasing process used by the case company. As can be observed, the process model is linear and similar to the models of the same type presented in the Sub-subchapter 3.3.2; even though the steps are named differently, they generally correspond with each other to a significant extent. The number of steps is in line with the previously mentioned statement by Bäckstrand et al. (2019) that linear PPMs usually consist of four to eleven steps. It is worth noting that the preparation for a new purchasing project and make-or-buy decision, the absence of which van Weele (2018:32) identified as the typical linear process models' weaknesses, are both part of the case company's PPM.

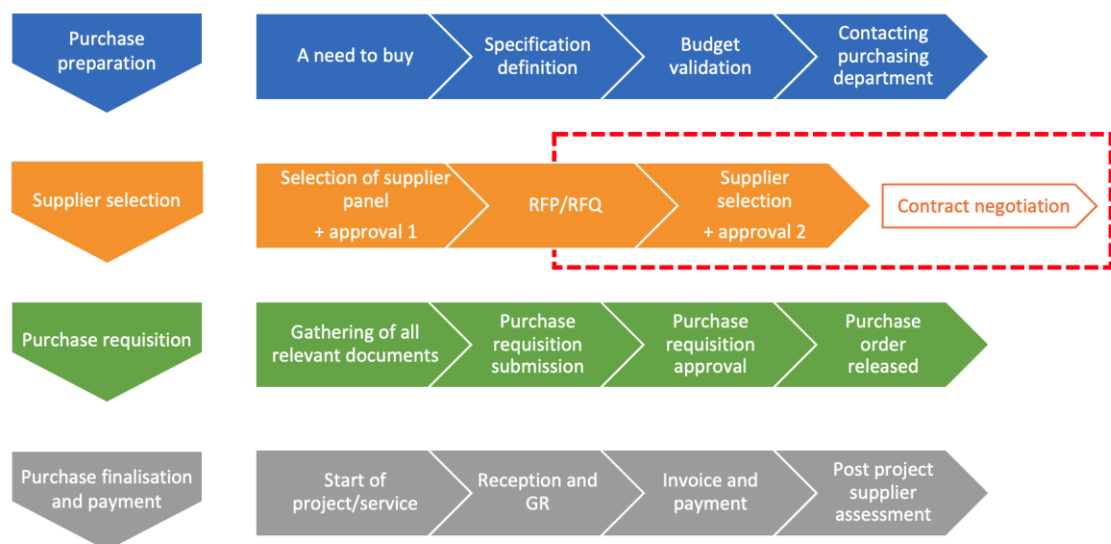


Figure 16. The purchasing process in the case company (an original model, used with the permission of the purchasing department of the case company)

However, neither the previous experience with buying goods and/or services nor the track record of relationships with suppliers which the company previously cooperated with (another theoretical weaknesses) are a part of the said model. This means, that based on the model exclusively, it is not possible to e.g. determine whether the model is applicable for a new task situation, a

rebuy or both. In practice, the case company, in the vast majority of situations, utilises a list of approved suppliers and follows three purchasing scenarios:

- The total amount to be spent on a purchase is not exceeding € xK. In such cases, the involvement of the buyer is not obligatory in the purchasing process. Instead, after deciding what goods or services need to be bought, the internal customer needs to ensure the sufficiency of the budget and prepare the necessary documentation. After that, he/she raises a purchase requisition (PR) in the company's invoicing/purchasing system. The supplier named in the PR is selected from the approved suppliers list by the internal customer. Upon validation by responsible parties, a purchase order (PO) is automatically created, and only then the purchase can be confirmed with the supplier. After the goods are received or the service has been provided, the internal customer needs to create the receipt of the goods (GR) in the system. This can be done not only when the invoice was received, but also before, when the exact amount to be paid for the purchase is known. Creating a GR is necessary to "trigger" the payment once the invoice appears in the system. The process ends with the post-project supplier assessment conducted collectively by the buyer and the internal customer. This scenario is typically used in case of recurring or occasional purchases of e.g. printing services for leaflets or brochures, production of small merchandise, courier services, etc.
- The total amount exceeds € xK (amount identical as previously) and the internal customer knows exactly what needs to be bought and from whom. In such a situation it is obligatory to be in contact with the buyer and provide justification that the proposed supplier is indeed the best for the task. Upon the buyer's approval, the process continues with the internal customer ensuring the sufficiency of the budget and preparing necessary documentation. The following steps are exactly as in the scenario described above.

- The total amount exceeds € xK (amount identical as previously) and the internal customer has certain expectations but the supplier has not been identified. In such a situation the internal customer, after deciding what goods or services need to be bought (and after validating the budget), must contact the buyer and provide the scope of work and, if needed, KPIs (Key Performance Indicators). The right approach is then discussed and agreed on. The next phase is supplier selection, described in more detail in the following Subchapter 5.2. After the best supplier has been selected the purchasing process continues by following steps included in the two previously described scenarios – starting from gathering necessary documentation and raising purchase requisition. This purchasing scenario is the only one in which the supplier selection process, in the form presented in Figure 16 (p.52), is applied.

When the approved list of suppliers is insufficient for a particular need, a new potential supplier needs to be sought. In such a situation, the buyer usually searches the Internet or asks other RBUs' buyers whether they cooperated with any suppliers that they could recommend for the particular need. Sometimes also the internal customer (budget holder) may know various suppliers that can potentially be suitable for the project in question. When the potential suppliers have been identified, the buyer performs thorough research on them, including their financial analysis, sustainability considerations, potential risk, etc. When an appropriate supplier is found, the buyer registers it in the company's invoicing/purchasing system. Only after this process has been finalised, i.e. the new supplier has provided all the necessary information and has accepted the company's trading terms and conditions (TT&C), a purchase can be made from them.

For low amount purchases the acceptance of the TT&C is sufficient to start the cooperation with the supplier. In other cases, a formal contract, and oftentimes legal department's involvement, are required before the cooperation can start. Some projects may also require signing a non-disclosure agreement (NDA) by the supplier.

5.2 Supplier selection process

The case company's supplier selection process comprises, as seen in Figure 16, p. 52, three stages: selection of suppliers panel, preparation of RFP/RFQ and supplier selection and is essentially identical to van Weele's model presented in the theoretical part of this paper (see p. 23 for reference).

This process takes place only in the situations described in the last scenario of the previous Subchapter 5.1., namely when the purchase amount exceeds € xK and the internal customer knows the product or service they want to purchase but has no clarity from which supplier. After ensuring the sufficiency of the budget, the internal customer needs to contact the purchasing team and provide the scope of work and, if needed, KPIs (Key Performance Indicators). These are delivered in a written format, usually in a PowerPoint or Word document format. When the buyer familiarizes themselves with the documents received, the right approach is then discussed and agreed upon. After that, the actual supplier selection process begins with selecting a panel of potential suppliers.

The selection of the supplier panel is done by the buyer, who uses a list of approved suppliers for this purpose. The outcome of this process is a list of potential suppliers with their relevant characteristics, including financial situation, scope of operations, examples of executed projects, previous cooperation with the case company if such took place, etc. The panel of suppliers is then reviewed by the internal customer. In some cases, the internal customer may request changes, e.g. replacement of a particular potential supplier with another one that he/she finds more suitable due to e.g. past cooperation, reference from another internal customer, etc. After the buyer and the internal customer reach an agreement on the panel line-up, the buyer sends it for further approval to the case company's general manager for purchasing. The general manager is located in France and covers the scope of operations of all ten European regional business units. Due to that, the validation time is expected to take up to two weeks.

After the general manager's approval has been received, the buyer sends - via e-mail - what is called an "RFP package" to all suppliers listed in the panel. The RFP package includes corporate social responsibility (CSR) guidelines, scope of work (SOW, in other words, a document enlisting all requirements regarding particular good or service to be purchased), anti-corruption policy information and environmental policy. Additionally, the potential supplier's interest, despite not being directly distinguished in the purchasing and supplier selection model, is ensured at this stage. This phase is called tendering and it sets the foundation for future contract negotiation. In some situations the budget for the purchase, whether it is a product or a service, may be pre-determined and the panel members are informed about it. After gathering responses, the buyer reviews them with the internal customer.

The possible outcomes of this phase are:

- Several offers appear to be potentially in line with the specification but some of them are incomplete and therefore it is unclear which supplier should be selected. In such a situation the suppliers are consulted to provide more information, present the previous projects, etc.
- Sufficient number of responses to an RFP was received but the characteristics of the purchase require that the supplier personally presents the offer to the internal customer. It happens, for instance, in a situation when the future supplier will be responsible for executing a promotional event and therefore needs to create a detailed plan of such event. The presence of the buyer is not mandatory during this kind of meeting, but it is preferred.

When the buyer has collected enough information, he/she evaluates the potential suppliers against pre-determined criteria together with the internal customer. The linear weighting method is used for this purpose. As stated in Sub-subchapter 4.5.1., the disadvantage of this model is that assigning weights relies on personal judgement and intuition, and thus is subjective. Figure 17 on the following page is an example of evaluation criteria used for selecting a supplier for organising a local product launch event. Each criterion has a weight assigned according to its relative importance for that particular project; the weights total 100% and are tailored to particular projects. The rates are

appointed to each criterion using a scale of 1 to 5, where 1 = bad, 2 = weak, 3 = sufficient, 4 = good, and 5 = outstanding. As can be observed, the most important criteria, in this case, were the proposal being in line with specification - which means all the conditions mentioned in the RFP were fulfilled, and the concept – which means the detailed plan of how the event would be executed. The least importance was assigned to receiving the proposal on time, automotive credentials or references, and identified and adapted project team. Other criteria used for the evaluation of the potential suppliers included budget compliance (which means that the supplier had to prepare the proposal within the budget limit determined by the buyer in the RFP), general presentation, i.e. quality and clearness, and supplier’s experience in the requested area of expertise.

| Evaluation criteria | Weight | Supplier A | Supplier B |
|--|-----------|-------------|-------------|
| | | Note* | Note* |
| Proposal received on time | 5 % | 5,00 | 5,00 |
| Budget compliance | 10 % | 4,00 | 4,00 |
| General presentation (quality of the document and understanding) | 10 % | 4,00 | 3,00 |
| Clear, precise and exhaustive proposal for the service supply | 15 % | 4,00 | 3,00 |
| Proposal in line with the specifications | 20 % | 5,00 | 4,00 |
| Concept | 20 % | 4,00 | 2,00 |
| Vendor experience in the requested area of expertise | 10 % | 4,00 | 3,00 |
| Other automotive credentials/references | 5 % | 3,00 | 3,00 |
| Identified and adapted project team | 5 % | 5,00 | 5,00 |
| TOTAL max. | /5 | 4,10 | 3,15 |

Figure 17. The linear weighting method used for selecting a supplier for product launch event (original scoring grid; used with the permission of the purchasing department of the case company).

The final scores of the suppliers participating in that tender were 4,1 for Supplier A and 3,15 for Supplier B, which means that the selection criteria were fulfilled well by Supplier A, and sufficiently by Supplier B. Supplier A was thus chosen for the project.

After the internal choice of the supplier is done, the buyer is responsible for providing all necessary documentation, including the offer itself and the scoring grid (see Figure 17 above) to the previously mentioned general manager for purchasing, who needs to validate the selection choice. Upon his/her approval,

the chosen supplier is informed of winning the bidding and the purchasing process can be continued.

5.3 Findings and recommendations

As established earlier, both, the supplier selection process and the supplier selection method, utilised by the case company, are linear. While it's important to recognize that linear models and methods have limitations and may not capture complex interdependencies or non-linear relationships that could exist in supplier selection data, the case company chose them due to their simplicity and transparency. Additionally, such a choice aligns with the indirect purchasing the case company performs.

The case study and the daily discussions between this paper's author (during their employment period) and the case company's purchasing officer revealed that the chosen strategy has some flaws and thus can be improved. The author of this study proposes the following ways to optimise the supplier selection process:

- Implementing a universal SOW (scope of work) document format for the internal customers to fill in and deliver to the buyer when a purchasing decision is made. Currently, the internal customer can choose whether they send their requirements via PowerPoint or Word document. Additionally, there is no clear information on what exactly such a document should include. This creates room for providing insufficient information to the buyer, who is then obliged to contact the internal customer with a request for delivering the missing information. The supplier selection process is in turn delayed. By having the universal SOW document format the internal customer would know precisely what is needed by the buyer and such information could be provided instantly.
- Limiting the number of approval stages from two to one or eliminating them. Currently, there are two approval stages (for purchases over € xK), the first takes place before the RFQ/RFP is sent to potential suppliers and the second one is when the supplier is selected. Given that there is only one person (the general manager for purchasing, located in France and overseeing the approval process for ten regional business units) performing the task, the waiting time is expected to take up to two weeks. This means that the entire approval phase alone may take up to one month, which, in some

cases, can be too extensive. An example can be purchasing goods/services from abroad when the conversion of the currency needs to be considered. The conversion ratio may fluctuate over time, which, in some cases may result in the company needing to spend significantly more money for the same goods/services. Additionally, some projects are time-sensitive – delaying the process for (sometimes) a month may result in the need to postpone the project or having to choose a less desired supplier. It is worth noting that each department, within each regional business unit, has a predetermined budget dedicated for the entire fiscal year. This budget has been granted (and thus approved) by the higher structures of the company. A further approval is done by the finance department of the regional business unit after they have been provided with an estimate of what each of the departments plans to utilise the budget for. Additionally, when the purchase requisition is created, it needs to be approved by the buyer and finance controller and, when the purchase exceeds the amount ten times bigger than the previously mentioned € xK, also by one of the senior vice presidents. These are the reasons for which, in the opinion of this study's author, the additional two approval stages during the supplier selection process should be either limited to one or eliminated.

- An alternative to the point made above, would be appointing more resources for the approval process. One general manager for purchasing, conducting the approval process for ten regional business units is certainly not sufficient. The delays that are caused by this significantly slow the supplier selection process and in consequence the entire purchasing process. This solution, however, is not recommended, because it would still require additional time designated for the approval phase.

A discussion with the purchasing officer of the case company revealed that even though the proposed improvements could significantly improve the efficiency of the process, the change needs to start in the higher structures of the case company, and thus cannot be executed immediately.

5.3.1 Proposed supplier selection model

Day-to-day discussions with the purchasing officers of the case company revealed that the flow of the purchasing process, and therefore its part – supplier selection – is sometimes misunderstood by the internal customers, i.e. it is unclear who is responsible for particular actions, and what the required order of these actions is. Therefore, regular, at least yearly, all-hands meetings

are organised by the purchasing department to discuss possible concerns. The materials used in the meeting are later available to each stakeholder – these include the purchasing process (and thus supplier selection process) models illustrated in Figure 16 on page 52.

It is this paper's author's opinion, that the linear process model used by the case company is indeed the most suitable one for indirect purchases. Indirect purchasing, according to Delke et al. (2023: 6) is characterised by, amongst others, heterogenous spend, many suppliers involved, low value per transaction (but, at the same time, a high number of transactions) and small order sizes. Thus, the supplier selection process should be simple, transparent and, above all, efficient – and hence the choice of the linear process model. The graphical representation of the model used by the case company should, however, be improved, i.e. include all crucial steps of the process and mark the party/stakeholder responsible for them.

The improved supplier selection model (as per the focus of this study) is presented in Figure 18 on the following page.

The proposed model comprises six steps, following the description of the supplier selection process the case company uses (see pp.55-58 for reference). Each of the steps has a brief explanation of what actions need to be performed to proceed to the next phase. The steps are colour-coded as follows: the internal customer's responsibility is marked in orange, the buyer's responsibility is marked in green and actions that are performed by both, the internal customer and the buyer, are marked in pink. The red dot represents the two approval stages, that the author of this study recommended to remove.

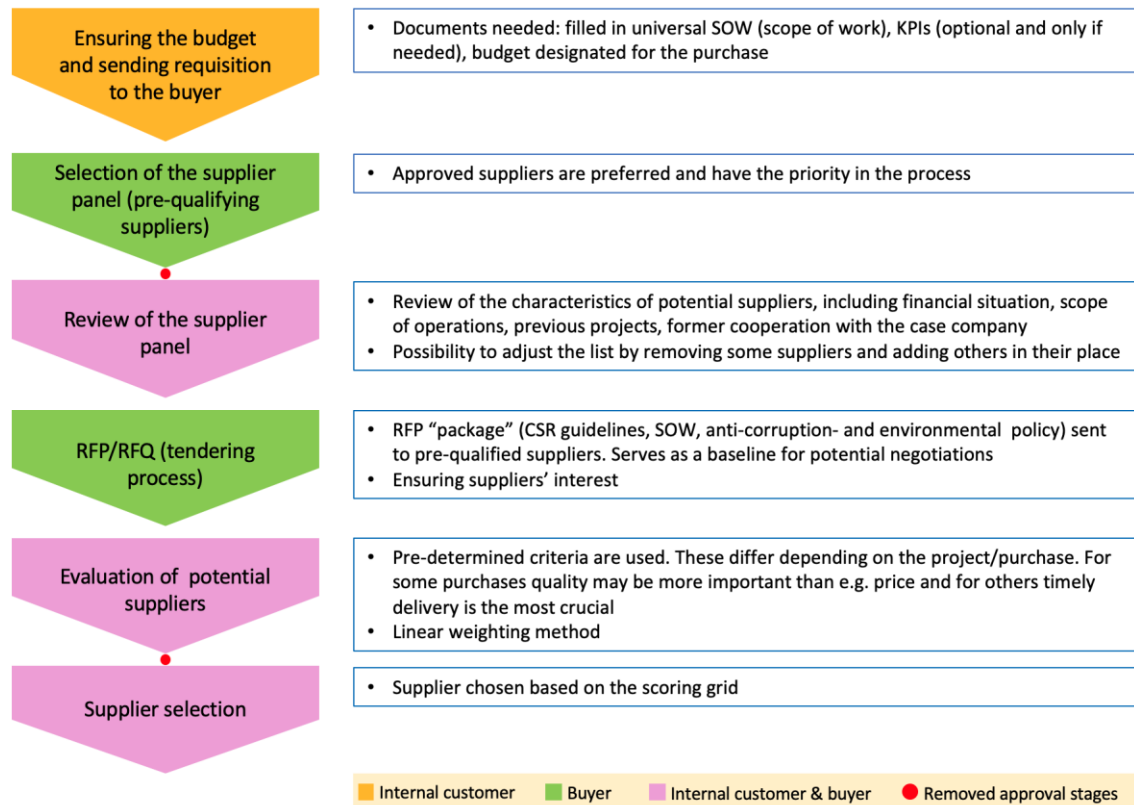


Figure 18. Proposed supplier selection model

Having a more detailed supplier selection model would allow for a better understanding and increased transparency of the model, leaving less room for uncertainty. At the same time, time-saving could occur, because all stakeholders, the internal customer in particular, would know what and when needs to be delivered to or discussed with the buyer, to progress with the supplier selection process.

As can be noted, the proposed model comprises steps previously seen across several supplier selection models in Subchapter 4.2. The names and number of the steps may vary, however, the outcome and goal of each of the previously discussed supplier selection processes remains the same – selecting the best possible supplier for the company.

6 Summary

Several purchasing process models presenting various approaches to the topic were described in Subchapter 3.3. It is therefore evident, that one, universal model does not exist. Purchasing processes can vary significantly depending on factors including the industry, the organization's size or existing specific requirements. Additionally, purchasing processes are subject to continuous improvement and adaptation to meet evolving business needs as well as market fluctuations and dynamics. The complexity of the supply chain, the types of goods or services being procured, as well as the regulatory environment and digital transformation, can all influence the purchasing process. According to Bäckstrand et al. (2019), a situation where a single PPM would exist, is not even necessarily a desirable one, due to the pluralistic character of the purchasing field. It is in the company's best interest to develop a customized purchasing process model that aligns with its specific needs and goals.

Similarly, the analysis of several supplier selection models in Subchapter 4.2 shows that one, universal supplier selection process does not exist. This can be attributed to several factors, including supplier selection being a complex and multifaceted process that involves considering various criteria and factors, different companies having different priorities, requirements, objectives and goals when it comes to selecting suppliers. The specific goals and objectives of the company can vary widely, which, in turn, makes it challenging to develop a one-size-fits-all supplier selection process. The dynamic nature of the business environment makes it difficult to develop a static and universal supplier selection process. Therefore, companies need to tailor their supplier selection process to their specific needs and context, taking into account various criteria and factors.

The selection criteria tend to vary depending e.g. on the industry, organizational goals, and specific project requirements. The most common criteria used for selecting the right supplier include price/TCO, quality, timely and uninterrupted delivery, flexibility of the supplier regarding possible changes in the order,

reliability of the supplier, and the sustainability norms and policies that the supplier follows. The business environment, however, is constantly changing, and thus companies need to adapt to new technologies, market trends, and customer demands. This results in the criteria and factors companies consider when selecting suppliers possibly changing over time.

Several methods and techniques can be used to aid the buyers in identifying and ultimately selecting suppliers that align with the company's strategic goals, operational requirements, and value proposition. The selection methods vary in underlying principles and complexity, scope, catering to diverse industries, supply chain structures, and decision-making contexts. Moreover, a particular set of selection criteria may be accommodated by several methods (De Boer et al. 2001) and several different methods can be combined to meet the specific needs of the buyer (Tahriri et al. 2008). The most common supplier selection methods are MCDM (multi-criteria decision-making) methods, including linear weighted average, AHP and FST, MP (mathematical programming) models, including linear-, goal- and multi-objective programming, TCO models, statistical models and AI-based models.

The case company showed that despite having a well-established supplier selection model, its shortcomings are inevitable. The current supplier selection model utilized by the company requires two additional approval stages, that the author of this paper finds redundant.

First of all, the budget is being allocated to RBUs by higher structures of the company – this means it is already approved. The second approval stage takes place internally – each department within each RBU needs to deliver to the finance department a detailed report of what the budget is planned to be spent on. Additionally, when the purchase requisition is created, it needs to be approved by the buyer and finance controller and, when the purchase exceeds the amount ten times bigger than the previously mentioned, also by one of the senior vice presidents. It is, in this paper's author's opinion, not necessary to have two further approval stages that need to be done during the actual supplier

selection phase, by a general manager located outside the particular RBU. The process is too time-consuming, as two weeks need to be allocated for each of these additional approval stages. The values per transaction – as per the characteristics of the indirect purchasing – are low, compared to the direct purchasing, therefore the approval process does not require to be that meticulous.

Another flaw of the existing supplier selection process is the partial lack of its clearance. A universal document which could be utilized by internal customers to define the specification does not exist. Instead, documents created in Word or PowerPoint are sent to the buyers with information regarding the potential purchase. This also results in delays – the lack of structure requires the buyer to search for the necessary information across the entire document. Additionally, it often happens that some information is missing – in this situation, the buyer needs to contact the internal customer to obtain the missing details. A universal SOW (scope of work), with a clear structure, as well as clear requirements regarding the specification, would be the best solution to this issue.

6.1 Further research

At the time of writing this paper, there are at least three recent, widely known examples of how unexpected events can negatively influence the flow of products and services in companies - the COVID-19 pandemic that started in November 2019, the blockage of the Suez Canal by Ever Given, so-called ultra-large container vessel (ULCV) in March 2021, and the Russian invasion on Ukraine which started in February 2022. These three events still affect the supply chains, causing delays. Many companies that relied on suppliers directly affected by the above-mentioned incidents had to search for alternative sources of products and services. Those who had a well-developed supplier network at the time had to, presumably, spend significantly less time and resources on finding said alternatives, compared to companies with limited supplier networks. All three previously mentioned cases exposed vulnerabilities in global supply chains, leading to disruptions in production, sourcing and distribution. Further

research on supplier selection can help identify strategies for building agile and resilient supply chains that can withstand or at least decrease the impact of future disruptions.

Recent years are marked by technological advancements (e.g. the emergence of artificial intelligence) and progressing digitalisation. Thus, further research can investigate, for instance, how these can enhance the supplier selection process, improve data-driven decision-making and enable real-time monitoring. Research can also explore the utilisation of digital tools for more effective supplier management.

Additionally, with environmental sustainability and ethical considerations gaining prominence, further research on supplier selection can explore means of evaluating suppliers' environmental practices, social responsibility, and ethical standards, aligning with changing consumer preferences.

In summary, the present environment is affected by rapid changes, emerging technologies, supply chain disruptions, and evolving consumer expectations. Further research on supplier selection is particularly relevant now, as it can help businesses navigate these challenges, capitalise on opportunities, and optimise their supply chain operations for the future.

7 References

- Aydin, S. & Urgan, M. C., 2023. Contribution to Industrial Buyer Behavior Model: An Empirical Research. *Marketing and Management of Innovations*, 14(1): 235-253.
- Baily, P., Farmer, D., Crocker, B., Jessop, D., Jones, D., 2015. *Procurement Principles and Management*. 11th ed. Harlow: Person Education Limited.
- Banton, C., 2023. Just-in-Time (JIT): Definition, Example, and Pros & Cons, *Investopedia*. Available at: <<https://www.investopedia.com/terms/j/jit.asp#citation-8>>. [Accessed 27 July 2023].
- Barbušová, M.; Medvecká, I.; Gašo, M., 2019. Use of TCO Analysis in Industry 4.0. In *Proceedings of the Průmyslové Inženýrství 2019 Mezinárodní Studentská Vědecká Konference, Pilsen, Czech Republic, 3–4 September 2019*. [online] Available at: https://www.researchgate.net/publication/336933931_Use_of_TCO_Analysis_in_Industry_40>. [Accessed 31 July 2023].
- Barratt, M. & Rosdahl, K., 2002. Exploring business-to-business marketsites. *European Journal of Purchasing & Supply Management*, 8(2): 111-122.
- Bartezzaghi, E. & Ronchi, S., 2003. Internet supporting the procurement process: Lessons from four case studies. *Journal of Manufacturing Technology Management*, 14(8): 632-641.
- Beil, D.R., 2010. Supplier selection. In *Wiley Encyclopedia of Operations Research and Management Science* (eds J.J. Cochran, L.A. Cox, P. Keskinocak, J.P. Kharoufeh and J.C. Smith). John Wiley & Sons, Inc.
- Bhutta, K. S., Huq, F., 2002. Supplier selection problem: A comparison of the total cost of ownership and analytic hierarchy process approaches. *Supply chain management*, 7(3): 126-135.
- Burt, D. N., Dobler, D. W. & Starling, S. L., 2003. *World class supply management: The key to supply chain management*. 7th ed. Boston: McGraw-Hill/Irwin.
- Burt, D. N., Petcavage, S. D. & Pinkerton, R. L., 2010. *Supply management*. 8th ed. Boston, MA: McGraw Hill.
- Bäckstrand, J., Suurmond, R., van Raaij, E. & Chen, C., 2019. Purchasing process models: Inspiration for teaching purchasing and supply management. *Journal of Purchasing and Supply Management*, 25(5): 1-11
- Cambridge Dictionary, 2023. Available at: < <https://dictionary.cambridge.org>> [Accessed 15 June 2023]

Carter, R., Croome, S., 2020. *Practical Supplier Selection and Relationship Management*. Cambridge Academic

Carter, C. R., Rogers, D. S., 2008. A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, 38(5): 360-387.

Chai, J. & Ngai, E. W. 2020. Decision-making techniques in supplier selection: Recent accomplishments and what lies ahead. *Expert Systems With Applications*, 140, Article 112903: 1-16.

Cheraghi, S.H., Dadashzadeh, M. and Subramaniam, M. 2004. Critical success factors for supplier selection: An update. *Journal of Applied Business Research*, 20(2): 91-108.

Cousins, P., Lamming, R., Lawson, B. & Squire, B., 2008. *Strategic supply management: Principles, theories and practice*. Harlow: Pearson Education.

Coyle, J.J., Bardi, E.J. and Langley, C.J., 2003. *The management of business logistics: A supply chain perspective*. South-Western/Thomson Learning.

De Boer, L., Harink, J. & Heijboer, G. 2002. A conceptual model for assessing the impact of electronic procurement. *European Journal of Purchasing & Supply Management*, 8(1): 25-33.

De Boer, L., Labro, E. & Morlacchi, P. 2001. A review of methods supporting supplier selection. *European Journal of Purchasing & Supply Management*, 7(2): 75-89.

Delke, V., Schiele, H., Buchholz, W., 2023. Differentiating between direct and indirect procurement: roles, skills, and Industry 4.0. *International Journal of Procurement Management*, 16(1): 1-30.

Dickson, G.W., 1966. An analysis of vendor selection systems and decisions. *Journal of Purchasing* 2(1), 5-17.

Fawcett, S. E., Ellram, L. M., & Ogden, J. A., 2014. *Supply chain management: From vision to implementation*. Pearson.

Ferrin, B. G. & Plank, R. E. 2002. Total Cost of Ownership Models: An Exploratory Study. *The Journal of Supply Chain Management*, 38(2): 18-29.

Ghodsypour, S., O'Brien, C., 1998. A decision support system for supplier selection using an integrated analytic hierarchy process and linear programming. *International Journal of Production Economics*, 56–57:199–212.

Golmohammadi, D., Creese, R.C., Valian, H., 2009. Neural network application for supplier selection. *International Journal of Product Development*, 8(3): 252-275.

- Handfield, R. B. & Nichols, E. L., 1999. *Introduction to supply chain management*. Upper Saddle River, N.J.: Prentice Hall.
- Humphreys, P., Wong, Y. & Chan, F., 2003. Integrating environmental criteria into the supplier selection process. *Journal of Materials Processing Technology*, 138(1): 349-356.
- Imran, M., Hameed, W. u. & Haque, A. u., 2018. Influence of Industry 4.0 on the Production and Service Sectors in Pakistan: Evidence from Textile and Logistics Industries. *Social sciences (Basel)*, 7(12): 246-266.
- Jain, V., Benyoucef, L. and Deshmukh, S.G., 2009. Strategic supplier selection: some emerging issues and challenges. *International Journal of Logistics Systems and Management*, 5(1-2): 61-87.
- Jana, P., 2020. Supplier selection under strategic decision environment. *Independent Journal of Management & Production*, 11(1): 65-80.
- Johnsen, T. E., Howard, M. & Miemczyk, J., 2014. *Purchasing and supply chain management: A sustainability perspective*. Abingdon: Routledge.
- Johnson, P. F., Leenders, M. R. & Flynn, A. E. 2011. *Purchasing and supply management*. 14th ed. Boston, MA: McGraw-Hill.
- Karpak, B., Kasuganti, R. R. & Kumcu, E. 2011. Multi-Objective Decision-Making In Supplier Selection: An Application Of Visual Interactive Goal Programming. *The Journal of Applied Business Research*, 15(2): 57-71.
- Kawa, A., 2010. Proces doboru dostawców do łańcucha logistycznego. *Studia i Prace Kolegium Zarządzania i Finansów*, 100: 66-73.
- Kim, J. & Shunk, D. L. 2004. Matching indirect procurement process with different B2B e-procurement systems. *Computers in industry*, 53(2): 153-164.
- Kim, D., Wagner, S., 2012. Supplier selection problem revisited from the perspective of product configuration. *International Journal of Production Research*. 50(11): 2864–2876.
- Kocabasoglu, C., Prahinski, C., & Klassen, R. D. (2007). Linking forward and reverse supply chain investments: The role of business uncertainty. *Journal of Operations Management*, 25(6): 1141-1160.
- Kołodziej, M., 2023. The Application of Analytical Tools and the Effectiveness of Procurement Departments: Examples of Monte Carlo Analysis, Linear Programming- Simplex.... *LinkedIn*, [online] Available at: <<https://www.linkedin.com/pulse/application-analytical-tools-effectiveness-examples-monte-kołodziej-1e/>>. [Accessed 10 August 2023].
- Koufteros, X., Vickery, S.K., Dröge, C., 2012. The effects of strategic supplier selection on buyer competitive performance in matched domains – does

supplier integration mediate relationships. *Journal of Supply Chain Management* 48(2): 93–115.

Kraljic, P., 1983. Purchasing must become supply management a strategy for supply. *Harvard Business Review*, 61(5): 109–117.

Kumaraswamy, S., 2023. What is RFQ (Request for Quotation) in the Procurement Process? *Happay*. Available at: < <https://happay.com/blog/rfq-request-for-quotation/>>. [Accessed 2 August 2023].

Lambert, D. M., Schwieterman, M. A., 2012. Supplier relationship management as a macro business process. *Supply chain management*, 17(3): 337-352.

Lewis, H. T., 1943. *Industrial Purchasing Principles and Practices*, Richard D. Irwin, Homewood IL.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, 34(2): 107-124.

Lysons, K. & Farrington, B., 2012. *Purchasing and supply chain management*. 8th edition. Harlow: Prentice Hall.

Min, H. & Galle, W. P. 2003. E-purchasing: Profiles of adopters and nonadopters. *Industrial Marketing Management*, 32(3): 227-233.

Monczka, R. M., Handfield, R. B., Giunipero, L. C. & Patterson, J. L., 2021. *Purchasing & supply chain management*. 7th edition. Boston, MA: Cengage.

Morlacchi, P., 1999. Vendor evaluation and selection: the design process and a fuzzy-hierarchical model. *Proceedings of 8th IPSERA Conference, Dublin*.

Munier, N. & Hontoria, E. 2021. *Shortcomings of the AHP Method*. [e-book] Available through: Metropolia University of Applied Sciences Library, < <https://metropolia.finna.fi/?lng=en-gb>> [10 August 2023].

Möller, S., Fassnacht, M. & Klose, S., 2006. A Framework for Supplier Relationship Management (SRM). *Journal of Business-to-Business Marketing*, 13(4): 69-94.

Narasimhan, R., Talluri, S., Mahapatra, S.K., 2006. Multiproduct, multicriteria model for supplier selection with product life-cycle considerations. *Decision Sciences*, 37(4): 577–603.

Nowakowski, T. and Werbińska-Wojciechowska, S., 2012. Przegląd metod oceny i wyboru dostawców w przedsiębiorstwie. *Logistyka*, (2, CD 2): 944-955.

O'Brien, J. 2019. *Category management in purchasing: A strategic approach to maximize business profitability*. 4th edition. London ; Philadelphia: Kogan Page.

- O'Brien, J., 2018. *Supplier relationship management: Unlocking the hidden value in your supply base*. 2nd edition. London: New York: Kogan Page.
- Onyali, C.I., 2014. Triple Bottom Line Accounting And Sustainable Corporate Performance. *Research Journal of Finance and Accounting* 5(8): 195-209.
- Ordoobadi, S. M. & Wang, S. 2011. A multiple perspectives approach to supplier selection. *Industrial Management & Data Systems*, 111(4): 629-648.
- Özfirat, P. M., Taşoğlu, G. T. & Memiş, G. T. 2014. A fuzzy analytic hierarchy process methodology for the supplier selection problem. *Journal of Enterprise Information Management*, 27(3): 292-301.
- Pal, O., Gupta, A. K., Garg, R.K. 2013. Pal, O., Gupta, A.K., & Garg, R.K., 2013. Supplier Selection Criteria and Methods in Supply Chains: A Review. *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 7: 2667-2673.
- Palmer, R. J., Green, L. D., & Ventura, M. T., 1996. Are corporate procurement cards for you? *Management Accounting*, 78(3): 22-29.
- Parikh, M.A. and Joshi, K., 2005. Purchasing process transformation: restructuring for small purchases. *International Journal of Operations & Production Management*. 25(11): 1042-1061.
- Park, K., Okudan Kremer, G. E. & Ma, J., 2018. A regional information-based multi-attribute and multi-objective decision-making approach for sustainable supplier selection and order allocation. *Journal of Cleaner Production*, 187: 590-604.
- Park, J., Shin, K., Chang, T. & Park, J. 2010. An integrative framework for supplier relationship management. *Industrial management + data systems*, 110(4): 495-515.
- Peek, L., Verweij, H., 2013. Supplier Relationship Management - How key suppliers drive your company's competitive advantage, PwC. Available at: <https://www.pwc.nl/nl/assets/documents/pwc-supplier-relationship-management.pdf> [Accessed 15 December 2022].
- Porter, M. E. 1985. *Competitive advantage: Creating and sustaining superior performance*. New York: London: Free Press; Collier.
- Rados, D.L., 1970. Some aspects of small firm purchasing activities. *European Journal of Marketing*, 4(1): 9-17
- Robinson, P. J., Faris, C. W. and Wind, Y., 1967. *Industrial buying and creative marketing*. Allyn & Bacon.
- Ropp, M., 2022. The RFP process: The ultimate step-by-step guide, RFP360. Available at: <https://rfp360.com/rfp-process-guide/> [Accessed 15 June 2023].

- Shil, N.C., 2010. Customized Supplier Selection Methodology: An Application of Multiple Regression Analysis. *Supply Chain Forum: An International Journal*. 11(2): 58-70.
- Smith, P., 2019. Why Supplier Management should be central to your procurement thinking. OFS Portal LLC. Retrieved November 20, 2021 from <https://docplayer.net/5804298-Whysupplier-management-should-be-central-to-your-procurement-thinking.html>
- Taherdoost, H., Brard, A., 2019. Analyzing the Process of Supplier Selection Criteria and Methods. *Procedia Manufacturing*, 32: 1024-1034.
- Tahriri, F., Osman, M., Ali, A., Yusuff, R., 2008. A review of supplier selection methods in manufacturing industries. *Suranaree Journal of Science and Technology*. 15(3): 201-208.
- Talluri, S., Narasimhan, R., 2003. Vendor evaluation with performance variability: Amax–min approach. *European Journal of Operational Research*, 146(3): 543–552.
- Thiruchelvam, S. & Tookey, J. 2011. Evolving Trends of Supplier Selection Criteria and Methods. *International journal of automotive and mechanical engineering*, 4: 437-454.
- Toyota, 2023. Toyota Production System, *Toyota*. Available at: https://www.toyota-global.com/company/history_of_toyota/75years/common/pdf/production_system.pdf [Accessed 27 July 2023].
- Ulaga, W. & Eggert, A. 2006. Value-Based Differentiation in Business Relationships: Gaining and Sustaining Key Supplier Status. *Journal of Marketing*, 70(1): 119-136.
- Verma, R. & Pullman, M. E. 1998. An analysis of the supplier selection process. *Omega (Oxford)*, 26(6): 739-750.
- Wagner, S. M. & Bode, C., 2014. Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing. *Journal of Operations Management*, 32(3): 65-78.
- Weber, C. A., Current, J. R., & Benton, W. C. (1991). Vendor selection criteria and methods. *European Journal of Operational Research*, 50: 2-18.
- Weele, A. J. v., 2018. *Purchasing and supply chain management*. 7th edition. Australia: Cengage.
- Weele, A. J. v. k. & Rozemeijer, F. 2022. *Procurement and supply chain management*. 8th edition. Andover, Hampshire, United Kingdom: Cengage Learning EMEA.

Yildiz Çankaya, S., 2020. The effects of strategic sourcing on supply chain strategies. *Journal of Global Operations and Strategic Sourcing*, 13(2): 129-148.