Rotterdam School of Management
Erasmus University

Leids Universitair
Medisch Centrum

Master Thesis
MSc Supply Chain Management

Prescribing Sustainability: a design study on incorporating economic, environmental, and social sustainability criteria in the procurement of medicine

Author: Christiane Wolfaart
Student Number: 521281
Student email: 521281cw@student.eur.nl

Coach: Erik van Raaij
Co-reader: Harwin de Vries
Date: July 6th, 2025

Author's declaration

The author declares that the text and work presented in this Master Thesis is original and that no sources other than those mentioned in the text and its references have been used in creating the Master Thesis. The copyright of the Master Thesis rests with the author. The author is responsible for its contents. RSM Erasmus University is only responsible for the educational coaching and beyond that cannot be held responsible for the content.

Preface

Dear reader,

This thesis was written in the context of an important topic: the sustainability of healthcare. As part of the LDE Sustainability Labs, I had the opportunity to conduct research on integrating sustainability into the procurement of pharmaceuticals. I carried out this research on behalf of Dutch hospital LUMC. I would like to express my sincere gratitude to my supervisor at LUMC, who was consistently available to answer my questions on this complex topic and to discuss potential next steps.

I would also like to thank the members of the purchasing group whose tender process I studied. They were extremely helpful in unpacking the various aspects of this issue and took the time to familiarize me with the context of the problem. Furthermore, I want to thank my academic coach, Erik van Raaij, whose thorough feedback elevated the quality of this thesis.

Finally, a big thank you to my fellow students in the LDE Sustainability Labs for the enjoyable collaboration and pleasant company.

I hope you enjoy reading this thesis as much as I enjoyed writing it.

Sincerely,

Christiane

Abstract

Within The Netherlands, the healthcare industry is responsible for 7.3 percent of the national climate change footprint. Within a hospital, the procurement of medicines is a significant contributor to a hospital's carbon footprint. This illustrates there is much to win in the reduction of the carbon footprint associated with the procurement of medicine. This thesis explores how economic, environmental, and social sustainability can be integrated into the procurement of medicine for the purchasing group of Dutch academic hospitals (UMCPG) to ultimately decrease this footprint. Recently, the UMCPG introduced a Pilot Supplier Questionnaire (PSQ) including sustainability criteria as a tool to achieve a more sustainable supplier selection process. Semi-structured interviews with both purchasers and suppliers revealed key challenges in the PSQ and corresponding tendering process. Findings on the PSQ reveal a lack of understanding about the goal and context of the PQ and its questions, the need for transparency about the outcome of the tender, the need for objectivity in the evaluation of the PSQ, and the desire for a uniform supplier questionnaire across purchasing parties. Findings on the tendering process reveal the complexities of the PSC that impact both parties like drastic medicine shortages, price competition, keeping general healthcare costs low, ensuring high patient safety, and the price tag of sustainability. The theoretical foundation of this thesis builds upon the Theory of Planned Behaviour for green procurement behaviour. Findings reveal that purchasers' have a positive attitude towards sustainability and green procurement, work-related stakeholders convey the norm for keeping medicine procurement costs low, the sense of behavioural control is biggest as being part of the UMCPG rather than on individual level, and the intention to engage in green procurement is generally positive like the purchasers' attitude. Based on the findings, the following solutions are designed for the UMCPG: 1) a renewed supplier questionnaire (TSQ) including categories, 2) a decision hierarchy, 3) 'rebranding' the procurement process, 4) a recommendation for tender transparency, and 5) suggestions for improving the TSQ including example question types and directions for moving towards a uniform TSQ across purchasing parties. Social sustainability criteria were eventually excluded in the TSQ design, since too little information was gathered on social sustainability during the interviews.

Table of Contents

Chapter 1. Introduction

The earth is heating up more rapidly than ever. The current global warming is about 1.3 degrees compared to the 1850-1900 baseline, which is higher than the average of the last ten years (Forster et al., 2023). Greenhouse gas emissions like carbon dioxide contribute significantly to climate change, and those emissions are increasingly produced by human activities (Bilgili et al., 2024). The healthcare industry is no exception to the contribution of global warming. Within The Netherlands, the healthcare industry is responsible for 7.3 percent of the national climate change footprint (Steenmeijer et al., 2022). Moreover, pharmaceuticals and chemical products are responsible for 27.9 percent of the total greenhouse gas emissions produced within the Dutch healthcare sector (Steenmeijer et al., 2022). A study of Dutch academic hospital Erasmus Medical Centre found that purchased goods and services account for more than half of the hospital's carbon footprint. Of that footprint, medicines are the most polluting category as they are responsible for 41.6 percent of the emissions of all purchased categories combined (Lau et al., 2024). This illustrates there is much to win in the reduction of the carbon footprint associated with the procurement of medicine. Therefore, it is relevant to explore 'green' procurement practices for the pharmaceutical supply chain (PSC). The PSC refers to all supply chain activities associated with pharmaceuticals, from sourcing raw materials to manufacturing medicine, distribution, inventory planning, purchasing, and the consumption of the final medicine. Green supply chain management refers to an organization's efforts to improve social and environmental performance of itself, suppliers, and customers, without compromising the economic performance (Gimenez et al., 2012). For the PSC, procurement refers to all processes involved when purchasing pharmaceuticals. Green procurement refers to purchasing medicine in a sustainable manner.

There is an increasing attention for a greener healthcare industry. An example is the 'Green Deal 3.0', which is the third version of an agreement between the government and various organizations to achieve sustainable business practices across industries. For the healthcare industry, the Green Deal focuses on five themes: improving general health, knowledge and awareness, carbon emission reduction, circularity, and medicine (Rijksoverheid, 2022). Within the theme of medicine, there are multiple focus points: obtaining knowledge about the ecological footprint of medicine, researching water purification for medicine waste, green prescribing behaviour for medicine, and including sustainability criteria for medicine procurement. The goal is to transition towards a green PSC. The procurement of medicine occurs across organizations in the PSC, like health insurance companies and hospital pharmacies. As illustrated with the example of Erasmus Medical Centre, hospital pharmacies purchase a significant amount of medicine. Within the Netherlands, there are eight academic hospitals known as University Medical Centres (UMCs), which collaborate on multiple aspects, including procurement. Consequently, the UMCs have a centralized purchasing group (UMCPG) for the procurement of medicine. The UMCPG is a collaboration between all procurement professionals of each individual hospital pharmacy, and is led by coordinating purchasers (NFU, 2025). One of the factors the UMCPG considers during their procurement process, is economic sustainability. They define economic sustainability as preventing delivery issues, since it has a significant negative effect on the patients in need if their medicine is unavailable. Recently, the UMCPG has introduced a pilot supplier questionnaire (PSQ) in the supplier selection phase of their procurement process. The PSQ includes sustainability criteria. For example, suppliers were

asked about, and later scored on, their waste management practices and how they source their raw materials. Other criteria included (safety) stock management and availability, and product specific requirements. The pilot revealed that it was difficult for purchasers to evaluate and compare suppliers on the sustainability criteria. On the other side, suppliers were dissatisfied with the new sustainability criteria as they felt they could not provide all information in the closed-ended format, which might give them a disadvantage in the procurement process. This highlights the importance of evaluating the impact of the current sustainability criteria on the procurement process and finding a more optimal approach to green medicine procurement (GMP) for the UMCPG. Hence, this study will research GMP within hospital pharmacies. More specifically, the aim of this thesis is to redesign the PSQ to incorporate all feasible sustainability criteria in the medicine procurement process of the UMCPG.

In general, there is a growing body of literature on green procurement, mostly in the areas of green supplier selection and supplier evaluation (Masudin et al., 2022). Research on GMP remains relatively limited, with much of the existing literature focusing on the application of Multi-Criteria Decision-Making models (MCDMs). The MCDMs are mathematical frameworks which are designed to incorporate multiple criteria, including green criteria, to support the decision-making process in supplier selection (Stević et al., 2020; Saputro et al., 2022). However, beyond this specific application, GMP remains relatively unexplored within the existing literature. This thesis contributes to theory by expanding on the current scope of research in the area of GMP. It explores how economic, environmental, and social criteria can be incorporated in medicine procurement. It further explores which criteria are feasible from a suppliers' perspective, along with the likelihood of purchasers engaging in GMP. For the latter, factors influencing the intention to engage in GMP are be explored. Such research has practical relevance as a formatted supplier questionnaire is designed which healthcare policy makers and other purchasing groups can utilize to reduce the negative environmental impact, such as carbon footprint, of purchased medicines as a category.

Chapter 2. Theoretical framework

This chapter explains the phenomena and processes underlying the research question as introduced in the preceding chapter. First, it discusses the pharmaceutical supply chain (PSC) per supply chain phase. Second, it elaborates on green medicine procurement (GMP). Third, it elaborates on green medicine manufacturing. Fourth, it discusses supply chain transparency and supplier selection to enhance PSC sustainability. Fifth, it discusses factors influencing green procurement behaviour. Sixth, the research question and related sub questions are presented.

2.1 Pharmaceutical supply chain

As described in the introduction, the PSC refers to all supply chain activities associated with the pharmaceutical industry. This includes the sourcing of raw material, manufacturing of pharmaceuticals, distribution, purchasing between tiers, consumption, and disposal of the pharmaceuticals (Singh et al., 2016). Figure 1 shows a visual representation of the PSC. Pharmaceuticals include medicine ready for prescription, but also chemical substances that are still to be included in medicine. This section will focus on pharmaceuticals as a whole, as most literature is focused on both categories. It will be narrowed down to medicine ready for prescription when explicitly referred to in the literature.

The PSC is suggested to be more complex, as there are various critical stakeholders, extensive product ranges, and (dynamic) regulations for all actors to oblige (Bhakoo & Chan, 2011). Prior studies have mainly focused on researching cost reduction practices within the PSC (Singh et al., 2016; Huff-Rouselle & Burnett, 1996; Baldi & Vannoni, 2017). Yet, over the last decade the body on sustainability within the PSC has been growing. The following subsections will discuss the environmental impact per supply chain phase and its corresponding activities.

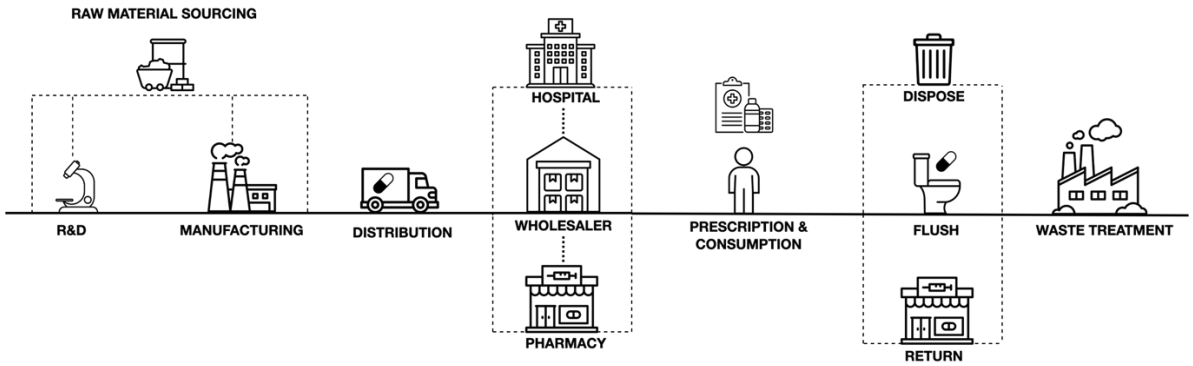


Figure 1. Pharmaceutical Supply Chain (author's own creation)

2.1.1 Manufacturing, warehousing, and distribution

Research shows that the manufacturing phase of pharmaceuticals is where a significant amount of the pollution occurs (Chen et al., 2024). During manufacturing, there is a high level of energy consumption, most of which is electricity. Additionally, the chemical consumption of raw materials and solvents used in the production process are associated with a high negative environmental impact.

Another element of pharmaceutical manufacturing is the packaging material that is used for various medicines. Research shows that different types of packaging, including blisters, bottles, and sachets, have a negative environmental impact (Bassani et al., 2022). The production of the packaging materials has the highest negative impact, compared to other stages

like distributing the raw materials. Moreover, blister packaging has the most room for improvement as there is excessive space between the pills within one blister, and between the blisters and the packaging around it. Finally, the authors argue that reducing unutilized space of pharmaceutical packaging will lead to greater transport efficiency. If a packaging becomes smaller in its dimensions, more products will fit into one full truckload. Consequently, the emissions attributed to each packaging in the truckload is decreased.

Finally, the distribution of pharmaceuticals contributes to the pollution within the PSC. Pharmaceutical logistics has some unique characteristics, for example the need to control the temperature of the vehicles and warehouses for temperature-sensitive medicine (Ashworth et al., 2025). The need for temperature control is associated with a higher electricity consumption of the vehicles and warehouse buildings. An example of research on decreasing the carbon footprint of pharmaceutical logistics, is applying the vehicle routing problem. The latter refers to a route optimization problem, where delivery routes are optimized to meet certain objectives like saving costs. For pharmaceutical logistics, the optimization of delivery routes has been proven effective to significantly reduce both costs and carbon emissions (Shao & Lu, 2023).

2.1.2 Pharmaceutical procurement

As illustrated in the introduction, the procurement of medicine is associated with a significant share of carbon emissions (Lau et al., 2024; Tomiak et al., 2024). Research highlights how including green policies or environmental criteria in pharmaceutical procurement is necessary for a more sustainable healthcare industry (Jerin et al., 2024; Tomiak et al., 2024). Yet, there is little research on the operationalization of green procurement for pharmaceuticals. Existing research will be further discussed in section 2.2 and 2.5.

2.1.3 Prescription and consumption of pharmaceuticals

After the pharmaceuticals have been manufactured and purchased by intermediate parties like pharmacies, the medicine will be prescribed to patients and consumed by them. However, research shows that prescription and consumption activities are also associated with negative social and environmental impact (Daughton & Ruhoy, 2012). There are many cases where too much of a medicine is prescribed. Negative social effects can be that the patients' medical expenses are unnecessarily high, possessing an excessive amount of medication could facilitate addiction or abuse of the medication, or it can stimulate second-hand use of medicine for recreational purposes instead of health purposes. Negative environmental effects include incorrect disposal of the medicine, where patients might flush the excess medication through the toilet. Unrightful disposal could then lead to pollution of the sewage systems, and harmful traces of toxins could contaminate drinking waters and food supplies later on. The proposed solution by the authors is to minimize the prescribed dose, to mitigate the aforementioned negative consequences of excessive dosage.

2.1.4 End-of-life treatment, waste treatment, and reverse flow

Another field of interest is the end-of-life treatment of pharmaceuticals. This refers to how the medicines are disposed of, or possibly processed for reuse. The prior paragraph described how wrongful disposal by patients can have a negative environmental impact. Recent research has studied how organizations within the PSC could play a role in a sustainable end-of-life treatment

of medicine. Viegas and colleagues (2019) researched how reverse flows could be organized within the PSC. An example of a reverse flow is reverse logistics, which focuses on reusing, repairing, and remanufacturing products to either recapture value or properly dispose of a product (Govindan et al., 2015). However, in practice it proves to be very complex to repurpose medicine (Viegas et al., 2019). It is difficult to donate the medicine, as there is often a mismatch between the donated supply of medicines and the demand of other patients. Moreover, the quality control of the donated medicine is complex due to strict regulations and the lack of verification on the conditions the medicines were stored in before donation. A patient might have unintentionally stored the medication in a different manner than is recommended for the medicine, like at a different temperature or the medicine is overexposed to sunlight. Further studies on PSC sustainability highlight waste management and waste reduction as key challenges (Veleva et al., 2017). Pharmaceutical waste is harmful for the environment and could, for example, be decreased through careful inventory planning (Romdhani et al., 2022).

From the review on all phases of the PSC, it is apparent that there is significant pollution throughout the whole supply chain. For most phases, there is an increasing body of research on how to decrease the carbon footprint of the respective phase. However, the research is relatively scarce on decreasing the negative environmental impact of pharmaceutical procurement. The need for guidelines on green pharmaceutical procurement has been emphasized, but in-depth research on how to design these policies appears difficult to find. This highlights the importance of contributing to theory about green procurement of pharmaceuticals. Moreover, most literature discusses pharmaceutical procurement, whereas little research is specifically focused on medicine procurement. Therefore, this thesis focuses on green medicine procurement (GMP), expanding the scarce body of research. Specifically, a problem of the UMCs' centralized purchasing group (UMCPG) is studied on how to incorporate sustainability criteria in their medicine procurement process. This thesis researches which criteria are feasible for suppliers to comply with, where green manufacturing practices and initiatives will be explored. In addition, this thesis researches the likelihood of purchasers engaging in GMP, where the factors influencing purchasers' intention to engage in green procurement are explored. The following sections provide an elaboration on green procurement and GMP, green manufacturing practices, supply chain transparency to achieve a sustainable PSC, and factors influencing purchasers' behaviour during the procurement process.

2.2 Green medicine procurement

There is a growing body of literature on the topic of green procurement, especially for the areas of supplier selection and supplier evaluation (Masudin et al., 2022). Within the small body of literature on green procurement in the healthcare industry, the method of Multi-Criteria Decision-Making models (MCDMs) is a recurring theme (Saputro et al., 2022). The MCDMs are mathematical models, in which multiple criteria are used to make a decision about, in this case, which supplier to select. Although the mathematical methods are beyond the scope of this research, the sustainability criteria that are evaluated in the MCDMs can provide interesting insights for the solution design of this thesis. Within the MCDMs, the sustainability criteria are often defined as threefold: economic, environmental, and social. Stević and colleagues (2020) have defined a framework of sustainable criteria based on a review on sustainable supplier

selection within the healthcare industry. Examples of the economic criteria are price, quality, assortment width, and reliability; examples of the environmental criteria are environmental competencies, recycling, pollution control, and green R&D; and examples of the social criteria are work safety and labour health, security practices, and information disclosure. These criteria can provide guidance on which criteria might be feasible to examine for the solution of thesis, also from the suppliers' perspective.

2.3 Green manufacturing and distribution of medicine

A relevant theme to explore from the suppliers' perspective is Green Chemistry or green manufacturing, which refers to the green production of pharmaceuticals. The goal is to minimize the negative impact on the environment caused by the manufacturing process of medicine. Examples of Green Chemistry practices in the PSC are preventing waste, minimizing the energy consumed by chemical processes, and designing chemicals in such a way that they are degradable and break down into substances that are not harmful to the environment (Al-Shatti et al., 2023). A second dimension of manufacturing includes the packaging of the medicine. As discussed in section 2.1.1., product packaging has a negative environmental impact. A third supply chain activity associated with the manufacturing process, is the distribution of the medicine once they enter the market. As described in section 2.1.1, this also contributes to the emissions generated by the PSC. Suppliers are often held accountable for the impact of both the manufacturing process and the distribution up until the delivery of the medicine to the hospital pharmacies. Insights into the current green manufacturing and distribution processes of medicine suppliers will help determine the feasibility of sustainability criteria included in the medicine procurement process of the UMCPG. The subsequent sections explore frameworks and initiatives that can be used to assess the extent to which sustainability is integrated into the business processes of pharmaceutical suppliers.

2.3.1 Green Chemistry Principles

A framework that can be utilized to assess (part of) the green manufacturing practices of pharmaceutical manufacturing firms, is the set of Green Chemistry principles. Green Chemistry refers to the design of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances (Anastas & Werner, 1998). The concept of Green Chemistry aims to achieve pollution prevention and minimizes the negative environmental impact of industrial chemistry (Noce, 2018). In total, twelve principles were designed by Anastas and Werner (1998), including, but not limited to, waste prevention, use of renewable materials, design for energy efficiency, and design for degradation. To date, these principles are a practical tool to explore whether the production process of pharmaceutical manufacturing firms happens in a manner that minimizes negative environmental impact.

2.3.2 Green Deal 3.0

A local initiative that can be used to examine the extent of sustainability integration in business practices is the 'Green Deal 3.0' for sustainable healthcare. As described in the introduction, the Green Deal 3.0 focuses on five themes: improving general health, knowledge and awareness, carbon emission reduction, circularity, and medicine (Rijksoverheid, 2023). The goal is to transition towards a green PSC. Across the themes, there are pointers mentioned that are

relevant for suppliers in the pharmaceutical sector to improve their sustainability performance. Within the theme of circularity, suppliers and manufacturing firms are not to use more packaging materials for pharmaceuticals than strictly necessary. Within the theme of medicine, firms are expected to source in a sustainable manner and maximize efforts to decrease medicine waste in water. Whether or not suppliers have signed the Green Deal 3.0, reflects the degree of sustainability integration within their business practices.

2.4 Supply chain transparency and supplier selection to enhance PSC sustainability

In general, an aspect in moving towards a more sustainable supply chain is supply chain transparency. A firm is considered to be transparent when it publishes information about its suppliers' sustainability practices and procurement practices (Brun et al., 2020). Factors that influence the degree of supply chain transparency are collaboration, information sharing, supply chain visibility and sustainability (Hussain et al., 2023). Supply chain visibility refers to the extent the upstream and downstream activities within a supply chain are known. Gardner and colleagues (2018) propose six types of information that can be shared in a supply chain: transactions, traceability, impacts, policies and commitments, activities, and effectiveness information. Research shows that trust is a requirement for information sharing in the supply chain (Kotcharin et al., 2024). A main challenge in supply chain sustainability is the lack of transparency, especially in buyer-supplier relationships (Gonçalves & Silva, 2021). Yet, supply chain transparency could be enhanced via supplier selection processes. The study of Yang & Lu (2024) developed a model for supplier evaluation considering transparency practices. The authors argue that tendering and evaluation processes within public tendering with predefined scoring systems are probably the most effective influence tools in enhancing supply chain transparency. Transparency on the published criteria and a public disclosure of missing data might stimulate firms to improve discovery processes and close the transparency gaps. For the PSC, there is mainly research on how to improve supply chain transparency via blockchain (Mirdad & Hussain, 2021) but little to no research on how to improve supply chain transparency via supplier selection. Although supplier selection can play a pivotal role in enhancing supply chain transparency to increase supply chain sustainability, it is ultimately the purchasers who operationalize these processes. Their intention to engage in green procurement impacts the effectiveness of tools like criteria to enhance supply chain transparency. Therefore, the next section explores the factors that influence purchasers' intention to engage in green procurement.

2.5 Factors influencing purchasers' intention to engage in green procurement

The literature review on supplier selection frameworks of Saputro and colleagues (2022) find that suppliers are assessed and selected based on a multi-criteria approach. Moreover, the criteria used within a procurement process consist of both quantitative and qualitative criteria. For example, price and quality are quantitative criteria, where service and flexibility are rather qualitative, and risk and environmental criteria tend to be a mixture of both. The mixed method assessment of the environmental criteria highlights how the evaluation of the sustainability criteria is partly reliant on the judgement of the respective purchasers. Research suggests that relying on the purchaser's judgement for supplier selection can be beneficial, if for example experience-based intuition is utilized (Kaufman et al., 2014). This emphasizes the importance of

exploring how the judgement of a purchaser is formed. The judgement of a purchaser and the subsequent purchasing behaviour are influenced by numerous factors. The following section discussed the Theory of Planned Behaviour, which explains the factors influencing a person's intention to engage in a particular behaviour and the actual performed behaviour.

2.5.1 Theory of Planned Behaviour

A theory that can explain how the decision-making process within supplier selection is influenced, is the Theory of Planned Behaviour (TPB). This theory is developed by Ajzen (1991) and explains how actual behaviour is strongly dependent on an individual's intention to perform a certain behaviour. Generally, the stronger the intention is, the more likely an individual will engage in the behaviour. An important note is that the person should have control over whether or not they perform the behaviour for intention to be a predictor. Moreover, the perceived control a person has over their behaviour influences the intention a person might have. This relates to the perception of how easy or difficult a person believes it to be to perform a given behaviour, as well as the confidence they have in their ability to perform it. Another determinant of intention is an individual's attitude towards the behaviour. This relates to how desirable or undesirable a person thinks a given behaviour is to engage in. A third and final determinant of intention is a social factor called subjective norm. This norm refers to the social pressure a person might feel to perform or not perform a given behaviour. Theoretically, the intention of a person to perform a given behaviour should be the strongest when the attitude and subjective norm is most favourable, and the perceived behavioural control is high. The TPB further suggests that the three predictors of intention are correlated, where perceived behavioural control also directly correlates with the performed behaviour. Figure 2 shows a conceptual model of the TPB.

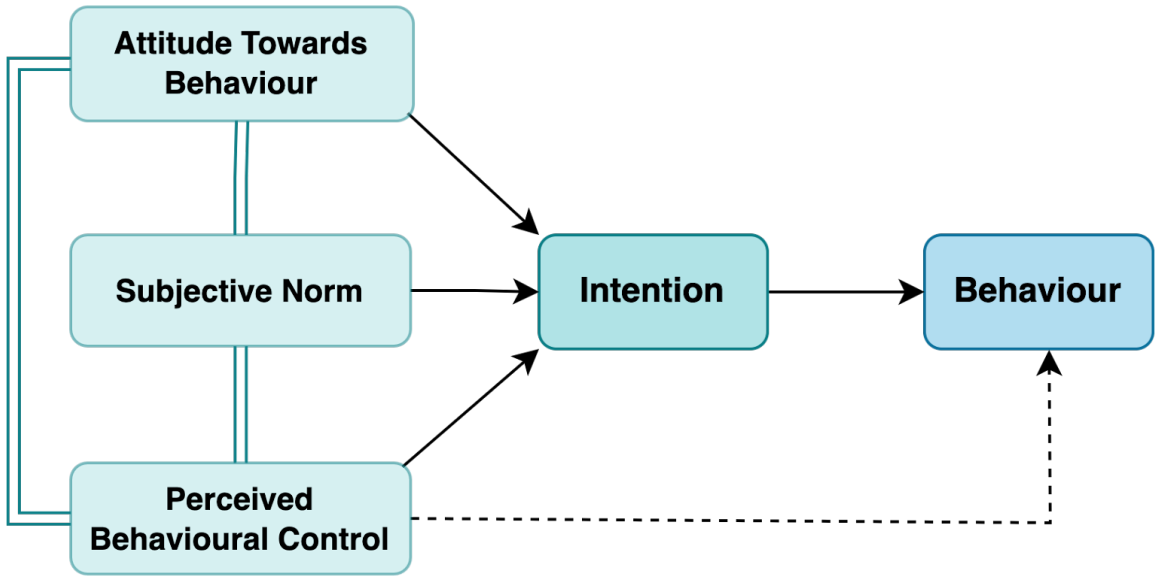


Figure 2. Theory of Planned Behaviour (author's own creation based on Ajzen (1991))

2.5.2 Theory of Planned Behaviour in green purchasing

There is already a significant body of research on how the TPB could explain green consumer purchasing. Examples are the consumers' intention to purchase electric cars, green footwear, and choose sustainable hotels and restaurants (Yeğin & Ikram, 2022; Aseri & Ansari, 2023; Nimri et al., 2020). However, green procurement within organizations is still a lot less explored. Within the area of procurement, the TPB has only since recently been researched specifically as a driver of green procurement.

Hinterhuber and Khan (2025) have defined the intention of procurement professionals as willingness to pay for sustainability. The procurement professionals that participated are from varying EU countries across different industries, including the healthcare sector. The researchers studied how attitude, subjective norm, and perceived behavioural control influences the willingness to pay (WTP) for sustainability, with the behaviour being defined as sustainable purchasing behaviour. It was found that the WTP is primarily influenced by attitudes and perceived behavioural control, but no significant relationship was found between subjective norm and WTP. Moreover, the authors find that awareness of consequences influences WTP. This awareness is defined as the purchaser being aware of the economic, social, and environmental consequences of their decision and behaviour. Another factor the authors found to be influencing the WTP is perceived CSR engagement, which relates to the organization's engagement in Corporate Social Responsibility practices. Finally, the strongest correlation was found between WTP and sustainable purchasing behaviour. The authors argue that this indicates that when a procurement professional is willing to pay for sustainability, they are more likely to select suppliers that are engaging in sustainable practices.

An earlier study by Yang and colleagues (2019) examines how likely buyers in the construction industry are to engage in green purchasing behaviour. In contrast to Hinterhuber and Khan (2025), this research found a significant influence of subjective norms and perceived behavioural control on the intent to, and consequently behaviour of, engaging in green procurement. Moreover, the authors find that subjective norms and perceived behavioural control influence the attitude of the buyers. This interaction between the predictors of intention is in line with the TPB as defined by Ajzen (1991). The authors argue that the more positive the attitude towards green procurement, the support originating from the buyer's environment, and the ability of the buyer to control their own resources, the more willing the buyers are to engage in green procurement. The authors further argue that the perceived behavioural control is more complex for the buyers in the construction industry, as one construction project involves many stakeholders and a complex project environment. This is an insightful note, as such complexity could also be the case for the UMCPG. The UMCPG has to satisfy the demand for each separate hospital pharmacy but also consider the wellbeing of the patients. Furthermore, any regulations or policies must be obliged. This can also restrict the control of the purchasers within the UMCPG. Where the study of Yang and colleagues (2019) shows how the classic constructs as defined in the TPB influence green procurement behaviour, the study of Hinterhuber and Khan complements the findings by incorporating the financial aspect of green procurement behaviour.

Another study by Neessen and colleagues (2021) researched how likely Dutch and Belgian purchasers across profit and non-profit organizations were to engage in circular purchasing. They defined the intention as the intent to act pro-environmentally, expressed by organizational citizenship behaviour towards the environment. It was found that the intent to act

pro-environmentally indeed preceded the behaviour to do so. Moreover, the researchers found that this was specifically the case for purchasers in high-level positions. There was no significant correlation found between the intent and behaviour for purchasers in low-level positions. The authors argue that this could be explained by the lack of perceived behavioural control for the low-level purchasers. This adds another complexity to the precedents of intention to display a certain behaviour.

The research discussed above illustrates how precedents and intentions differ across purchasing positions in terms of hierarchy (low-level vs. high-level), how financial aspects like WTP influence the behaviour, and how complexities might differ across industries. This thesis explores which attitudes, subjective norms, and perceived behavioural control are present for the purchasers of the UMCPG, and how these are connected to the intention to engage in green procurement. The findings contribute to the growing body of research on how the TPB influences green procurement practices, specifically for GMP. Furthermore, the answer to this question gives insights to any barriers in engaging in green procurement behaviour. This is relevant since the adoption of sustainability criteria by itself might not be enough to move towards a green procurement process. If the criteria are considered to be irrelevant due to, for example, personal attitudes, this could affect the procurement process in a negative manner. Another example is if a purchaser gives each supplier the same rating on the sustainability criteria, the inclusion of the criteria will not matter for the final ranking of suppliers. Furthermore, if green suppliers turn out to be the more costly options and purchasers are not willing to pay for this, the criteria are also easily overruled. The insights on the TPB provide guidelines for a holistic and successful implementation of the sustainability criteria.

2.6 Research question and sub questions

The literature review above leads to the following research question and sub questions.

RQ. How can the Dutch University Medical Centre's pharmacies' purchasing group (UMCPG) for medicine incorporate economic, environmental, and social sustainability criteria in their procurement process?

SQ1. What does the current procurement process of the UMCPG look like?
SQ2. What has already been done to integrate sustainability into the medicine procurement process?
SQ3. What are suppliers currently doing in terms of green manufacturing and distribution practices?
SQ4. Which sustainability criteria are feasible to include in the supplier selection process from the suppliers' perspective?
SQ5. What are the attitudes, subjective norms, and perceived behavioural control underlying purchasers' intention to engage in green procurement?

Chapter 3. Methodology

This chapter outlines the research methodology of this thesis. Research design, participants and data collection, interview protocol, survey design, data analysis, and validity and reliability of the research are discussed.

3.1 Research design

This thesis aims to redesign the pilot supplier questionnaire (PSQ) that the UMCPG introduced for the supplier selection phase in their procurement process. Feedback on the PSQ is gathered, and the PSQ is redesigned accordingly and in such a manner that it includes feasible economic, environmental, and social sustainability criteria. Both the perspectives of the suppliers and purchasers on the PSQ are explored to provide insight in an appropriate redesign of the PSQ. Additionally, suppliers' developments on green manufacturing and green distribution practices are explored to see which criteria are feasible to include. Moreover, purchasers' intention to engage in GMP is explored to identify potential barriers that could impede the practical application of the PSQ. Both perspectives are researched and discussed within interviews. Hence, the research design of the study is of qualitative nature in the form of a design study. A qualitative approach is appropriate, as this can be utilized to describe and interpret subjective opinions attributed to actions and situations (Fossey et al., 2002). In this thesis, a qualitative approach allows the researcher to gain in-depth knowledge about the opinions of both the suppliers and purchasers on the procurement process and sustainability. A design study is appropriate as this type of study is focused on designing a solution for a field problem that is addressed by the problem holder (Van Aken & Berends, 2018). The problem that is researched in this thesis is proposed by one of the UMCs that is a member of the UMCPG.

3.1.1 Design study

A design study, as proposed by Van Aken and Berends (2018) follows the intervention cycle as displayed in figure 3. Under standard conditions, the first step is problem definition, where the perceived problem is validated. For this research, the problem is how to include sustainability in the procurement process of the UMCPG. Since the UMCPG has recently conducted a pilot where they implemented the PSQ for the suppliers, this research started with the evaluation of this the PSQ. Hence, this thesis begins with the evaluation step of the intervention cycle instead of the problem definition step. Within the evaluation step, I explored the experiences of relevant stakeholders with the PSQ. Relevant stakeholders could be categorized in three groups: a) members of the UMCPG who are part of its sustainability team that designed the PSQ, b) supplying firms that participated in the pilot tender and provided answers to the PSQ and c) purchasers and hospital pharmacists of both the UMCPG and individual UMCs that evaluated the scores of all suppliers on the PSQ. For example, prior to this research, the suppliers have expressed that they felt the PSQ was unfair as they were unable to provide all answers. Within the problem diagnosis phase, the problem was empirically validated by performing a root cause analysis. The root cause analysis embodied further specifying the problem by elaborating on its problematic characteristics and exploring the causes (van Aken & Berends, 2018). In this step, the sub questions stated in section 2.6 were answered. The data for both the evaluation and the root cause analysis has been collected via interviews with and questionnaire responses from the aforementioned stakeholders. The insights in the current procurement process, suppliers' green

manufacturing or distribution practices, feasibility of the criteria, and insights arising from the TPB framework have provided a substantial basis for the design of a solution. Prior to the the solution design, a set of design rules was formulated in accordance with the UMCPG, as well as relevant theory. The design rules defined the boundaries within which the solution was to be developed. Multiple solutions were designed and discussed with the UMCPG members and redesigned according to the gathered feedback. The final solution was presented to the UMCPG, accompanied by a guideline on how to utilize the solution. The implementation of the solution was out of scope for this research due to time constraints. Yet, the evaluation of the solution was performed as a final step, where the solution is validated. The solution was validated via reviews from various members of the UMCPG gathered during a prestation on the solution held by the author of this thesis.

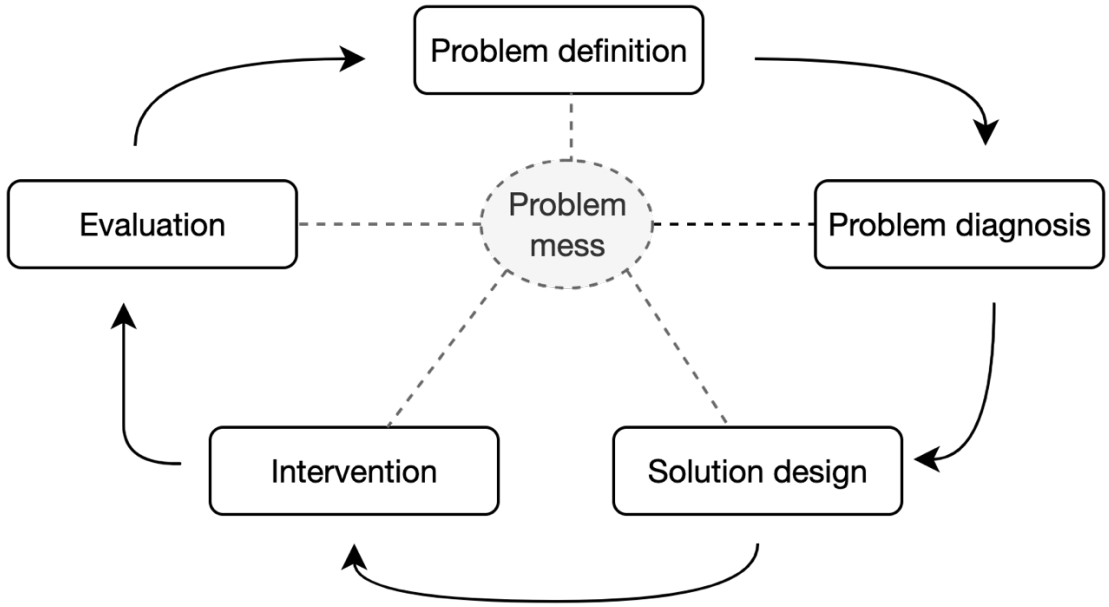


Figure 3. Intervention cycle (author's own creation based on Van Aken and Berends (2018))

3.2 Sampling strategy

For the evaluation, problem definition, and problem diagnosis phase of the intervention cycle (see figure 3), purposive sampling of interviewees is used. Purposive sampling is appropriate as this method allows the researcher to choose participants that are of maximal interest to this thesis (Zickar & Keith, 2022). Expert sampling is used as a variant of purposive sampling. This variant refers to the inclusion of participants that have a certain expertise or knowledge on the topic of interest. The sample exists of interviewees within the three aforementioned groups: a) members of the UMCPG who are part of its sustainability team that designed the PSQ, b) supplying firms that participated in the pilot tender and provided answers to the PSQ and c) purchasers and hospital pharmacists of both the UMCPG and individual UMCs that evaluated the scores of all suppliers on the PSQ. In total, 24 people participated across 17 interviews. Additionally, 14 firms were invited to respond to the survey about the PSQ. In total 9 firms responded, bringing the response rate to 64.3 percent. Of the 9 respondents, 2 respondents did not finish the last few questions on green manufacturing and distribution practices. The other parts of these responses are still considered, as they are judged to be elaborate enough for providing relevant insights to the research.

3.3 Data collection and participants

The primary data collection method for this thesis is in-depth interviews with the three aforementioned groups in section 3.2. An additional survey was sent out to supplying firms that answered the PSQ but could not be interviewed due to the limited time frame of this thesis. The type of interviews that were conducted are semi-structured interviews. This type of interview enables the interviewer to improvise follow-up questions, and allows space for the interviewees' individual expressions, while also being guided by a structure (Kallio et al., 2016). Additionally, semi-structured interviews are preferred when the research goal is to understand the unique perspective of each interviewee, rather than a generalized understanding of a problem (McGrath et al., 2019). Researching the unique perspective of each stakeholder in the context of this thesis is particularly useful, as the perspective of the purchasers and the suppliers might contradict each other. For the semi-structured interviews, interview guides were designed as this enhances the trustworthiness of qualitative research (Kallio et al., 2016).

3.4 Interview protocol

The following sections describe the interview protocol that is used in this research for both purchasers and supplying firms, across the three sample groups.

3.4.1 Employees UMCs, UMCPG, and sustainability team

In total, 10 interviews were conducted with the employees of the UMCs and the UMCPG. The employees consisted of both purchasers and hospital pharmacists. An overview of the participants can be found in table 1. Interviews were conducted both face-to-face and via Microsoft Teams. The first interview was held with the coordinating purchasers of the UMCPG to determine the current procurement process of the UMCPG, providing an answer to SQ1. The corresponding interview guide can be found in Appendix A The second interview was held with the purchasers of the UMCPG that are part of the sustainability team. The purpose of this interview was to investigate how the PSQ was designed, providing an answer to SQ2. The corresponding interview guide can be found in appendix B. The remaining interviews were held with purchasers and hospital pharmacists from the UMCs that were involved in evaluating the PSQ. The purpose of these interviews was twofold: 1) to investigate purchasers' experience with evaluating the suppliers based on the PSQ and 2) to investigate green purchasing behaviour among the purchasers and hospital pharmacists based on the TPB. These interviews provide an answer to SQ5 and give input for the solution design phase, where the PSQ is optimized. The corresponding interview guide can be found in Appendix C.

Table 1. Interview participants (UMCPG, sustainability team, UMCs)

Interview	Organization	Participant(s)	Mode	Duration	Recorded
[1] Current procurement process	UMCPG	Two coordinating purchasers	Face-to-face	1:27:19	Yes
[2] PSQ design	Sustainability Team	Five purchasers of various UMCs involved in designing the PSQ	Microsoft Teams	1:02:45	Yes
[3] Purchasing process including PSQ and green purchasing behaviour	UMCPG	Two coordinating purchasers	Microsoft Teams	1:25:12	Yes
[4]	UMC 1	Hospital pharmacist who is also part of UMCPG's core team	Face-to-face	55:10	Yes
[5]	UMC 2	(a) Hospital pharmacist (b) Strategic purchaser	Microsoft Teams	40:20	Yes
[6]	UMC 3	Strategic purchaser	Microsoft Teams	46:28	Yes
[7]	UMC 4	Hospital pharmacist who is also part of UMCPG's core team	Microsoft Teams	40:20	Yes
[8]	UMC 5	Two pharmaceutical purchasers	Microsoft Teams	1:08:14	Yes
[9]	UMC 6	Strategic purchaser	Microsoft Teams	22:40 21:51	Yes
[10]	UMC 7	Head of logistic department within hospital pharmacy	Microsoft Teams	52:36	

3.4.2 Supplying firms

In total, 7 interviews were conducted with supplying firms. The sample of suppliers consisted of pharmaceutical manufacturing firms (PMFs) and pharmaceutical distribution firms (PDFs). An overview of the participants can be found in table 2. Interviews were conducted both face-to-face and via Microsoft Teams. The purpose of these interviews was twofold: 1) to investigate the suppliers' experience with answering the PSQ and 2) to investigate the green manufacturing and distribution practices. These interviews provide an answer to SQ3 and SQ4. The corresponding interview guide can be found in Appendix D.

Table 2. Interview participants (supplying firms)

Interview	Firm	Participant(s)	Mode	Duration	Recorded
[11] PSQ and green manufacturing practices	PMF 1	Manager of Dutch division	Face-to-face	58:29	Yes
[12]	PMF 2	(a) Marketing manager (b) Head of purchasing	Face-to-face	1:21:49	Yes
[13]	PMF 3	(a) Contract Manager (b) PR manager	Face-to-face	1:06:07	Yes
[14]	PMF 4	(a) Contract manager (b) Logistic manager (c) Pricing manager	Face-to-face	1:11:08	Yes
[15]	PMF 5	(a) General manager (b) Contract manager (c) Marketing manager	Face-to-face	1:09:32	Yes
[16] PSQ and green distribution practices	PDF 1	Commercial manager	Face-to-face	1:12:06	Yes
[17]	PDF 2	Account manager	Microsoft Teams	52:36	No

3.5 Survey design for suppliers

In addition to the interviews, an online qualitative survey was sent out via email to a predetermined list of supplying firms, provided by the UMCPG. An online qualitative survey is appropriate as it is a time-efficient tool that allows the researcher to gather rich and focused data from participants that otherwise would or could not have participated in the research (Thomas et al., 2024). Therefore, an online qualitative survey was an appropriate complementary data collection tool considering the time constraints of this thesis.

3.5.1 Survey procedure

The survey was conducted in the form of an online questionnaire on the Qualtrics platform. The questionnaire within the survey is based on the interview guides for the suppliers as mentioned in section 3.3.2. The full questionnaire can be found in Appendix E. The questionnaire followed the same flow and logic as the corresponding interview guide. The survey is cross-sectional, self-administered, and answers were provided by a single informant. The informant is a representative of the company, who was known to be involved in the pilot tender and answering the PSQ. Variety within the format of the questions was used to keep the informant engaged. To ensure a high response rate, a realistic time estimate was given upfront along with a reminder via email to complete the survey.

3.6 Data analysis

The following sections describe the data analysis method that is used in this thesis.

3.6.1 Data management

All interviews were recorded and transcribed or summarised as notes based on interviewees' preferences. First versions of the transcripts were generated using the AI-software 'TurboScribe' and afterwards checked and adjusted according to the interview recording. All collected data were processed with strict confidentiality to ensure the privacy of participants. The identities of the interviewees were anonymized throughout the research process to protect personal and organizational data.

3.6.2 Thematic analysis

The collected data is analysed according to the thematic analysis method, as developed by Braun and Clarke (2006). For the coding process, the software ATLAS.ti was used. Both the inductive and deductive approach are used in the data analysis process. Results are grouped and classified according to corresponding SQs as described in section 2.6. Other relevant information that did not fit into these groups, are classified in a separate category. Each category is represented by a code. Within each code, patterns are identified, and codes are merged if applicable. As a last step, all codes are transformed into final themes with corresponding data. After the analysis, the themes are utilized in the solution design phase of this thesis.

3.6.3 Survey analysis

The collected responses from the questionnaire in the survey are also analysed using thematic analysis, as the majority of the questions are open-ended. Using the same approach for both the interviews and the survey allows for comparison of the findings and facilitates the identification of recurring patterns.

3.7 Validity and reliability

The validity of this thesis might be compromised by both informant and researcher bias. The informant bias can arise when the interviewee feels uncomfortable, has strong feelings on the topic, or potentially does not remember something correctly. To reduce the respondent bias as much as possible, I will ensure informant and data triangulation. Where relevant, multiple respondents will be asked the same questions to cross-check the data provided. Where

possible, the provided data will be verified using internal databases providing such data. Additionally, if sensed that an interviewee had a particularly strong opinion regarding a topic, this is reported in the results section to enhance transparency and reliability of the data.

The researcher bias may arise if the researcher has strong feelings on the topic that is being studied, the respondents are unintentionally chosen to all have the same (favourable) opinion on a topic, or the researcher has inadequate skills to conduct and analyse interviews. To reduce the researcher bias as much as possible, I made sure to ask my coach and my peers to review my work such as interview guides. This reduced the risk that potential strong feelings of the researcher influenced the research process, while enhancing the quality of the interviews. Furthermore, notable or strong similarities in the opinions of interviewees were reported in the results section to enhance transparency and reliability of the data.

Chapter 4. Data analysis

In this chapter, the findings of the thematic analysis of all interviews are presented. The findings correspond to the research question of how the UMCPG can incorporate economic, environmental, and social sustainability criteria in their procurement process. The UMCPG recently introduced a pilot tender with a PSQ, including sustainability criteria. This thesis explores the experience of both the suppliers and purchasers with the PSQ. The research is conducted in four subsequent steps.

First, the current procurement process of the UMCPG is explored through an interview to define the context of the research question and see where the PSQ fits in. Second, the design process of the PSQ is mapped through an interview with the designers to gain a deeper understanding of the intention and goal of using the PSQ. Third, the suppliers that filled in the PSQ are interviewed to gain a deeper understanding of their experience with this pilot tender. Additionally, a survey was sent out to suppliers that participated in the tender with the SPQ but could not be interviewed due to time constraints, for a richer data set on the supplier experience with the SPQ. The open-ended questions are also analysed with a thematic analysis. Outcomes of closed-ended questions are discussed in section 4.4. Fourth and final, purchasers of the UMCPG are interviewed to gain a deeper understanding of their experience with evaluating the suppliers using the PSQ.

4.1 Current procurement process of the UMCPG

As a first step, an interview with the coordinating purchasers of the UMCPG was conducted to map the current procurement process of the UMCPG. Figure 4 shows a visualisation of all steps in the procurement process. Approximately one year before a contract ends, a new tender will start[1]. The official request is then sent out via a digital tendering platform to all suppliers with a G-registration. Having a G-registration means that the supplier has the license to trade a particular medicine within the European Economic Area (EEA) and export them outside of the EEA. After the request closes, all received offers are evaluated by the coordinating purchasers of the UMCPG. Next, the package holders and other members of the UMCPG evaluate the offers as well. Package holders are hospital pharmacists with extensive knowledge on pharmaceuticals and processes in the hospital pharmacy. Then, all UMCPG members have a plenary discussion where a consensus is reached on the supplier selection for this tender. Contracts are then awarded, where new suppliers are subject to the supplier rating process of the UMCPG. This process continuously repeats throughout all tenders for all suppliers with an awarded contract. The frequency of the evaluation is based on the ranking the suppliers were awarded with in the preceding evaluation round. For example, the highest-ranking suppliers are re-evaluated once every three years. Whereas lower-rankings suppliers are evaluated every year. First-time suppliers that are awarded with a contract are directly evaluated after the award. As a final step the contract is implemented, with a duration of typically one to two years. Throughout the contract, occurrences like delivery issues are resolved.

[1] Before the introduction of the PSQ, suppliers received a request about 2 – 6 months before the new contract would be effective. Thus, the period between the request and contract start has been lengthened since the introduction of the pilot tender.

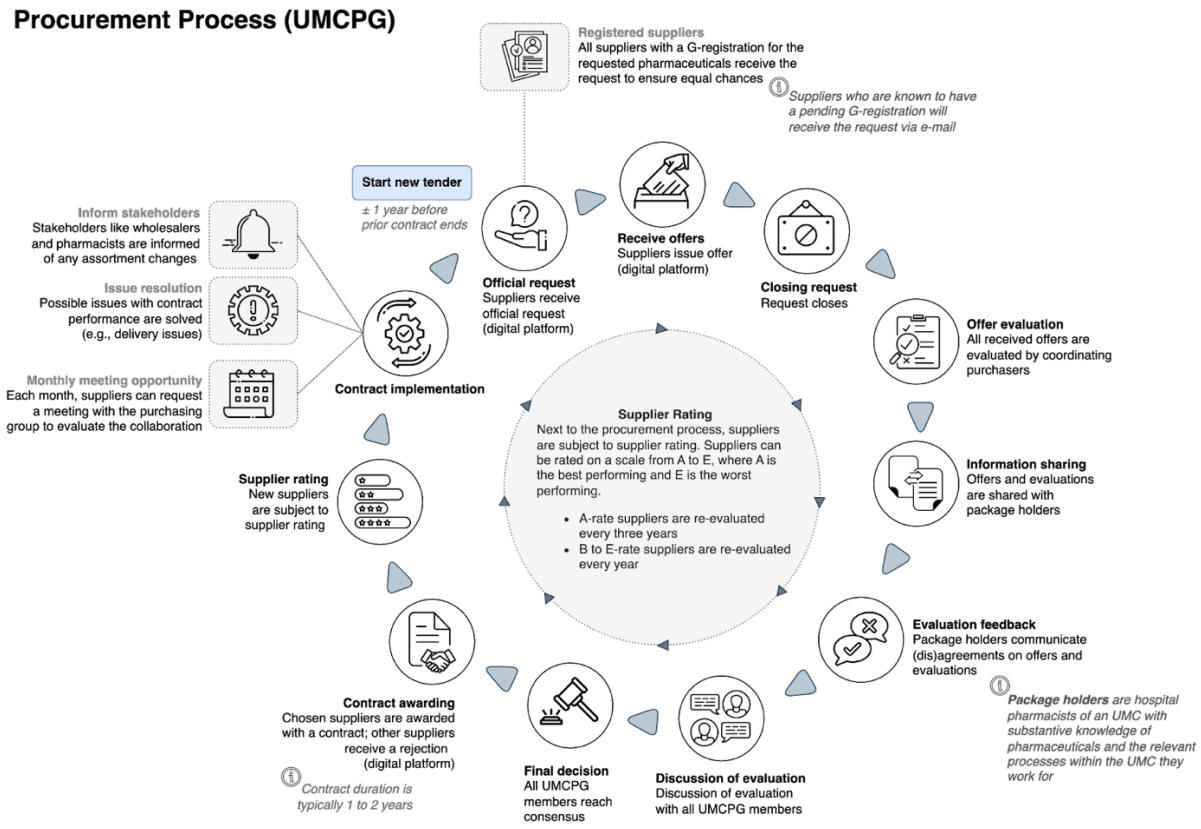


Figure 4. Current procurement process of UMCPG (author's own creation)

4.2 Introduction of PSQ

The PSQ is a novel aspect to the tendering process of the UMCPG as of 2025. The PSQ is implemented in the "Official request" step, where the PSQ was added to the digital tendering platform. Suppliers could provide their answers to each question within the platform. The PSQ was introduced in February 2025, for the contracts of February 2026. So, the request with the PSQ was sent a year before the contracts will be effective. After the tender closed, the purchasing coordinators downloaded an overview of all answers per supplier for the evaluation step. Scores were assigned to the answers to each question in the PSQ. The aggregated score of the PSQ was weighed against price, resulting in a total score for each supplier. The subsequent section will present the design of the PSQ.

Former to the PSQ, the suppliers were evaluated based on the criteria represented in figure 5. Price refers to the pricing of the pharmaceutical. Barcode refers to a scannable barcode on the packaging of the product, to enhance user friendliness within the hospital pharmacy. This barcode can be used for processes like stock management. API stands for Active Pharmaceutical Ingredient and refers to the component of a medicine that produces the intended effect of a medicine. A final medicine is composed of the API and excipients which serve as a medium for conveying the API. The country of origin and packaging of the API refers to where the API is sourced and produced, as this can occur in different countries. The mode of delivery refers to the party which delivers the product orders to the hospital pharmacy. Delivery can be facilitated by wholesalers or other parties like third-party logistics providers. Finally, label distribution is a novel criterion in the tender process. Label distribution refers to the phenomenon

that multiple suppliers get selected to deliver the same product, to increase delivery reliability in the Dutch market. None of these criteria were associated with a particular score, like in the PSQ.

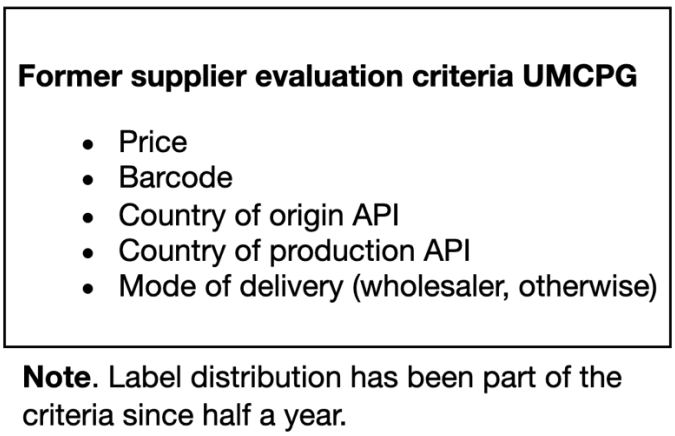


Figure 5. Former supplier evaluation criteria UMCPG (author's own creation)

4.3 Design of PSQ

As a second step, an interview was held with the members of the sustainability team within the UMCPG who designed the PSQ. The interview was conducted to gain insight about the choices that were made in the design process of the PSQ. A small thematic analysis for this interview can be viewed in figure 6. An overview of the PSQ can be found in figure 7. The interview themes are discussed in the subsequent section.

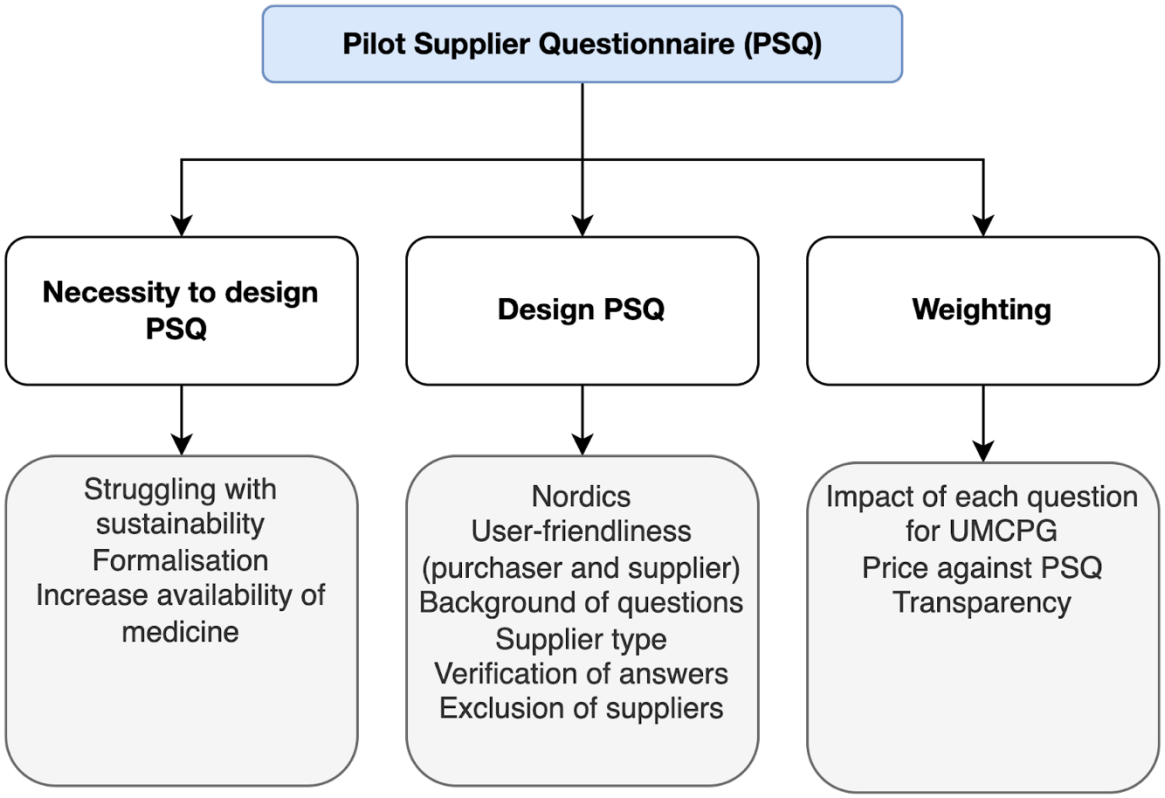


Figure 6. Thematic analysis of PSQ design process (author's own creation)

4.3.1 Necessity to design PSQ

In general, the PSQ is designed as a means to incorporate sustainability in the UMCPG tendering process. The members of the sustainability team highlight the necessity for designing the PSQ, as they have been struggling for an extended period with the topic of sustainability. In addition, suppliers were asking the UMCPG how they will integrate sustainability into their tendering process (respondent A). Another respondent remarks that the PSQ was also designed to formalise the UMCPG tender process as it was. The member says the SPQ is therefore complementary to their prior tendering process (respondent E). A final point that is made is that sustainability is closely related to availability of medicine, of which the latter is another important topic for the UMCPG (respondent E). A respondent adds to this that if a medicine cannot be delivered, a lot of unsustainable logistic movements must be made (respondent D). So, the PSQ was designed to both integrate sustainability in the tendering process as well as ensuring medicine availability. Figure 7 shows the final SPQ.

Question	Answer options
Are you prepared to keep 3 months' minimum stock for the UMCPG members concerned for the medicines in this procurement process and do you have the stock of contracted products available in the Netherlands 3 months before contract effective date?	Yes / No
Is the stock allocatable to UMCPG members?	Yes / No
The supplier can have a 6-month safety stock, destined for its own customers in the European market.	Yes / No
The supplier has implemented an environmental management system in the production of active ingredients and finished products, which ensures risk assessments, environmental routines, environmental audits and sanctions in case of breach of the agreement. To answer 'yes', the environmental management system must be certified by a third party accredited party.	Yes / No
The product offered must be produced by an active substance and finished product manufacturer that has routines for processing and/or treating wastewater from production to achieve the concentration at which no effect is assumed (PNEC) of the active substance. To answer 'yes' to the requirement, the environmental management system must be certified by a third party.	Yes / No
The product offered must be produced by an active substance and/or finished product manufacturer that has procedures for handling, processing and disposal of waste so that emissions of active substances into the environment are eliminated or minimised.	Yes / No
The products offered are provided on the outer and/or inner packaging with a 2D matrix barcode containing at least a GTIN.	Inner and outer packaging fitted with 2D matrix barcode. / Outer packaging fitted with 2D matrix barcode. / No 2D-matrix barcode
The product is packaged and registered in the same appearance in at least 3 European countries, making the product interchangeable across countries.	Yes / No
From which continent do the active ingredients of your product originate?	Europe / North-America / Asia / Other
Is your finished product produced and packaged within the European Economic Area (EEA)?	Yes / No
Offered products should have clear labelling on the inner packaging with dosage form, contents, strength indication in mg/1ml.	Yes / No
The product offered must have an inner packaging where the smallest unit is marked with name, strength, expiry date and batch number. The name and strength should be printed as text. Batch/exp can be marked or printed as text.	Yes / No
Specific question for antimicrobial agents package The product offered must be produced by a supplier that can demonstrate compliance with the AMRIA Antibiotic Manufacturing Standard or a comparable manufacturing standard that combats antimicrobial resistance throughout the supply chain. To answer 'yes' to the requirement, this must be certified by a third party or the certification process must have started.	Yes / No
Specific question for oncolytics package Have you listed the 'density' of your product under 'details'? (Oral oncolytics excluded)	Yes / No
Specific question for oncolytics package Have you added the clean statement for your product to the quotation? (Oral oncolytics excluded)	Yes / No

Figure 7. PSQ as designed by the members of the UMCPG sustainability team (author's own creation)

4.3.2 Design of PSQ

The design of the PSQ is derived from the 'Nordics', which refers to the countries that are part of the Nordic Pharmaceutical Forum. These include Finland, Iceland, Norway, Sweden and Denmark. Some time ago, the Nordics have already started an initiative for increasing the availability of medicine within Europe, which a member highlights to be a 'great initiative' (respondent E). The member further elaborates on the wish to work towards a national and uniform supplier questionnaire with the other purchasing groups in the Netherlands. Another respondent adds the importance of collaboration between countries, as the Netherlands is a small group. Manufacturers will not start up a trajectory for just the Netherlands (respondent D). Moreover, the importance of recognizability between the PSQ and the tendering process of the Nordics is highlighted. Uniformity across tenders notifies the supplier that they are not only putting in an effort for the Netherlands, but also the Nordics (respondent E).

The members of the sustainability team did decrease the number of questions compared to the Nordics. It is explained how this reduces the administrative burden of the questionnaire. To further decrease that burden, the questionnaire has also been integrated in the digital tendering platform (respondent E). Additionally, the answer format has been reduced to yes or no questions and some multiple-choice questions, to ensure an easier evaluation and better integration in the digital platform (respondent E). On the other side, it is emphasized that the PSQ also must be manageable for the suppliers to fill out, so that it yields results (respondent B).

The design of the PSQ started with three concrete questions in the context of sustainability. These were the land of origin for the active pharmaceutical ingredient (API), land of production, and whether it is a refrigerated medicine (respondent D) The questions about land of origin and land of production are supposed to trigger the suppliers to research the answers to those questions, and ultimately stimulate them to try and move the production to Europe instead of Asia (respondent A).

Other included questions concern the certification for environmental management systems. One respondent says that requiring certification is to ensure themselves the business practices of the suppliers are in order. The certification bodies are referred to as the 'accountants' of pharmaceuticals. The respondent further acknowledges that it cannot be expected from the first pilot that every supplier has everything in terms of sustainability. It is highlighted that, like the Nordics and NHS, certification is a stepping stone towards a 'new normal' (respondent E).

More questions were added, with other motives like safety considerations or delivery reliability. For example, the questions related to (safety) stock are added with the purpose to decrease the vulnerability of The Netherlands in case of delivery issues (respondent D). A respondent highlights the unusualness of the pharmaceutical market as there is a lot of cooperation between hospitals and purchasing groups.

"*Everyone just tries to put their own patients first, but the fundamental premise is that it is not important whether your aunt comes to a peripheral hospital or a top clinical hospital or a university hospital. She, as far as we are concerned, should always have access to the best possible medicines that are most applicable to her and we as a column just have to do our best to achieve that … so, we also look at the others very much to see how we can help each other.*" (respondent A)

Another goal of the PSQ is to create an equal playing field for all suppliers, which led the UMCPG to exclude some supplier types to partake in the tender. An important difference is highlighted between the generic medicine market, and the patented medicine market. It is described that for the patented medicine market ('spécialité'), both the 'spécialité' firms and so-called 'parallel distributors' can put in offers. Yet, if the medicine is under patent, all products come from the same manufacturer. Hence, the parallel distributors import the medicine from the same plant as the 'spécialité' firms and simply resell it, which causes them to have a longer distribution route than the 'spécialité' firms. Thus, it is argued that it would be impossible for the parallel distributor to have a more favourable score on sustainability than the manufacturing firm that directly delivers their product to the Dutch market (respondent A). Consequently, the equal playing field is overruled. This had led the UMCPG to the decision of excluding both spécialité firms and parallel distributors from this tender round.

4.3.3 Weighting[2]

Each answer within the PSQ has been assigned an individual score, where all answers are summed up for an aggregated score to be weighed against price. The number of points for each answer is assigned based on the impact the question has on the business practices of the UMCPG. An example of impact is how delivery issues can disrupt the daily operations of the UMCPG, which corresponds with the points given to the stock management questions (respondent A). The respondents address the complexity of deciding and assigning points to each answer.

The split between the weight of price and the aggregated score of the PSQ is determined in such a way that the PSQ does influence the total scores. Otherwise, the PSQ could be omitted or not taken seriously by the suppliers (respondent A). The split between price and PSQ is made transparent to the suppliers in the tender process. It becomes apparent that the initial idea was to provide full transparency of the scoring towards suppliers, but this decision has been reversed. A respondent highlights the risk of suppliers performing a 'strategic intervention', by only focusing on the questions with the highest score (respondent E). This is what the UMCPG wants to avoid.

4.4 Supplier Interviews

As a third step, 7 suppliers were interviewed and nine suppliers reacted to the survey about their experience with the PSQ as part of the tendering process, and the current pharmaceutical landscape. For the former, themes like general experience, PSQ design, transparency, and the future of tendering are identified. For the latter, themes like PSC complexities, sustainability in PSC, and barriers to sustainability development were identified. A full overview of the thematic analysis can be found in figure 8. In general, all suppliers are both in favour and recognize the need of integrating sustainability in the procurement process, with the remark that the PSQ needs some adjustments.

[2] As the weighting of the PSQ is confidential, the particular weights or adjectives such as 'high' or 'low' are not disclosed.

Figure 8. Thematic analysis of interviews with suppliers and purchasers (author's own creation)

4.4.1 Tendering process

4.4.1.1 General PSQ experience

First, most suppliers are aware that the PSQ is derived from the Nordics. One respondent gives the example of how the Nordics have a tedious tendering process for the MedTech industry (Interview 11 – PMF 1). A few respondents raised the question to what extent the way of working of the Nordics is applied in the tendering process of the pilot. For example, questions were asked on how the Nordics weigh the various subjects in their tender process.

Second, multiple suppliers indicate that the timing of the tender was difficult, as the offers were requested almost a year before the start of the contract. The difficulty with this timing is that the pricing of the medicine is still unknown (Interview 13 – PMF 3). Suppliers are then taking a bigger risk in responding to the offer without certainty on the pricing (Interview 15 – PMF 5). However, the benefits of an early offer are that suppliers can adjust their forecast (Interview 12 – PMF 2), and how it gives time to get their production planning sorted (Interview 11 – PMF 1).

Third, suppliers mentioned the significant workload of answering the PSQ, especially in comparison with the old tender. Some respondents mention how the workload and the quantity of products or total price thereof for which the offer is made, are out of balance (Interview 12 – PMF 2; Interview 15 – PMF 5). The quantity or price of the offer is too little to justify the significant workload. Multiple suppliers do recognize that if the PSQ has been answered once, the subsequent tender with the same PSQ has a decreased workload (Interview 15 – PMF 5; Interview 17 – PDF 2). However, information must continuously be kept up to date, as the answers could be different in a later year (Interview 14 – PMF 4). The main cause for the significant workload is the rather tedious information retrieval process that was needed to provide answers in the PSQ. Information had to be retrieved from various departments (Interview 14 – PMF 4; Interview 11 – PMF 1; Interview 12 – PMF 2). One respondent does emphasize how they do not only retrieve the information for the UMCPG, but also for the other purchasing groups. Therefore, they are putting more efforts in the information retrieval in the future (Interview 12 – PMF 2). Another aspect of information retrieval is that for APIs that are being used for 40 years or more, there is little sustainability information available. It is emphasized that it is important to acknowledge which data is still missing and will take longer to obtain (Interview 13 – PMF 3).

Fourth, it is highlighted how the experience of the PSQ was different for distribution compared to manufacturers due to the difference in business models. One of the distributing firms mentions how they must retrieve the information from various manufacturers, which is a time-intensive activity. Additionally, the distributing firm is dependent on both the speediness and willingness of information sharing by the manufacturing firm (Interview 17 – PDF 2). Moreover, the distributors highlight how the questions are formulated for the manufacturing firms, which makes it difficult to answer. It is indicated that they have no impact on the certification of the manufacturing firms they work with (Interview 17 – PDF 2). It is further described how difficult it is as a distributor to make an impact in the PSC in terms of sustainability. Within their influence, they can select suppliers and strive for a greener logistic process. Outside of that, their impact is limited compared to manufacturing firms (Interview 16 – PDF 1).

Fifth, in comparison with other purchasing groups, the UMCPG is often labelled by suppliers as a precursor and pioneer in terms of sustainable purchasing. Other purchasing groups are mentioned to focus mainly on price (Interview 11 – PMF 1). Nonetheless, suppliers do recognize that a shift is happening amongst purchasing groups. Some respondents mention that they did receive a small questionnaire from other purchasing groups, including questions labelled with a green leaf to indicate sustainability (Interview 13 – PMF 3). The UMCPG also uses these green leaves in their supplier evaluation to label their sustainability questions. It is emphasized how the UMCPG is expected to be a precursor in sustainability, due to the academic nature of the hospitals.

"*But I do think that you... within the UMCPG... could take a pioneering role. And I think academically that would suit you well*" (Interview 12 – PMF 2)

Survey

Respondents in the survey confirm how the information retrieval process is tedious, as information must come from different plants and suppliers (Survey response 1 – PDF 3; Survey response 8 – PMF 12). It is added how the digital tendering platform enhances user friendliness of the PSQ suppliers (Survey response 7 – PMF 11). Finally, the respondents acknowledge how the UMCPG is a precursor with the PSQ (Survey response 6 – PMF 10). Some respondents do acknowledge they have seen some of the PSQ questions in other tenders, which made it easier for them to fill out the PSQ (Survey response 3 – PMF 6; Survey response 6 – PMF 10; Survey response 7 – PMF 1; Survey response 8 – PMF 12).

4.4.1.2 PSQ design

First, various suppliers acknowledge the lack of context for some questions in the PSQ. One respondent highlights the unclarity of the questions about (safety) stock, wondering whether they should have six months of safety stock as a daughter company, or if it is targeted at the holding company (Interview 16 – PDF 1). It is further stated that suppliers cannot allocate stock for any purchasing group, as they cannot 'play god' and decide who receives medicine and who does not (Interview 14 – PMF 4). Other suppliers describe they were not certain what was meant with a 'clean statement' (Interview 11 – PMF 1), or with the 'density' of a product (Interview 14 – PMF 4). Multiple suppliers were also confused by the certification for the environmental management systems and wastewater treatment. Suppliers wonder which type of certification the UMCPG wants to prevent them investing in the wrong certificate Interview 16 – PDF 1), or whether region compliant certificates would suffice (Interview 15 – PMF 5). It is also noted that if suppliers comply with legislation in the Netherlands or Europe, certification is then redundant (Interview 13 – PMF 3). It is further illustrated how the costs of certification can be problematic since the costs of external agencies cannot be passed on in the product price, as the product then becomes three times more expensive. It is noted that it would be possible to show the certifications of each plant instead of for each product (Interview 12 – PMF 2). One of the distribution firms explains how certification is costly, and compliance with European regulations overrules the necessity of certification (Interview 16 – PDF 1).

Second, suppliers express the need for more flexibility in the answer options of the PSQ. Some questions concern the aggregated sum of products for which an offer is submitted, but products within the same offer could fall into different answer categories. Hence, there is a need

for specification on product-level. Respondents give the example that it differs per product where the API originates from (Interview 14 – PMF 4), or how not all products in the offer contain the barcode on the packaging (Interview 15 – PMF 5). In other cases, suppliers would simply like to provide more clarification on the answers they have given (Interview 14 – PMF 4). Hence, some suppliers provided additional documents to complement the PSQ answers. Suppliers express the desire for more open-ended questions.

Third, suppliers were asked which other sustainability-focused questions they could have answered but were not part of the PSQ. The example questions concerned which efforts are made to reduce transport movements (Interview 13 – PMF 3) and sustainability of packaging (Interview 12 – PMF 2). It is noted, however, how such questions could increase the complexity of the PSQ.

Survey

Survey respondents address the ambiguity of 'allocatable stock' (Survey respondent 4 – PMF 8), wonder which part of the packaging is meant to have the similar look (Survey respondent 9 – PDF 4), and which types of certifications are required (Survey respondent 6 – PMF 10). Suggested additional questions for the PSQ regard product packaging (Survey respondent 5 – PMF 9).

4.4.1.3 Transparency

First, multiple suppliers indicate that they would prefer to know how each question is scored within the PSQ. It is stated that transparent weights are necessary to motivate other employees within the company about the PSQ (Interview 12 – PMF 2). One respondent explains that the weight of a question could point out how important that question is to the UMCPG. It is further added that there is a lot of one-sided transparency in the tender process with the PSQ, and there should be bilateral transparency (Interview 13 – PMF 3). Examples are addressed of how other countries, like Denmark, Germany, and the UK, are transparent in their weighting. It is highlighted how the Belgian system even reports the scores of all competition in a tender (Interview 11 – PMF 1). Most suppliers want to know why they did not win a contract, such that they can improve their performance for the upcoming tender. In contrast, one supplier does not argue the need for full transparency. The respondent describes how some suppliers might fill out the PSQ more seriously than others, and how some suppliers might not be truthful in their answers. With the current tender process, the UMCPG still has the opportunity to be able to factor in previous experiences with suppliers to judge the honesty of the answers. That would not be possible if weighting and competition performance would be published (Interview 16 – PDF 1). There are varying opinions on whether or not the scores of the competition should become transparent. Some respondents say that they are sometimes able to deduce which supplier has won the tender, without it being reported (Interview 11 – PMF 1; Interview 15 – PMF 5). However, a respondent does acknowledge these are not public tenders, and that the score of each supplier concerns sensitive information. The respondent does argue that in light of label distribution across the market it would be 'elegant' if the UMCPG shares the label distribution to illustrate that the system works (Interview 15 – PMF 5).

Second, multiple suppliers express the need for clarification on the motivation behind the PSQ and its questions. One respondent is confused whether the PSQ was an exercise in

general, or if it had really been weighted in the tender (Interview 11 – PMF 1). Most suppliers want to know why a particular question is important to ask, next to how it is weighted. One respondent wonders why the UMCPG wants to know the country of origin for the API. It is mentioned how country of origin is not decisive for the degree of sustainability.

> *"Because it does not mean that if a raw material comes from China, for example, that on balance it is more sustainable than a raw material from Europe. On the contrary, we already have several case studies where it is just the opposite. That something from China is just more sustainable than something from Europe, for example."* (Interview 14 – PMF 4)

Another respondent adds to this by asking whether the underlying motivation are the transport movements, ethical business practices, or if there are other elements at play. Suppliers emphasize if they know why a question is being asked, they can provide a more focused answer (Interview 13 – PMF 3). Moreover, most suppliers raise the question how price relates with PSQ performance. It is asked whether a high PSQ score would justify a higher product price. In addition, it became apparent during the interviews how some respondents were confused about the purpose of the PSQ in comparison with the purpose of the supplier evaluation.

Third, most suppliers are willing to share information regarding the questions of the PSQ. One respondent describes this is on the condition of the information not being shared outside of the relationship between them and the UMCPG (Interview 14 – PMF 4). Some suppliers are already used to sharing information (Interview 13 – PMF 3). One respondent does state that some information, like the source of the API, has always been kept confidential. They do, however, share the land of production of the medicine (Interview 15 – PMF 5).

Survey

The respondents emphasize the need for transparency on both the weighting and the outcome of the tender. One respondent states the UMCPG is accessible and transparent and explains how the Dutch system lacks transparency compared to other countries (Survey respondent 7 – PMF 11). Another respondent expresses the need to know the goal behind the questions (Survey respondent 6 – PMF 10). A different respondent also poses the question what the consequences are of a one-euro price difference compared to the sustainability score (Survey respondent 8 – PMF 12).

4.4.1.4 Future of tendering

First, all suppliers agree that it is a good idea that all purchasing parties utilize a national, uniform supplier questionnaire. The risk of using different tendering questionnaires is identified, where ultimately suppliers really will not take the questionnaires seriously anymore. It is added that different questionnaires would keep the workload high for the suppliers (Interview 16 – PDF 1). Ideally, one tendering system across purchasing parties would be desirable, also including parties like the healthcare insurers (Interview 13 – PMF 3). A uniform system decreases the workload of suppliers in preparing the tender beforehand (Interview 17 – PDF 2). Next to a uniform questionnaire, a uniform way of working is desired. It is emphasized how all purchasing parties should enforce the same weight distribution, with the caveat of small nuances that always arise between purchasing parties (Interview 14 – PMF 4).

Second, suppliers address that collaboration between the suppliers and UMCPG is very important. It is stated that the UMCPG and suppliers should be partners rather than purchaser and supplier (Interview 14 – PMF 4; Interview 11 – PMF 1). In addition, collaboration could help prevent the destruction of product batches and keep medicine availability high in the market (Interview 16 – PDF 1). Most suppliers do indicate that they find the current work interaction is pleasant with the UMCPG. On a broader spectrum, suppliers suggest that all actors in the PSC should be more collaborative. Not only within the context of sustainability, but also because the patient is the common denominator for all actors.

"And the key word is always chain, chain approach. You can't do it alone. And now we are all working in our own front yard, whereas you can do a lot more together I think." (Interview 14 – PMF 4)

Third, several suppliers suggested the implementation of a system of rewards and punishments within the tendering process. One respondent says that suppliers who do not fill out the PSQ truthfully, should face the consequences of this. It is emphasized how there should be an equal playing field for all the suppliers in the tendering process (Interview 16 – PDF 1). Another respondent describes that precursors should be rewarded, but that laggards should be stimulated and not punished (Interview 13 – PMF 3). Suppliers do indicate it would become difficult for them if purchasing groups would start to work with fines (Interview 15 – PMF 5).

Survey

A survey respondent describes the need to investigate label distribution for critical medicines. Currently, suppliers are excluded for a period of two to three years, even if it concerns an essential medicine (Survey respondent 5 – PMF 9). Another respondent describes that it would be a better option to publish the questions prior to the start of the tender, because of the tedious information retrieval (Survey respondent 1 – PDF 3).

4.4.2 Current Pharmaceutical Landscape

4.4.2.1 PSC complexities

First, a lot of suppliers address the issue of price competition in the Dutch market. They indicate that price has been the main focus point of the tenders they have been involved in. Multiple respondents express this has led to a problematic situation in the Netherlands for suppliers.

"You just see that your margins... It's just a race to the bottom. And it's getting lower and lower. And that is great for the hospitals. Great for the whole healthcare story. Which, of course, is also easy scoring in the media..." (Interview 11 – PMF 1)

Another respondent mentions how the low prices are responsible for the medicine shortage that the Netherlands is dealing with. It is said that we are served last as a country due to the prices, as there is a hierarchy in that. The respondent further describes that medicine is only half a percent of the national healthcare budget, and purchasers are trying to decrease that to even less. A lot of our problems would be solved if medicine were to take up one percent of the national healthcare budget. The point is further underscored by describing how many products of this supplier have been remediated due to the low prices (Interview 12 – PMF 2)

The problem of medicine shortage in The Netherlands is further stressed by other suppliers. For some firms, the shortages are the reason that delivery reliability is a key focus point for them as a supplier (Interview 17 – PDF 2). With the current shortages, delivery reliability is a key focus point of tendering processes by now (Interview 14 – PMF 4). Hence, it is a strategic choice to keep more stock stored more locally, but that it all is inherent to the Dutch system (Interview 11 – PMF 1). It is stressed, however, that stock management is challenging as everyone has a low stock, and that it becomes even more challenging when assortment size increases (Interview 15 – PMF 5).

Second, the sourcing of raw materials also adds complexity to the PSC. Various suppliers state that most of the raw materials or APIs are sourced in Asia, mostly from China and India. One respondent states that there are only a few suppliers of raw materials, so a lot of firms have the same suppliers for this (Interview 15 – PMF 5). However, the land of production for the medicine differs. This could be in Asia or India, but also within Europe. Benefits of European production are less dependency on distant countries, faster response to medicine shortages, a smaller carbon footprint, and stricter environmental regulations compared to Asia or India. One respondent does argue that they only produce in Europe and consequently have a higher cost price than some other suppliers. They feel punished for European production as price is still a focal point within tendering processes, and they feel they lose tenders because of their pricing (Interview 12 – PMF 2).

Survey

A survey respondent stresses that because of the rising geopolitical pressures, it is crucial to think about how medicines stay available for the Dutch patients. Sustainability initiatives are said to be valuable but must ultimately serve the patients (Survey response 5 – PMF 9).

4.4.2.2 Sustainability in PSC

First, all manufacturing firms confirm they are incorporating sustainability into their business practices. Some suppliers are familiar with the Green Chemistry principles, and those who are not do say the principles are applied after listening to the explanation of them. One respondent mentions how all their laboratories must be certified with the 'My Green Lab' certification, indicating a sustainable laboratory. Moreover, one of their production facilities in the Netherlands is their testing ground for sustainability initiatives, like disinfection with a UV-robot instead of water and cleaning products (Interview 13 – PMF 3). Most suppliers mention how the sustainability initiatives often occur at plants outside of the Netherlands. Respondents of globally active firms often refer to their sustainability reports for specific information. It is apparent that a part of the respondents is not fully informed about all the sustainability initiatives that occur at production level due to the size of some organizations.

Another aspect of green manufacturing is the product packaging. Several respondents describe how they either optimize packaging material (Interview 14 – PMF 4), or how they went from a 1-pack to a 4-pack of a product (Interview 15 – PMF 5).

Second, there are also initiatives within the PSC to ensure a greener distribution of the pharmaceuticals. This is also the aspect where the distributing firms can make their sustainability impact. Examples are consolidation of transport when products have to be repackaged abroad (Interview 16 – PDF 1), or a bigger order quantity of stock to minimize the

amount of transport (Interview 17 – PDF 2). One of the manufacturers also mentions how they distribute their products in a sustainable manner, but notes that the impact is a lot less compared to the impact on production-level (Interview 15 – PMF 5). The manufacturers also refer to order consolidation, as bigger and less frequent orders are more sustainable. It is argued how some hospitals want to be delivered multiple times per day, and why this cannot be reduced to a single time (Interview 14 – PMF 4). For this, order consolidation across hospital units is stressed as a key to sustainability (Interview 15 – PMF 5). The manufacturers further express the value of delivery via a wholesaler, as then orders can be even consolidated across different suppliers. One of the distributors mentions, however, that for them a wholesaler is competition. So, they are unable to deliver via that route as they would 'shoot themselves in the foot'. The respondent does, however, want to help hospitals in consolidating orders. This is referred to as the 'low-hanging fruit' to realize a minimization in transport movements (Interview 17 – PDF 2).

Third, suppliers also engage in sustainable, responsible selection of their own suppliers and partners (Interview 13 – PMF 3; Interview 16 – PDF 1). One respondent explains how they use a third-party system called 'Ecovadis' in which their suppliers can report on their policy, measurements, and progress. The respondent emphasizes how such systems are a good base to test whether two companies align in terms of values and policy such that they can do business together. The firm also supports suppliers that are on the road towards becoming more sustainable (Interview 13 – PMF 3). With regards to third-party logistic providers (3PLPs), suppliers indicate that they know these partners have integrated sustainability into their business practices. However, respondents do mention that this is not the main reason they took on the partnership, which is often quality and reliability (Interview 11 – PMF 1; Interview 16 – PDF 1). In this case, sustainability is described to be more of a nice-to-have. Some suppliers do specifically invest in an electric vehicle fleet (Interview 17 – PDF 2) or specifically choose sustainable 3PLPs (Interview 14 – PMF 4).

Fourth, suppliers also introduced sustainability initiatives to help other actors in the PSC. An example of this is a return box that a supplier designed for patients to drop off their old medicine at their local pharmacy. That prevents the medicine waste from ending up in the toilet and allows it to be disposed of in a correct manner by the responsible parties (Interview 12 – PMF 2).

Fifth, most suppliers state they report on sustainability. Reporting guidelines that are followed are Environmental, Social, and Governance (ESG) and Corporate Sustainability Reporting Directive (CSRD). Most globally active suppliers report on a global level, but one of the suppliers does indicate that they are working on making a local translation of their reporting for their Dutch operations (Interview 14 – PMF 4). One of the distributors mentions that sustainability reporting is not something you really do as a distributor, and likely also not as a big distributing firm (Interview 16 – PDF 1). Next to reporting, auditing also occurs for measuring sustainability. One of the distributors mentions they visit the manufacturers and perform audits themselves (Interview 17 – PDF 2). A manufacturer indicates that they do an external audit every five years, and an internal audit for the remaining four years. It is highlighted how the internal audits can sometimes be stricter than the external audits (Interview 14 – PMF 4).

Sixth, there are differences in how suppliers would indicate their own position in terms of sustainability development. Part of the suppliers label themselves as precursors in terms of

sustainability development, and part of the suppliers consider themselves to be on par with the competition. No one identifies themselves as laggards

Seventh, the suppliers identify various stakeholders that are important for sustainable development. Identifies stakeholders are energy suppliers in facilitating renewable energy sources for the plants; all purchasing parties including the UMCPG, other hospitals, health insurers and wholesalers; and the patients that consume the medicine (Interview 11 – PMF 1; Interview 12 – PMF 2; Interview 13 – PMF 3; Interview 14 – PMF 4; Interview 15 – PMF 5). One respondent discusses stakeholders like policy makers. It is stated that the general system in the Netherlands should change, and a pessimistic view about the current government is expressed. In contrast, the European Commission is said to be on the right track (Interview 12 – PMF 2). One respondent emphasizes how every chain in the PSC is important.

"Again, that chain. Everyone is part of that chain. From the piece of raw material. Until the patient going to the toilet is important. And even then, it goes further. Because then the RIVM has to work on it. So, I think everyone. There is no stakeholder who should not be involved in the process." (Interview 14 – PMF 4)

Survey

Examples of sustainability practices that are given in the survey are the application of the Green Chemistry principles (Survey response 6 – PMF 10); sustainable product packaging (Survey response 2 – PMF 6); delivery via wholesalers (Survey response 8 – PMF 12); and extensive supplier assessment (Survey response 5 – PMF 9). Respondents describe they report according to the ESG framework (Survey response 6 – PMF 10; Survey response 8 – PMF 12); the CSRD framework (Survey response 5 – PMF 9); or obtained certification through MVO, the Dutch Corporate Social Responsibility institution (Survey response 6 – PMF 10). Finally, all respondents also label themselves to be either precursors or to be on par with the industry. No respondent identifies themselves as laggards.

4.4.2.3 Barriers to sustainability development

First, the barrier of the price tag that comes with sustainability is described. Many suppliers express how integrating sustainability into their business practices comes at a price. One respondent emphasizes how products that are sourced more nearby, or are more sustainable, are more expensive (Interview 16 – PDF 1). It is also discussed that since the margins are so small, there is no financial space to really do the maximum. The risk of pushing generic suppliers out of the markets is identified, when they are pushed too far in terms of sustainability and its costs. Consequently, the competition will reduce, and the prices will go up. A respondent highlights how every euro that is added to their costs, will take them 'further down the road' (Interview 12 – PMF 2).

"The green business model simply carries a different price tag" (Interview 11 – PMF 1)

One of the respondents, a manufacturer of 'spécialité' medicine, states they have the financial resources to opt for the more expensive yet more sustainable APIs. The respondent acknowledges the difficulty for suppliers of generic medicine, since they have such small margins (Interview 13 – PMF 3).

Second, the barrier of ownership is identified. Some suppliers indicate that they wish to invest more in sustainability, but that they are dependent on other supply chain parties for this. One distributor describes that if they would require something from a manufacturer, but the rest of the world would require otherwise, it is very unlikely that supplier will deliver it. The same respondent also mentions they want to relocate their warehouse, but there is not enough energy on the grid in the area (Interview 17 – PDF 2). Another respondent mentions that they are dependent on the municipality to get charging poles placed for electric vehicles in front of their office (Interview 14 – PMF 4).

Survey

No additional barriers to sustainability development were identified in the survey.

4.5 Survey: closed-ended questions

The results of the closed-ended questions of the supplier survey are represented in Appendix F. Overall, respondents expressed mixed experiences: some found the tender difficult, while others considered it easy. Likewise, perceptions of clarity varied, with some describing it as clear and others as unclear. Most of the respondents do agree that context on the PSQ questions would have been helpful. In line with the mixed experiences of the tender, there were mixed experiences with the sustainability questions: some found the question difficult, while others considered it easy. Likewise, some found the questions clear, while others considered them to be unclear. Finally, sustainability appears to be an important topic for the firms and their employees.

4.6 Purchaser interviews

As a fourth step, ten purchasers were interviewed across eight interviews about their experience with evaluating the PSQ, and green procurement (GP) behaviour. For the former, similar themes are identified as the suppliers: general experience, PSQ design, transparency, and future of tendering. For the latter, themes like attitudes, norms, perceived behavioural control, and intention for GP behaviour are identified. A full overview of the thematic analysis can be found in figure 8. In general, all purchasers are both in favour and recognize the need of integrating sustainability in the procurement process, with the remark that the PSQ needs some adjustments. This is in line with the view of the suppliers.

4.6.1 Tendering process

4.6.1.1 General PSQ experience

First, all purchasers recognize that evaluating this tender was a lot more work than previous tenders. Specifically, the coordinating purchasers had a significant increase in workload, as they are responsible for the first round of offer evaluations (Interview 3 – UMCPG). The package holders mention how they appreciate this preliminary evaluation, as for them the evaluation afterwards did not appear as difficult (Interview 4 – UMC 1). The complexity of the tender is further addressed (Interview 8 – UMC 5), and how there was a lot of discussion after the first evaluation round (Interview 5 – UMC 2).

Second, the purchasers describe the difficulty of information verification. Multiple purchasers describe there is no way of knowing whether the PSQ questions have been answered

truthfully by the suppliers. If a supplier indicates the API is sourced from Europe, but secretly is from elsewhere, the purchasers will not discover this (Interview 5 – UMC 2). One purchaser remarks the lack of skill and knowledge to verify the answers by going through the received sustainability reporting of the suppliers (Interview 10 – UMC 7). Moreover, it is mentioned how some answers are not recognized to be true based on past experiences Interview 3 – UMCPG). Questions like how to verify the answers to the SPQ, and whose responsibility it is to verify those are voiced.

Third, the final scores of the PSQ are a black box to the suppliers. It is not insightful for the purchaser to see on which aspects the points originated, and it is very time-intensive to review each individual score (Interview 3 – UMCPG; Interview 5 – UMC 2).

Fourth, it became apparent throughout the interviews that there were some internal miscommunications about the PSQ during the tender. Some purchasers thought the scores of each question were made available for the suppliers in advance. As stated, the weighting is confidential information.

4.6.1.2 PSQ design

First, the majority of purchasers emphasize the importance of medicine availability and delivery reliability.

> *"But for us that delivery reliability a prime necessity"* (Interview 4 – UMC 1)

It is stressed how The Netherlands must become less dependent on other countries. Production in Europe is often mentioned as a condition for this independence (Interview 3 – UMCPG. The hope is that there will occur less delivery issues when medicines are produced in Europe. Additionally, including multiple European languages on the product packaging enables exchanging the medicine between European countries in case of a shortage (Interview 6 – UMC 3). The increased availability of medicine is described as a benefit of integrating sustainability in the tendering process.

Second, purchasers state certain questions are best to split up in multiple questions. Purchasers indicate that most of the APIs are sourced in Asia, and there are only a few suppliers that prepare the APIs themselves. One of the respondents describes how in the PSQ one question asks in which continent both the production and packaging takes place, but states how this should be split up. It is explained how sometimes products are also produced in Asia but sometimes packaged in Europe (Interview 3 – UMCPG). The differences between the land of purchasing, production, and packaging are currently blurry in the PSQ.

Third, all purchasers indicate that the binary (yes/no) and sometimes multiple-choice answer model was easy to evaluate. The coordinating purchasers do recognize that the answers for suppliers were not always a clear yes or no and describe how the suppliers provided additional clarification. However, the answers on the PSQ were considered leading. So, if a question was left unanswered the supplier would miss out on the points. Despite that in reality, they might not perform that bad (Interview 3 – UMCPG).

Fourth, all purchasers agree with the current weighting of the questions.

4.6.1.3 Transparency

Purchasers are afraid that suppliers will make ill-use of transparency on the weighting of the PSQ questions. One respondent mentions how the suppliers could give the socially desirable answers but note they could also do this without knowing the weights (Interview 7 – UMC 4; Interview 10 – UMC 7). It is emphasized that suppliers could manipulate the questionnaire if they know the weight of each question (Interview 3 – UMCPG). Another respondent mentions how full transparency might limit the flexibility in the evaluation of the tendering process. It is described how when circumstances outside of the PSQ make a strong case to choose for a different supplier, this would not be possible anymore. In contrast, some respondents support the idea of providing partial transparency. If categories are implemented in the PSQ, then purchasers recognize the benefits of being transparent about the weight of each category. That way, suppliers can see which questions they should allocate the most effort into answering it (Interview 6 – UMC 3). Part of the purchasers also agree to give suppliers transparency about their own score after finalisation of the tender. This way, suppliers can see on which parts they can improve their business practices (Interview 10 – UMC 7). Another part of the purchasers is afraid that providing full transparency gives room for discussion with suppliers, which will significantly increase the workload (Interview 3 – UMCPG; Interview 10 – UMC 7).

4.6.1.4 Future of tendering

First, all members of the UMCPG are in favour of a uniform tendering process and are actively promoting this amongst other purchasing groups. One respondent mentions how they believe UMCPG is a precursor for integrating sustainability in the procurement process.

> *"I do think as an UMCPG I do think we can make a statement. I do feel that academic hospitals are being looked at in this. And that possibly other purchasing groups will follow us*." (Interview 5 – UMC 2)

It is further emphasized how the Netherlands is a 'very small radar' in the pharmaceutical landscape, and how it is beneficial to work together with other countries towards one essentially similar tendering process (Interview 9 – UMC 6). Within the Netherlands, the desire is for all purchasing parties to use the same, uniform pilot questionnaire.

Second, purchasers stress the need for guidelines on how much more money they could spend on selecting sustainable suppliers since sustainably is associated with a higher cost price. Hence, it is questioned whether sustainability should be a percentage of the current spendings, a fixed budget, or whether there is a maximum growth rate allowed. One respondent highlights how it is not their own wallet they use but explains the trade-off between keeping the costs low for 'Ltd. The Netherlands' and improving the health care sector (Interview 3 – UMCPG). The responsibility for designing the guidelines is alternately assigned to the government and higher-level positions like the board of directors of an UMC.

Third, multiple purchasers acknowledge the ease of automation within the digital tendering platform (Interview 3 – UMCPG; Interview 4 – UMC 1; Interview 8 – UMC 5). This significantly reduces the workload. It is also indicated how the designers of this platform are available to collaborate on any adjustments the UMCPG would like to be integrated into the platform for the tendering process (Interview 3 – UMCPG).

Fourth, the purchasers express the need to follow-up on the PSQ questions like available (safety) stock once contracts are awarded. It is described how currently, there is no verification

of the available stock if a supplier has won the tender. The assumption that it is there must be verified, in order to prevent delivery issues (Interview 3 – UMCPG).

Fifth, the principle of label distribution is also important in the tendering process as of recently. Label distribution reduces the risk of delivery issues, and consequently shortages. One respondent remarks how if a product has been historically problematic in terms of delivery, it would be nice to have a second or thirds label in the market (Interview 10 – UMC 7). Next to the advantage for medicine availability, label distribution is also inherently sustainable. If there are multiple labels in the market, there is more availability and enough back-up in the country. This prevents the urgent import of extra medicines, which causes excessive, unsustainable transportation movements (Interview 9 – UMC 6).

Sixth, switching costs are also considered in the tendering process. Sometimes the UMCPG decides to stay with the current supplier, as the switching costs are too high. Switching costs include how much extra workload it will provide to the hospitals if a different product is chosen, as not every medicine is the same across brands. It could be either easier or more labour-intensive to, for example, process the product in the hospital pharmacies. The purchasers have addressed how label distribution and switching costs will be taken into account in future tenders as well, next to the PSQ.

4.6.2 TBP for GP behaviour

This section elaborates on the interview results regarding the Theory of Planned Behaviour (TBP) for Green Procurement (GP) behaviour, as discussed in chapter 2 of this thesis.

4.6.2.1 Attitudes GP

All purchasers find sustainability an important topic in their private life and try to progress towards a more sustainable lifestyle. Examples are buying less products and plastics, buying second-hand, going to work by train or bike, installing solar panels at home, cutting meat out from diet, and travelling less by airplane. All purchasers think sustainability is important within their working life as well. It is mentioned that the hospitals are big polluters (Interview 5 – UMC 2), and that they should not make people sicker with the ecological footprint of the hospital (Interview 7 – UMC 4). Another example is that the most sustainable practice for medicine is to not take them, so the usage of medicine should be decreased (Interview 4 – UMC 1). In general, the respondents emphasize how sustainability is a global matter, and that everyone should contribute to making the world more sustainable. All purchasers are in favour of integrating sustainability in the procurement process of the UMCPG. Some respondents stress how it is a necessity to do so (Interview 3 – UMCPG), and how the UMCPG should take on a pioneering role in doing so (Interview 6 – UMC 3). The respondents can see the benefits of green procurement, as this can enhance for example delivery reliability. However, the concerns of costs and potential greenwashing are raised when practicing green procurement (Interview 8 – UMC 5; Interview 4 – UMC 1).

4.6.2.2 Norm GP

The purchasers indicate that in their private circle, there are varying opinions on sustainability. In general, the opinion of a purchaser on sustainability is related to what is expected of them in their job roles. If a purchaser is known to care about sustainability, they feel it is expected from them to perform GP behaviour. Moreover, if someone in their social circle finds sustainability important, it is valued by them if the purchaser engages in GP. Another respondent mentions that a hospital is a government agency, and therefore it is expected to engage in sustainable practices (Interview 5 – UMC 2). Contrastingly, for some people procurement is rather abstract, and that people will generally not associate this business practice with the potential of making sustainability impact. Hence, they will not expect GP behaviour (Interview 7 – UMC 4).

The purchasers also discuss the norm that is set by work-related stakeholders. These include the board of directors, National Federation of the UMCs, National Institute for Public Health and the Environment ('RIVM'), Ministry of Health, Welfare and Sport ('VWS'), and healthcare insurances. Such parties are mentioned to value sustainability but simultaneously expect the purchasers to still buy medicine at a fairly low price.

"They are all in favour of sustainability. And they all think label distribution is wonderful. But they do want to know what it costs." (Interview 3 – UMCPG)

4.6.2.3 Perceived control GP

Some respondents say they do not have a lot of influence on a green purchasing policy as an individual, but rather as being part of the UMCPG or the sustainability team. One respondent describes how their personality is to be a frontrunner and will always allocate maximum efforts for promoting sustainability initiatives (Interview 9 – UMC 6). That respondent does feel they make an individual impact on a GP policy.

The most recurring requirement for displaying GP behaviour is the need for policy on how much extra money can be spent on green procurement. This has already been discussed in section 4.3.1.4 (future of tendering). One respondent identifies how there should be more research on the sustainability of pharmaceuticals. One example is research on the environmental impact of each medicine (Interview 7 – UMC 4). Another example is research on the effect of medicine in surface water (Interview 9 – UMC 6). That way, there can be steered to prescribing the more sustainable medicine. Purchasers do make the remark that in the end, patient safety is still the number one priority. So, only if the sustainable alternatives are considered safe, they will be prescribed. Another respondent identifies how the lack of transparency in the PSC is a barrier for displaying GP behaviour (Interview 4 – UMC 1). A different respondent also identifies the dependency on the information that is received from the suppliers as a barrier, due to the lack of verification (Interview 5 – UMC 2).

4.6.2.4 Intention GP

All purchasers agree that the GP practices should be expanded within the UMCPG. One respondent mentions they want to implement the PSQ for more medicine types (Interview 3 – UMCPG). Another respondent describes how sustainability should be a standard aspect of the procurement process.

"And that soon in the future, we will include a set of criteria as standard in every tender. And that that will be woven into our work as a standard. Also, that we keep ourselves up to date on what's going on and whether we can keep refining our criteria." (Interview 6 – UMC 3)

On the contrary, one respondent notes no supplier must be given preferential treatment because of their sustainability performance, when for example there is a different supplier with a higher PSQ score. In the end, the tendering process must remain an equal playing field for all suppliers as this is one of the procurement fundamentals (Interview 6 – UMC 3).

Chapter 5. Solution & Design

This chapter focuses on the solution design process. The solution is a redesign of the PSQ, which is hereafter called a tender supplier questionnaire (TSQ). The design requirements, solution itself, and evaluation of the design are discussed.

5.1 Design requirements

Throughout this thesis, the design requirements for the solution have been iteratively identified. During the interviews the purchasers were asked about fixed design elements, desired design elements, and feedback on drafts of design elements created by the author throughout the thesis. Additionally, the author has held two presentations for various members of the UMCPG about the results of the interviews and design of the solution. During these presentations, feedback for the design requirements and evaluation of the solution was gathered.

5.1.1 Answer format

The purchasers express the desire to retain the current answer formats of binary questions (yes/no) and multiple choice. This ensures objectivity in the evaluation process.

5.1.2 Question design

As described in paragraph 4.5.1.2, purchasers indicated that some questions like land of production and packaging are best to split up. Additionally, suppliers expressed the need for context of some questions. Members of the sustainability team suspected this beforehand and expressed that they want to provide such context.

5.1.3 Additional questions

Based on the interviews, three question types are identified that could be included in the TSQ: sustainable product packaging, sustainable logistics, and mode of delivery (wholesaler or otherwise). Example questions are provided. To implement such questions, the author suggests the UMCPG to thoroughly research which questions would be best suitable to include in the TSQ.

5.1.4 Recognizability of Nordics tendering process

The members of the UMCPG express the desire to keep the TSQ as similar as possible to the tender format of the Nordics. The author has received a confidential document with the supplier questionnaire of the Nordics.

5.1.5 Implementation of categories

The author has introduced the design element of categories within the TSQ to enhance an easier evaluation for the purchasers, and to use a format for providing feedback to suppliers about the outcome of the tender. Moreover, the categories are meant to provide more clarity on the goal of the TSQ and motivation behind the questions. All purchasers agreed this was a good element to include in the design.

5.2 Solution: TSQ

The solution is designed based on the PSQ that was used for the package of antimicrobial agents. This TSQ serves as a baseline and can be adjusted, based on package-specific requirements.

5.2.1 Categories TSQ

Figure 9 displays the designed categories for the TSQ, based on the document of the Nordics.

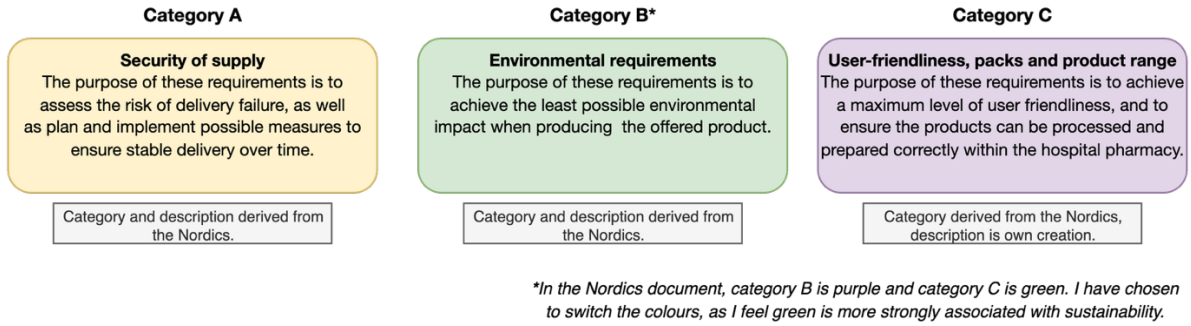


Figure 9. Categories for TSQ (author's own creation)

In figure 10 each question is assigned to the appropriate category. This classification is also based on the document of the Nordics. Moreover, the questions about sourcing are appropriate for category A, as the interviews illustrated how delivery reliability was the main priority for preferring products that are produced and packaged in Europe. Sustainability was described to be a welcome concomitant of this. Additionally, suppliers assumed the intent of this question was about the (negative) environmental impact associated with the land of production and packaging. Some suppliers illustrated how they felt they had the proper policy for ensuring sustainable business practices, and how it was unfair to be judged by the environmental impact associated with the continent itself. Categorizing the sourcing questions under category A is expected to increase the comprehension of the context and decrease the sense of unfairness. In category A, the continent itself has more to do with the associated risks of geopolitical instabilities and long lead times. Category B includes all questions related to certification for environmental management systems, wastewater management systems, and the AMRIA manufacturing standards. It is advised to disclose why the UMCPG cannot require or nudge towards specific types of certifications, since the suppliers were confused about this. Category C includes all questions that relate to product-specific aspects that enhance the user-friendliness of the products in the hospital. These questions are expected to vary the most between medicine packages.

It is highly recommended to share the categories and respective explanations with the suppliers. This would resolve the lack of understanding the suppliers have expressed regarding the goal of the PSQ (future TSQ), and why all questions are important to ask. This is expected to enhance the buyer-supplier relationship.

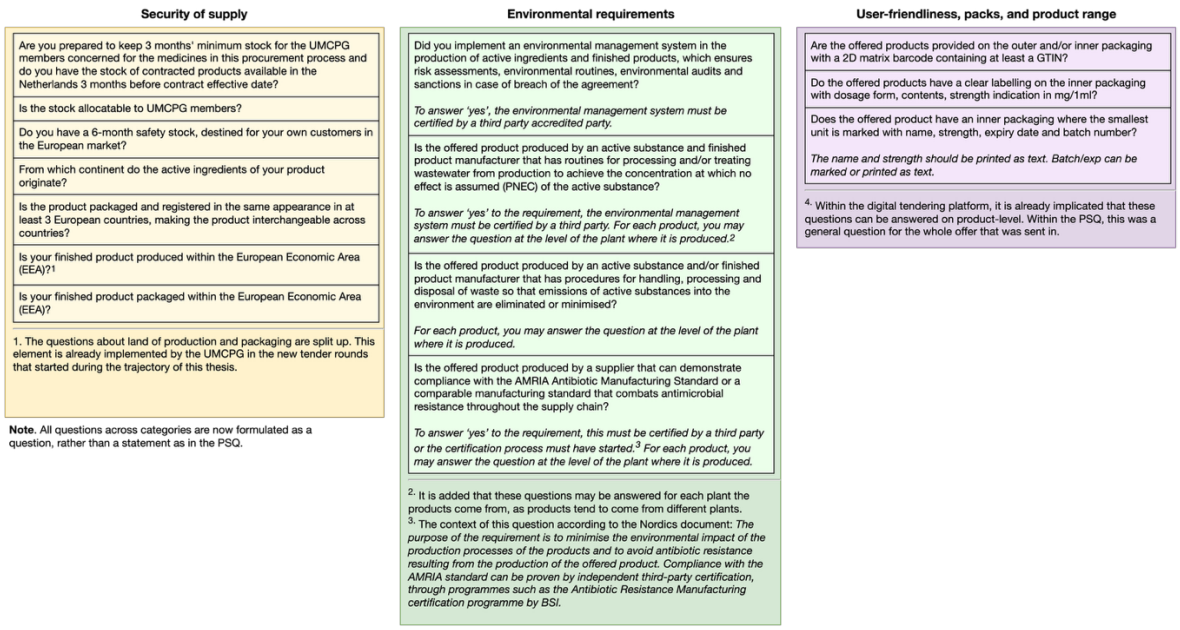


Figure 10. Questions in categories TSQ (author's own creation)

5.2.2 Decision hierarchy

The analysis shows that the former PSQ and price are not the only decision variables in the supplier selection process of the tender. Switching costs and label distribution are also identified as decision variables. Therefore, it is proposed to implement a decision hierarchy for the tender process. Figure 11 shows this hierarchy.

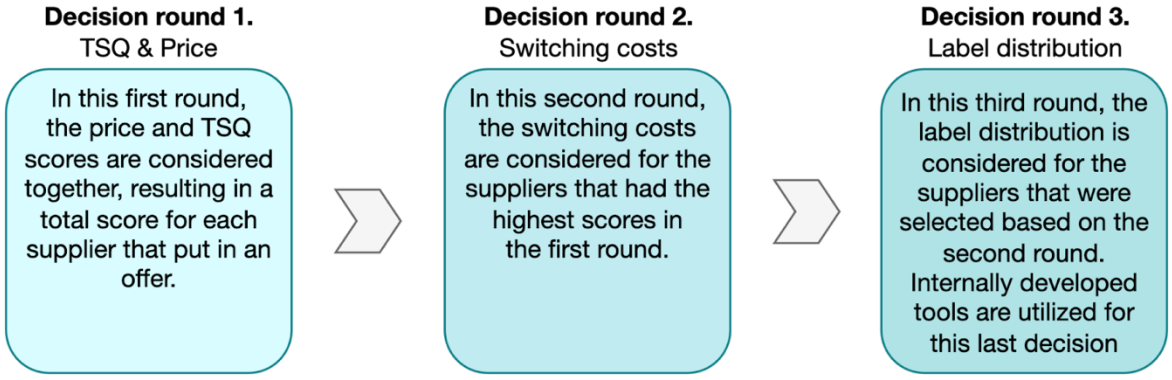


Figure 11. Decision hierarchy for UMCPG (author's own creation)

5.2.3 'Rebranding' the tendering process

It is highly recommended that the tendering process is 'rebranded'. The results show that the suppliers have the feeling that the supplier selection decisions were highly dependent on only price and the outcome of the former PSQ. However, it is apparent that the TSQ will only be a tool in the supplier selection process to help level the playing field for the suppliers and ensure a more objective evaluation. Considering the complexity and uniqueness of the PSC that the results show, the TSQ remains subject to the circumstances occurring in the pharmaceutical market. It is advised to follow the lead of the Nordics, who state that their tendering process involves sustainability criteria. This implies sustainability is a part of the tender and TSQ, but not the only subject that is covered. This also prevents the misunderstandings that may arise due to the

many, sometimes negative, associations that suppliers appear to have with the topic of sustainability. Therefore, it is advised to inform suppliers that this tender was part of a shift towards a renewed tendering process, where sustainability is included. Moreover, it is advised to organize a 'supplier day', where all suppliers are invited for a presentation on the renewed tender process. On that day all questions of suppliers can efficiently be answered, whilst enhancing the transparency between buyer and supplier. Additionally, some suppliers could be invited by the UMCPG to give a presentation that day about sustainability developments in the pharmaceutical manufacturing industry. This enhances knowledge sharing and stimulates collaboration within the PSC.

5.2.4 Feedback for suppliers

It is advised that the suppliers receive more feedback regarding the outcome of the tender. During evaluation, the purchasers expressed that transparency is still an ambivalent topic within the UMCPG. To aid in this decision, the options are outlined in table 3, with progressively decreasing transparency per option.

Table 3. Options for feedback for suppliers

Option	Explanation
Full transparency	The suppliers are given full transparency about the weighting of each TSQ question and their own score, scores of the competition, and insight in the reason they have been rejected (price, TSQ, label distribution or switching costs)
Almost full transparency	The suppliers are given full transparency about the weighting of each TSQ question, their own TSQ score, and insight into the reason they have been rejected (price, TSQ, label distribution or switching costs). The scores of the competition are not shared in this scenario.
Partial transparency (A)	The suppliers are given transparency on the weighting of each TSQ category, receive their own total TSQ score and insight into the reason they have been rejected (price, TSQ, label distribution or switching costs). The weights of the individual questions are not shared in this scenario.
Partial transparency (B)	The suppliers are given transparency on the weighting of each category beforehand and only receive the reason of rejection afterwards (price, TSQ, label distribution or switching costs). The total scores are not shared in this scenario.
Little transparency	The suppliers only receive the reason for rejection afterwards (price, TSQ, label distribution or switching costs). The weighting of the categories is not shared in this scenario.

No transparency	The suppliers receive no transparency on the weighting of the categories nor the reason for rejection.

Based on the interview analysis of this thesis, at least 'Partial transparency (B)' is recommended. This way, suppliers are informed of the reason they have not won a tender and whether they can improve their performance on that aspect. Moreover, the weighting of the categories would indicate the importance of each category within the tendering process. Consequently, the suppliers will know which business practices are most urgent to improve on.

With regards to the preference of digitizing and automating the TSQ, it is advised to collaborate with the developers of the online tendering platform on providing feedback to suppliers. It is advised to discuss the implementation of a format where the purchasers can choose the reason for rejection for the tender (price, TSQ or TSQ category, label distribution or switching costs) from a drop-down menu, after which an automated email is sent to each supplier with this information. This minimizes the workload but still informs suppliers with the requested information.

5.2.5 Additional questions

Based on the thematic analysis and results, some examples of additional questions for the PSQ are given in table 4. However, it is recommended that the UMCPG will research in advance which questions and question types are most suitable to include in the next version of the TSQ. It is advised to collaborate with other purchasing groups, and other countries like the Nordics. Moreover, the sustainable business practices of suppliers can be researched more in-depth to see which questions add the most value for the TSQ.

Table 4. Examples of additional questions for TSQ

Topic	Question example	Category	Answer format
Sustainable packaging	• Is the product packaging made from recyclable materials?	Environmental requirements	Yes / No
	• What is the carbon footprint of the product packaging? *Expressed in CO_2 or CO_2-equivalent*		MC options with suitable CO_2 ranges
Sustainable logistics	• Are the offered products distributed with an electric vehicle?	Environmental requirements	Yes / No
Mode of delivery	• Can the offered product be delivered by a wholesaler? *If 'yes', specify which wholesaler?*	Security of supply	Yes / No

5.3 Purpose of TSQ

The proposed TSQ is an improved version of the PSQ. However, it must be noted that this is not the final version of the ideal TSQ for the UMCPG. More research is required on refining the TSQ. Research directions could be customizing the TSQ per medicine package and differentiate between manufacturers and distributors, suitable questions to add, and revising the weighting.
Moreover, it was planned to incorporate social sustainability in the TSQ criteria. However, this is deemed as infeasible since too little information was gathered on social sustainability during the interviews. Therefore, more research is required on social sustainability as a TSQ criteria. This thesis is focused on the general experience with the PSQ of both supplier and purchaser. The thematic analysis revealed potential solutions for both the PSQ and the tendering process. Yet, this second version of the questionnaire should be considered as the foundation for a new intervention cycle.

5.4 Evaluation TSQ

In general, the UMCPG members express the TSQ to be a good improvement. Some design elements have already been implemented during the trajectory of this thesis. In addition, the purchasers liked the idea of a ‘supplier day’. The UMCPG and researcher will also prepare documentation together to inform the suppliers about the outcome of this research, as this has been highly requested since the start of this trajectory.

The biggest point of ambivalence remains the topic of transparency. This is something the UMCPG will decide upon themselves. With the results of this research, the UMCPG has expressed the desire to follow-up with research on topics like weight distribution of the TSQ. The topic of weight distribution is something that was out of scope for this thesis and calls for a researcher with relevant (mathematical) knowledge.

Chapter 6. Conclusion & Discussion

This chapter presents a summary of the key findings and discusses the results. Within the discussion, findings are compared to prior research. Interesting differences are be highlighted. Additionally, the limitations are stated and directions for future research are given. Finally, managerial implications are discussed.

6.1 Summary of key findings

This thesis explores how economic, environmental, and social sustainability criteria can be integrated in the procurement of medicine for the purchasing group of the Dutch academic hospitals (UMCPG). A recent pilot tender with sustainability criteria has been studied (PSQ). Through interviews with both suppliers and purchasers, the bottlenecks within the PSQ and tendering process have been identified for both parties. Key findings on the PSQ highlight how there is a lack of understanding about the goal and context of questions, the need for transparency about the outcome of the tender, the need for objectivity in the evaluation, and the desire for a uniform supplier questionnaire across purchasing parties. Key findings on the tendering process highlight the complexities of the PSC that impact both parties like drastic medicine shortages, price competition, keeping general healthcare costs low, ensuring high patient safety, and the price tag of sustainability. Based on the findings, the following solutions are designed for and proposed to the UMCPG: 1) a renewed supplier questionnaire (TSQ) including categories, 2) a decision hierarchy, 3) 'rebranding' the procurement process, 4) a recommendation for tender transparency, and 5) suggestions for improving the TSQ including example question types and moving towards a uniform TSQ across purchasing parties. Social sustainability criteria were eventually not incorporated in the TSQ design, since too little information was gathered on social sustainability during the interviews.

The theoretical foundation of this thesis builds upon the Theory of Planned Behaviour (TBP) for Green Procurement behaviour. Key findings highlight that purchasers' have a positive attitude towards sustainability and green procurement, work-related stakeholders convey the norm for keeping medicine procurement costs low, the sense of behavioural control is biggest as being part of the UMCPG rather than on individual level, and the intention to engage in green procurement is generally positive like the purchasers' attitude.

6.2 General discussion

Chapter 2 illustrates that the literature on sustainability in the PSC has been growing over the last decade, yet the literature on green pharmaceutical procurement is still scarce. This section first discusses the contributions of this thesis for general sustainability in the PSC and then focuses on contributions for enhancing transparency in the PSC, and intentions to engage in green pharmaceutical procurement. Due to the limited existing research, the findings of this thesis in light of the studies as described in sections 2.4 and 2.5 are discussed more in-depth per article.

First, this thesis confirms and adds on to the complexities of the PSC as addressed by Bhakoo and Chan (2011). Their study identified complexities like various critical stakeholders, extensive product ranges, and (dynamic) regulations for all supply chain actors to oblige. This thesis illustrates how the most critical stakeholder is the patient, which is described as the common denominator for all PSC parties. Other complexities are identified specifically for the Dutch market, like price competition for the generic suppliers and extreme medicine shortages.

These complexities are shown to have a significant impact on how easy it is to integrate sustainability in both the procurement and manufacturing process. In general, the extra costs associated with sustainable business practices limit the extent to which purchasers can allocate budget to sustainable supplier selection and the extent to which generic manufacturers can integrate sustainability practices in their business model.

Second, this thesis identifies an extra manner in reducing the carbon footprint of pharmaceutical logistics. Where Shao and Lu (2023) studied optimization of delivery routes, findings of this thesis highlight the prospect of order consolidation and order frequency. These topics are relevant for both suppliers and purchasers. Suppliers can increase consolidation and decrease frequency of the orders they place when importing medicines and building stock. Moreover, product deliveries can be consolidated across suppliers when delivery is facilitated by a wholesaler. Purchasers from the UMCs can consolidate orders across hospital units to decrease the number of deliveries per day to the hospital and consequently reduce the carbon footprint of received deliveries.

Third, this thesis adds to theory on enhancing transparency within the PSC. Kotcharin and colleagues (2024) find that trust is a requirement for information sharing in a supply chain. The findings of this thesis add how bilateral transparency between the purchasing and supplying parties is foundational to this trust. Many suppliers emphasize how transparency from the purchasers about the purpose of the PSQ and tendering process will increase the willingness to share information. In contrast, purchasers voice the need for transparency from suppliers to ensure an informed and sustainable supplier selection. As of now, some purchasers distrust the suppliers' answers on the PSQ due to the lack of transparency. It is addressed how suppliers give answers that the purchasers do not recognize from them based on past experiences. Thus, in order to facilitate information sharing this buyer-supplier relationships, mutual trust is enhanced by bilateral transparency. This underscores and nuances the challenge of lack of transparency in buyer-supplier relationships as posed by Gonçalves and Silva (2021). Moreover, Yang & Lu (2024) propose that specifically for public tendering processes, predefined scoring systems are probably the most effective influence tools in enhancing supply chain transparency. It is argued that transparency on the published criteria and a public disclosure of missing data might stimulate firms to improve discovery processes and close the transparency gaps. This thesis adds how a predefined scoring system can also enhance transparency for private tendering processes. Moreover, this effect is likely to be the most significant when a national-wide format for the evaluation criteria is adopted across purchasing parties. The effect is expected to further increase when the national format aligns with the criteria adopted in other countries where the suppliers operate. Moreover, a criteria format that is used across countries can increase the urge for firms to close any transparency gaps within the criteria, assuming they would gather information to increase their scores on the criteria. Suppliers emphasized how they would prefer to provide the same information about their supply chain practices, like environmental certifications and country of origin and production, for all purchasing parties. The current differences in requested information across purchasing parties decreases the willingness to share information, as the total workload of information retrieval is too much for the supplier. When the same information can be provided at once to all purchasing parties, the workload of information retrieval is significantly reduced. Ultimately, supply chain transparency can be

enhanced when utilizing a national, or even European, format of supplier evaluation criteria as the willingness to share information increases with such format.

Fourth, this thesis adds to existing research on factors influencing purchasers' intention to engage in green procurement. The study of Hinterhuber and Khan (2025) found that the willingness to pay (WTP) for sustainability is primarily influenced by attitudes and perceived behavioural control, but no significant relationship was found between subjective norm and WTP. This thesis, however, found that most influencing subjective norm influencing green procurement, is the norm as expressed by board members and directors. These parties expect the purchasers to keep the costs as low as possible when purchasing medicine. Hence, the purchasers are more reluctant to engage in green procurement, despite the shared opinion of the purchasers that sustainability important. Purchasers are generally also surrounded by like-minded people. It is also indicated that even if non-work-related people do not think sustainability is important, they would still engage in green procurement behaviour at work. Yet, the norm of work-related parties does interfere with the intention to engage in such behaviour. Hence, the subjective norm from higher-level people in the organization impose the most influential factor for engaging in green procurement and influences WTP for sustainable suppliers. Moreover, this thesis adds that the WTP itself is a factor that is dependent on stakeholders like directors and policy makers. In the context of this thesis, the procurement professionals do not feel they have the authority to decide on their own WTP. Moreover, the purchasers address that if they have budget guidelines on sustainability, they are willing to spend more on procurement to enable the selection of sustainable suppliers. This resonates with the findings of Hinterhuber and Khan (2025), where it is found that when a professional is more willing to pay for sustainability, they are more likely to select suppliers engaging in sustainable practices. In retrospective, the findings of Hinterhuber and Khan (2025) inherently implicates that sustainability likely comes with a price tag. Otherwise, there would be no need for purchasers to be willing to pay for sustainable suppliers. The price tag of sustainability is also greatly emphasized in the findings of this thesis. Another finding of Hinterhuber and Khan (2025) is that that awareness of economic, social, and environmental consequences of purchasers' decisions influences the WTP. This thesis finds that purchasers are aware of the economic consequences of choosing for a more sustainable supplier, since they state this is the more expensive option. Choosing for the sustainable suppliers would lead to increased procurement costs, which would then be reflected in the national healthcare costs. Hence, the economic consequences could decrease the WTP for sustainability in procurement. Contrastingly, the economically sustainable option that is presented for the UMCPG, is sourcing from Europe. As illustrated in the interviews, the purchasers prefer European sourcing as it enhances delivery reliability and is more sustainable than other alternatives. So, the economic consequence of delivery reliability could enhance the WTP for a more sustainable supplier, even though the main reason for such a choice is increased delivery reliability. Moreover, purchasers do acknowledge the necessity for choosing environmentally sustainable supplier. In the interviews it is emphasized how sustainability is a global matter, and how we should all allocate effort to decreasing the negative environmental impact. This could be done by choosing suppliers that actively try to minimize their negative environmental impact caused by their business practices. That way, environmental benefits like a minimized environmental impact could increase the WTP for sustainability in procurement.

In a study by Yaung and colleagues (2019) it is argued that perceived behavioural control is complex for the buyers in the construction industry, as one construction project involves many stakeholders and a complex project environment. It is mentioned in paragraph 2.5 that this could also be the case for the UMCPG. As suspected, the perceived behavioural control tends to be more complex for the members of the UMCPG. There is a trade-off between keeping costs low for the Dutch healthcare system and choosing for the more expensive yet greener suppliers. Even though there are no strict policies for the UMCPG to keep the costs low, the purchasers do describe they feel this is expected from them by the earlier mentioned stakeholders like the board of directors. This implies the subjective norm influences the perceived behavioural control. Moreover, the medicine shortages can 'force' the purchasers to retrieve the medicine on short notice in a more unsustainable manner. The medicine availability is crucial for ensuring patient wellbeing. This illustrates how the context of the pharmaceutical landscape influences green procurement behaviour. Even though the purchasers might have the intention to engage in green procurement, this could be overruled by contextual variables like medicine shortages. Furthermore, the perceived behavioural control was little on individual level, but strong on group level for the purchasers. The purchasers felt they could make more of a sustainable impact when they implemented green procurement as the UMCPG, rather than on an individual level. This adds an extra complexity to how perceived behavioural control influences the intention to display green purchasing behaviour. As an extension of perceived behavioural control, Neessen and colleagues (2021) address how high-level purchasers are more likely to engage in green procurement when it is their intention to do so as opposed to low-level purchasers. It is argued this could be caused by the lack of perceived behavioural control for the low-level purchasers. The findings of this thesis add how individual control compared to collaborative control impacts the perceived behavioural control of a purchaser. The purchasers also address how they specifically want to engage in green procurement with the UMCPG as a collective. This implies that the intention to engage in green procurement could indirectly be affected by individual vs. collaborative control.

6.3 Limitations and future research suggestions

Even though this thesis designed a solution for a practical problem of the UMCPG and provided insights on green procurement behaviour, some key limitations must be addressed.

First, the geographical scope of this thesis is limited to The Netherlands. As discussed, the PSC is a highly complex supply chain. This thesis illustrates the complexities for the Dutch pharmaceutical market, like price competition and medicine shortages. These complexities might be different for pharmaceutical markets in other countries. Moreover, the Dutch procurement system is described to be less transparent than other European countries. Since the design is specifically designed based on data retrieved from the Dutch market and characteristics specific for that market, the generalizability of the solution to pharmaceutical markets in other countries might be limited. Future research can explore the applicability of the proposed TSQ in different national contexts, comparing how varying regulatory environments, procurement structures, and market dynamics influence green procurement strategies in the pharmaceutical sector.

Second, the supplier interviews were held with a limited number of pharmaceutical manufacturers and distributors. The majority of the interviewee sample consisted of generic

pharmaceutical manufacturers. Hence, the findings for other supplier types, like 'spécialité' firms and pharmaceutical distributors, are limited. This thesis likely has not captured the complete spectrum of perspectives for those supplier types. Future research can focus on how a tool such as the TSQ can be tailored so that it is a suitable tool for evaluating those types of suppliers on sustainability criteria.

Third, the purchaser interviews were held with the purchasers of one particular purchasing group. The findings for other purchasing groups could differ from those in this thesis. A key difference is that the academic hospitals (UMCs) tend have more general income compared to other hospitals. As a result, a purchasing group like the UMCPG might have more financial resources to engage in green procurement practices, assuming sustainability comes with a price tag. Based on that prospect, the purchasers of the UMCPG might be more likely and willing to engage in green procurement since they believe the UCMPG could ensure that budget is be allocated to green procurement in the future. Other purchasing groups might not have the funds to do so, even if they are willing to. Besides the willingness to engage in green procurement, other hospitals or purchasing groups might have different priorities in the procurement process. Future research could expand the scope by researching more a more diverse range of purchasing groups. The following characteristics could be explored: priorities within the procurement process, stakeholders' opinions on sustainability and available resources.

Fourth, this thesis applied the Theory of Planned Behaviour (TPB) in a qualitative context, rather than its conventional quantitative context. Even though constructs like attitude, norm, perceived behavioural control, and intention were explored in-depth, the constructs were not measured using the full standardized scales that are available throughout research. Hence, the findings are more interpretive than predictive as the relationships between the variables were not quantified. Future research could study the application of the TPB for green pharmaceutical procurement in a quantitative context. It could be explored how collaborative control compared to individual control interacts with perceived behavioural control, and ultimately the intention to engage in green procurement behaviour. It could also be explored how subjective norms influence the willingness to pay for and intention to engage in green procurement. Future research could then explore the predictive power of the new variables that are identified in this thesis.

6.4 Managerial relevance

This thesis offers several practical insights for procurement professionals and policy makers in the pharmaceutical industry.

First, it provides a structured solution for the PSQ in the form of a TSQ. The TSQ includes three categories: a) security of supply; b) environmental requirements; and c) user-friendliness, packs, and product range. The implementation of categories helps suppliers to understand the intention behind each criterion of the TSQ, while enabling purchasers to evaluate the responses more efficiently. In addition, a decision hierarchy is proposed for the purchasers where they consecutively evaluate a) TSQ and price; b) switching costs; and c) label distribution. The formalisation of such a decision hierarchy provides a more efficient decision-making tool for purchasers in the tendering process. Furthermore, it is advised for purchasing parties to be transparent about the intention behind the TSQ and the steps in the tendering process to prevent misunderstandings and a sense of unfairness from the suppliers. Findings highlight how the

suppliers assumed the whole TSQ was related to sustainability, without knowing some questions had a different intention, leading them to feel unjustly evaluated. Additionally, suppliers were under the impression that the TSQ was very influential in the evaluation process of the tender. Transparency about the formalised decision hierarchy shows suppliers how the TSQ is a tool for the tender process, and how sustainability is integrated rather than the primary focus. Moreover, this thesis finds that sustainability tends to evoke a lot of different, sometimes negative, associations. It tends to be a complex subject for suppliers as well as purchasers. Hence, 'branding' the procurement process as a green procurement process could elicit negative responses of suppliers. Therefore, it is recommended for purchasing managers that sustainability is explicitly labelled as an integrated element in the shift towards a renewed procurement process to decrease any negative effects of existing associations with sustainability.

Second, this thesis finds the strong desire amongst both suppliers and purchasers for a national, uniform TSQ. The discussion addresses how a uniform TSQ can also enhance transparency in the PSC, ultimately improving PSC sustainability as suppliers might feel more urged to close any transparency gaps within the TSQ. Hence, purchasing groups across the pharmaceutical sector are encouraged to bundle their efforts into designing a national TSQ. Another benefit of this is the significant reduction of workload within the procurement process for both suppliers and purchasers. In addition, it is recommended for a national TSQ to remain similar to other European countries, like the Nordics, to enhance the relevance of the TSQ. Suppliers are more likely to allocate effort to answering the TSQ if they know the answers are also relevant for other countries they operate in. Thus, collaboration with other countries on designing the TSQ is recommended.

Third, the findings from applying the TPB provide important insights in the context of green procurement. This thesis finds that policy makers and directors tend to impose conflicting subjective norms. They underscore the importance of green procurement but still indicate that they ultimately prefer purchasers to obtain the lowest procurement costs. This can discourage purchasers from engaging in green procurement, even though they have the intention to do so. The purchasers express the need for guidelines on a green procurement budget. It is recommended that at least the board of directors of each UMC defines a budget for green procurement in the near future. Next to this, purchasers report they have a greater sense of control and influence when being a part of the UMCPG rather than individually. This suggests that collaboration between procurement professionals can increase green procurement behaviour. It is advised that such collaboration is stimulated by e.g., coordinating purchasers of a group.

7. References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Al-Shatti, B. J., Alsairafi, Z., & Al-Tannak, N. F. (2023). Green chemistry and its implementation in pharmaceutical analysis. *Reviews in Analytical Chemistry*, *42*(1). https://doi.org/10.1515/revac-2023-0069

Anastas, P. T., & Warner, J. C. (1998). *Green Chemistry: theory and practice*. http://ci.nii.ac.jp/ncid/BA39849008

Aseri, M., & Ansari, Z. A. (2023). Purchase behaviour of green footwear in Saudi Arabia using theory of planned behaviour. *Sustainability*, *15*(6), 5045. https://doi.org/10.3390/su15065045

Ashworth, B., Du Plessis, M. J., Goedhals-Gerber, L. L., & Van Eeden, J. (2025). The carbon footprint of pharmaceutical logistics: Calculating distribution emissions. *Sustainability*, *17*(2), 760. https://doi.org/10.3390/su17020760

Baldi, S., & Vannoni, D. (2015). The impact of centralization on pharmaceutical procurement prices: the role of institutional quality and corruption. *Regional Studies*, *51*(3), 426–438. https://doi.org/10.1080/00343404.2015.1101517

Bassani, F., Rodrigues, C., Marques, P., & Freire, F. (2022). Life cycle assessment of pharmaceutical packaging. *The International Journal of Life Cycle Assessment*, *27*(7), 978–992. https://doi.org/10.1007/s11367-022-02062-9

Bhakoo, V., & Chan, C. (2011). Collaborative implementation of e-business processes within the health-care supply chain: the Monash Pharmacy Project. *Supply Chain Management an International Journal*, *16*(3), 184–193. https://doi.org/10.1108/13598541111127173

Bilgili, M., Tumse, S., & Nar, S. (2024). Comprehensive overview on the present state and evolution of global warming, climate change, greenhouse gasses and renewable energy. *Arabian Journal for Science and Engineering*, *49*(11), 14503–14531. https://doi.org/10.1007/s13369-024-09390-y

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brun, A., Karaosman, H., & Barresi, T. (2020). Supply chain collaboration for transparency. *Sustainability*, *12*(11), 4429. https://doi.org/10.3390/su12114429

Chen, Z., Lian, J. Z., Zhu, H., Zhang, J., Zhang, Y., Xiang, X., Huang, D., Tjokro, K., Barbarossa, V., Cucurachi, S., & Dong, B. (2024). Application of life cycle assessment in the

Pharmaceutical Industry: A Critical review. *Journal of Cleaner Production*, *459*, 142550. https://doi.org/10.1016/j.jclepro.2024.142550

Daughton, C. G., & Ruhoy, I. S. (2012). Lower-dose prescribing: Minimizing “side effects” of pharmaceuticals on society and the environment. *The Science of the Total Environment*, *443*, 324–337. https://doi.org/10.1016/j.scitotenv.2012.10.092

Forster, P. M., Smith, C., Walsh, T., Lamb, W. F., Lamboll, R., Hall, B., Hauser, M., Ribes, A., Rosen, D., Gillett, N. P., Palmer, M. D., Rogelj, J., Von Schuckmann, K., Trewin, B., Allen, M., Andrew, R., Betts, R. A., Borger, A., Boyer, T., . . . Zhai, P. (2024). Indicators of Global Climate Change 2023: annual update of key indicators of the state of the climate system and human influence. *Earth System Science Data*, *16*(6), 2625–2658. https://doi.org/10.5194/essd-16-2625-2024

Fossey, E., Harvey, C., Mcdermott, F., & Davidson, L. (2002). Understanding and evaluating qualitative research. *Australian & New Zealand Journal of Psychiatry*, *36*(6), 717–732. https://doi.org/10.1046/j.1440-1614.2002.01100.x

Gardner, T., Benzie, M., Börner, J., Dawkins, E., Fick, S., Garrett, R., Godar, J., Grimard, A., Lake, S., Larsen, R., Mardas, N., McDermott, C., Meyfroidt, P., Osbeck, M., Persson, M., Sembres, T., Suavet, C., Strassburg, B., Trevisan, A., . . . Wolvekamp, P. (2018). Transparency and sustainability in global commodity supply chains. *World Development*, *121*, 163–177. https://doi.org/10.1016/j.worlddev.2018.05.025

Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, *140*(1), 149–159. https://doi.org/10.1016/j.ijpe.2012.01.035

Gonçalves, A., & Silva, C. (2021a). Looking for sustainability Scoring in Apparel: A review on environmental footprint, social impacts and transparency. *Energies*, *14*(11), 3032. https://doi.org/10.3390/en14113032

Gonçalves, A., & Silva, C. (2021b). Looking for sustainability Scoring in Apparel: A review on environmental footprint, social impacts and transparency. *Energies*, *14*(11), 3032. https://doi.org/10.3390/en14113032

Govindan, K., Soleimani, H., & Kannan, D. (2014). Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future. *European Journal of Operational Research*, *240*(3), 603–626. https://doi.org/10.1016/j.ejor.2014.07.012

Hinterhuber, A., & Khan, O. (2025). What drives sustainable procurement? Insights from the theory of planned behavior. *International Journal of Operations & Production Management*, *45*(13), 28–52. https://doi.org/10.1108/ijopm-02-2024-0164

Huff-Rousselle, M., & Burnett, F. (1996). COST CONTAINMENT THROUGH PHARMACEUTICAL PROCUREMENT: a CARIBBEAN CASE STUDY. *The International Journal of Health Planning and Management*, *11*(2), 135–157. https://doi.org/10.1002/(sici)1099-1751(199604)11:2

Hussain, G., Nazir, M. S., Rashid, M. A., & Sattar, M. A. (2022). From supply chain resilience to supply chain disruption orientation: the moderating role of supply chain complexity. *Journal of Enterprise Information Management*, *36*(1), 70–90. https://doi.org/10.1108/jeim-12-2020-0558

Jerin, A., Mahmud, M. a. P., Ackland, M. L., & Kouzani, A. Z. (2024). Recent progress on carbon footprint assessment of healthcare services. *Environmental Research Communications*. https://doi.org/10.1088/2515-7620/ad7e83

Kallio, H., Pietilä, A., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, *72*(12), 2954–2965. https://doi.org/10.1111/jan.13031

Kaufmann, L., Meschnig, G., & Reimann, F. (2014). Rational and intuitive decision-making in sourcing teams: Effects on decision outcomes. *Journal of Purchasing and Supply Management*, *20*(2), 104–112. https://doi.org/10.1016/j.pursup.2014.03.003

Kotcharin, S., Dehe, B., & Boonchoo, P. (2024). 'All you need is trust': examining trust, information sharing, and supplier performance perception in SMEs from a social exchange perspective. *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2415523

Lau, I., Burdorf, A., Hesseling, S., Wijk, L., Tauber, M., & Hunfeld, N. (2024). The carbon footprint of a Dutch academic hospital—using a hybrid assessment method to identify driving activities and departments. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1380400

Masudin, I., Umamy, S. Z., Al-Imron, C. N., & Restuputri, D. P. (2022). Green procurement implementation through supplier selection: A bibliometric review. *Cogent Engineering*, *9*(1). https://doi.org/10.1080/23311916.2022.2119686

McGrath, C., Palmgren, P. J., & Liljedahl, M. (2018). Twelve tips for conducting qualitative research interviews. *Medical Teacher*, *41*(9), 1002–1006. https://doi.org/10.1080/0142159x.2018.1497149

Mirdad, A., & Hussain, F. K. (2021). Blockchain-Based Pharmaceutical Supply Chain: A Literature review. Lecture Notes in Networks and Systems, 106–115. https://doi.org/10.1007/978-3-030-89899-1_11

Neessen, P. C., De Jong, J. P., Caniëls, M. C., & Vos, B. (2020). Circular purchasing in Dutch and Belgian organizations: The role of intrapreneurship and organizational citizenship behavior towards the environment. *Journal of Cleaner Production*, *280*, 124978. https://doi.org/10.1016/j.jclepro.2020.124978

NFU. (2025, February 3). Inkoopcombinatie ziekenhuis apotheken academische ziekenhuizen (IZAAZ). Retrieved February 24, 2025, from https://www.nfu.nl/themas/bestendig-zorgstelsel/inkoopsamenwerking/inkoopcombinatie-ziekenhuis-apotheken-academische

Nimri, R., Patiar, A., & Jin, X. (2020). The determinants of consumers' intention of purchasing green hotel accommodation: Extending the theory of planned behaviour. *Journal of Hospitality and Tourism Management*, *45*, 535–543. https://doi.org/10.1016/j.jhtm.2020.10.013

Noce, A. M. (2018). Green chemistry and the grand challenges of sustainability. *Physical Sciences Reviews*, *3*(12). https://doi.org/10.1515/psr-2018-0072

Rijksoverheid. (2022). GREEN DEAL: Samen werken aan duurzame zorg. In Rijksoverheid (C–238). Retrieved March 8, 2025, from https://www.rijksoverheid.nl/documenten/rapporten/2022/11/04/green-deal-duurzame-zorg

Romdhani, S., Nouaouri, I., Tounsi, J., Gattoufi, S., & Allaoui, H. (2022). Two-echelon Inventory Management for Sustainable Pharmaceutical Supply Chain through Waste Reduction. *IFAC-PapersOnLine*, *55*(10), 1380–1385. https://doi.org/10.1016/j.ifacol.2022.09.583

Saputro, T. E., Figueira, G., & Almada-Lobo, B. (2022). A comprehensive framework and literature review of supplier selection under different purchasing strategies. *Computers & Industrial Engineering*, *167*, 108010. https://doi.org/10.1016/j.cie.2022.108010

Shao, X., & Lu, S. (2023). Optimizing dual distribution scheme in pharmaceutical cold chain for cost and carbon emissions reduction. *Applied Sciences*, *13*(9), 5524. https://doi.org/10.3390/app13095524

Singh, R. K., Kumar, R., & Kumar, P. (2016). Strategic issues in pharmaceutical supply chains: a review. *International Journal of Pharmaceutical and Healthcare Marketing*, *10*(3), 234–257. https://doi.org/10.1108/ijphm-10-2015-0050

Steenmeijer, M. A., Rodrigues, J. F. D., Zijp, M. C., & Loop, S. L. W. D. (2022). The environmental impact of the Dutch health-care sector beyond climate change: an input–output analysis. *The Lancet Planetary Health*, *6*(12), e949–e957. https://doi.org/10.1016/s2542-5196(22)00244-3

Stević, Ž., Pamučar, D., Puška, A., & Chatterjee, P. (2019). Sustainable supplier selection in healthcare industries using a new MCDM method: Measurement of alternatives and ranking according to COmpromise solution (MARCOS). *Computers & Industrial Engineering*, *140*, 106231. https://doi.org/10.1016/j.cie.2019.106231

Thomas, S. L., Pitt, H., McCarthy, S., Arnot, G., & Hennessy, M. (2024). Methodological and practical guidance for designing and conducting online qualitative surveys in public health. Health Promotion International, 39(3). https://doi.org/10.1093/heapro/daae061

Tomiak, W., Kupis, R., Kowalik, J., & Skrobisz, K. (2024). Green Hospitals: A a remedy for the Climate Change Burden on the Polish Healthcare System. Prospects in Pharmaceutical Sciences, 22(2), 45–49. https://doi.org/10.56782/pps.179

Van Aken, J. E., & Berends, H. (2018). *Problem solving in organizations*. https://doi.org/10.1017/9781108236164

Veleva, V., Bodkin, G., & Todorova, S. (2017). The need for better measurement and employee engagement to advance a circular economy: Lessons from Biogen's "zero waste" journey. *Journal of Cleaner Production*, *154*, 517–529. https://doi.org/10.1016/j.jclepro.2017.03.177

Viegas, C. V., Bond, A., Vaz, C. R., & Bertolo, R. J. (2019). Reverse flows within the pharmaceutical supply chain: A classificatory review from the perspective of end-of-use and end-of-life medicines. *Journal of Cleaner Production*, *238*, 117719. https://doi.org/10.1016/j.jclepro.2019.117719

Yang, S., Su, Y., Wang, W., & Hua, K. (2019). Research on developers' green procurement behavior based on the theory of planned behavior. *Sustainability*, *11*(10), 2949. https://doi.org/10.3390/su11102949

Yeğin, T., & Ikram, M. (2022). Analysis of Consumers' electric vehicle purchase Intentions: An expansion of the theory of planned Behavior. *Sustainability*, *14*(19), 12091. https://doi.org/10.3390/su141912091

Zickar, M. J., & Keith, M. G. (2022). Innovations in sampling: Improving the appropriateness and quality of samples in organizational research. *Annual Review of Organizational Psychology and Organizational Behavior*, *10*(1), 315–337. https://doi.org/10.1146/annurev-orgpsych-120920-052946

List of appendices

Appendix A. Interview guide: Current procurement process

Interview guide: standard procurement process

This interview guide is designed to gain more insight in the standard procurement process of the UMCs' purchasing group for medicine, prior to the introduction of the sustainability pilot. The goal of this interview is for the researcher to get acquainted with the standard procurement process of the purchasing group. Consequently, the researcher will be able to adequately explore the differences between the standard procurement process and the sustainability pilot. The subsequent interviews will concern the sustainability pilot from both the purchasers' perspective and the suppliers' perspective. The researcher will be further referred to as the interviewer in this interview guide.

Interviewees

Appropriate interviewees for this topic are the purchasers that are involved with the UMCs' purchasing group.

Subtopics

The interview consists of a few subtopics which will be discussed below.

Introduction

The introduction serves to inform the interviewee on the topic of the interview. Second, consent to recording the interview will be asked. If no consent is given, the interviewer will solemnly take notes. Finally, the interviewee is asked to describe their job position within the purchasing group, as well as the University Medical Centre they are employed with.

Procurement process

The goal of this section is to map all the steps in the standard procurement process of the purchasing group. The interviewer will probe the interviewee with some examples of steps to help them in the thought process. The exemplary steps are taken from the 'purchasing and supply management process wheel' (PSM wheel) as depicted in figure 1. This wheel is designed by van Raaij (2016) to capture all the steps involved in a procurement process on a strategic, tactical, and operational level. Ultimately, the interviewer will use the insights to create a visualized set of steps of the procurement process. It will also be discussed how the process differs per medicine type. Additionally, it will be discussed which stakeholders are involved in each step of the procurement process. The stakeholders can be people both within and outside of the purchasing group. The PSM wheel emphasizes how the procurement process involves activities both within and between organizations (van Raaij, 2016). If there are stakeholders outside the purchasing group, the type of organization and reason for collaboration will be discussed.

Supplier selection and evaluation

The goal of this section is to gain in-depth insights on the standard supplier selection and evaluation process of the purchasing group. The interviewee will be questioned about the criteria

on which the suppliers are evaluated. It will be discussed why these criteria were included, and how they are scored. This section includes questions about the division of qualitative and quantitative criteria, scoring scales, weighting of the criteria, and how criteria are scored if they are binary or when suppliers were unable to provide information.

Conclusion

In the conclusion the interviewee is asked if any relevant information was not yet discussed during the interview. If so, the interviewee is asked to elaborate on this information. It is also asked if the interviewee would like to receive the recording and interview notes for verification, if the interviewer can contact them in case of follow-up questions, and whether the interviewee knows other people that would be appropriate as interviewee. The latter is also referred to as the 'snowball effect'.

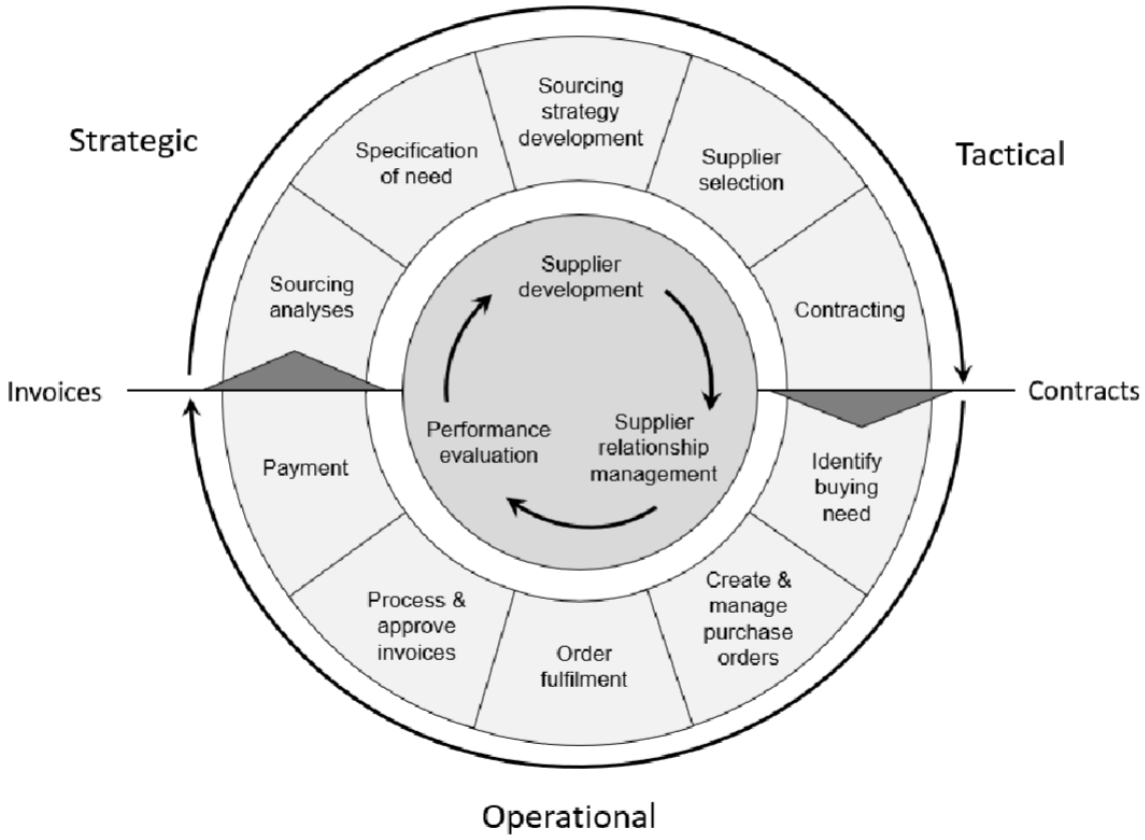


Figure 1. Purchasing and supply management process wheel (van Raaij, 2016)[3]

[3] Van Raaij, E. (2016). Purchasing value: purchasing and supply management's contribution to health service performance. ERIM Inaugural Address Series Research in Management. Retrieved from http://hdl.handle.net/1765/93665

Introduction	The purpose of this interview is to gain more insight into the standard procurement process of the UMCs' purchasing group for medicine, before the sustainability pilot was introduced.
	
	Do you consent to me recording this interview? If not, notes will be taken instead.
	• Which University Medical Centre do you work for?
	  o What is your job position there?
	  o How long have you been working in this job position?
	• What is your job position in the purchasing group?
	  o How long have you been working in this job position?
	• How would you describe your day-to-day activities?

Procurement process	In this next phase, I would like to map all the steps involving the standard procurement process of the purchasing group.
	• Can you describe the steps in the procurement process of the purchasing group from beginning to end? Think of steps like identifying the medicine needed, supplier selection, supplier evaluation, contract negotiation, contract management etc.
	  o Does this process differ for different pharmaceuticals?
	  ▪ If so, can you give me an example?
	• Which stakeholders are involved in each of the steps we have discussed just now? These may be both within the purchasing group, or outside of the purchasing group.
	  o If the stakeholders are outside of the purchasing group, which type of organizations are these?
	  o Why do you collaborate with them?

Supplier selection and evaluation	In this phase, we will focus on the supplier selection and evaluation steps within the procurement process.
	• What criteria are the suppliers currently selected on?
	  o For each criterion, why has this been chosen to include?
	  o What is the division between qualitative and quantitative criteria?
	• How are these criteria evaluated and scored?
	  o How do you go about assigning scores to binary (yes/no) criteria?
	  o How do you go about scoring criteria for which some suppliers have not or could not provide information?
	• What are the weights of these criteria?
	  o How were these weights decided upon?

Conclusion	The interview has now come to an end. • Is there anything else that was not covered in this interview, but you feel that it is relevant for this topic? This can be about the pilot or the procurement process of the purchase group in general. o If so, can you tell me more about this? • Would you like me to send you the summary of the interview for verification?

	• Could I contact you in case I have any follow-up questions about this interview? • Do you know other people that I could interview for more insights on this topic?

Appendix B. Interview Guide: Design of PSQ

Interview guide: design of PSQ

This interview guide is designed to gain more insight in how the PSQ was designed. The researcher will be further referred to as the interviewer in this interview guide.

Interviewees

Appropriate interviewees for this topic are the purchasers that are a member of the UMCPG sustainability team, which designed the PSQ.

Subtopics

The interview consists of a few subtopics which will be discussed below.

Introduction

The introduction serves to inform the interviewee on the topic of the interview. Second, consent to recording the interview will be asked. If no consent is given, the interviewer will solemnly take notes. Finally, the interviewee is asked to describe their job position within the purchasing group, as well as within the sustainability team.

Questionnaire

This part is aimed to gain in-depth understanding of how the PSQ was designed. First, the trigger for designing the PSQ is discussed. Second, the types of medicine and suppliers the PSQ is designed for are discussed. Third, the importance of sustainability in the PSQ design is addressed. Finally, it is discussed which questions were included, and why.

Scoring

This part is aimed to gain in-depth understanding of how the scores of the PSQ were decided upon, and why there has been chosen for the current weight distribution between price and the PSQ score. This topic is still very much unexplored to the researcher prior to the interview.

Conclusion

In the conclusion the interviewee is asked if any relevant information was not yet discussed during the interview. If so, the interviewee is asked to elaborate on this information. It is also asked if the interviewee would like to receive the recording and interview notes for verification, if the interviewer can contact them in case of follow-up questions, and whether the interviewee knows other people that would be appropriate as interviewee. The latter is also referred to as the ‘snowball effect’

Introduction	The purpose of this interview is to gain more insight into the questionnaire used in the revised procurement process of the UMC purchasing group for pharmaceuticals which incorporates sustainability.
	
	• Do you give permission to record this interview?
	  ○ If not, I will take notes during the interview.
	• Which University Medical Centre do you work for?
	  ○ What is your position there?
	  ○ How long have you been in this position?
	• What is your role within the purchasing group?
	  ○ How long have you held this role?
	
	Next, we will briefly discuss the sustainability team.
	• When was the sustainability committee established?
	• Can you summarize the purpose and core activities of the sustainability team?
	• What is your role within the sustainability team?
	  ○ How long have you been a member of the team?
	• Are there people involved in the sustainability team who are not present today?
	  ○ If so, what is their role in the team?

Questionnaire	In this next phase, I'd like to understand how the questionnaire was developed and why each specific question was selected. I would like to emphasize that these questions relate to the design process of the questionnaire. The evaluation of the questionnaire will be discussed in a later interview.
	[The interviewer has the questionnaire with answer scores ready for this section]
	
	• Can you describe the process that led to the design of the questionnaire? In other words, what was the trigger for developing the questionnaire?
	  ○ Which stakeholders were involved?
	  ○ Did you experience pressure from stakeholders?
	  ▪ If so, could you elaborate?
	• For what type of medicines or suppliers was the questionnaire developed?
	  ○ Why?
	• How important was sustainability during the design process?
	  ○ Which part of the questionnaire focuses on sustainability?
	  ○ Did you include economic, ecological, and social aspects of sustainability in the questionnaire?
	  ○ If one of these was excluded, why?
	  ○ Why were the chosen categories and themes within sustainability selected?
	  ○ Are there sustainability topics that were intentionally left out of the questionnaire?
	  ▪ Why?
	• What other categories and themes were included in the questionnaire to assess suppliers?
	  ○ For each question, why was it specifically selected for inclusion?

	○ What is the balance between qualitative and quantitative questions? • How did you experience the process of designing the questionnaire? ○ Were there moments that were particularly easy or challenging?
Scoring	In this phase, we will focus on how the answers were scored. • How did you determine the number of points assigned to each answer? ○ How do you deal with assigning points to binary (yes/no) criteria? ○ Did you decide in advance how to score criteria for which suppliers could not provide information? • The final weighting of the questionnaire is [confidential] %, with the remaining [confidential]% based on price. What is the reason for this specific distribution?
Conclusion	The interview has come to an end. • Is there anything that was not covered in this interview that you believe is relevant to this topic? This could relate to the procurement process in general or the supplier selection. ○ If so, could you tell me more about it? • Would you like me to send you a summary of the interview for verification? • May I contact you in case I have follow-up questions about this interview? • Do you know other individuals I could interview to gain more insights on this topic?

Appendix C. Interview Guide: Purchasers' experience with PSQ and green procurement behaviour

---

Interview guide: sustainability pilot and green procurement behaviour from purchasers' perspective

---

This interview guide is designed to explore two topics. First, the interview is conducted to gain more insight in the purchasers' perspective of the sustainability pilot that the UMCs' purchasing group for medicine has introduced in 2024. The sustainability pilot involved the introduction of sustainability criteria to the standard procurement process of the UMCs' purchasing group. The goal of this interview is for the researcher to get in-depth insight in the changes to the standard procurement process with the introduction of the sustainability criteria. The interview will explore the barriers, difficulties and successes of the sustainability pilot. Separate interviews will be conducted to explore the sustainability pilot from the suppliers' perspective.

Second, this interview will explore purchasers' intention to engage in green purchasing behaviour according to the theory of planned behaviour (TBP). The interview will explore the three antecedents influencing the intention to engage in green purchasing: attitude, subjective norm, and perceived behavioural control. The researcher will be further referred to as the interviewer in this interview guide.

Interviewees

Appropriate interviewees for this topic are the purchasers that are involved with the UMCs' purchasing group.

Subtopics

The interview consists of a few subtopics which will be discussed below.

Introduction

The introduction serves to inform the interviewee on the topic of the interview. Second, consent to recording the interview will be asked. If no consent is given, the interviewer will solemnly take notes. Finally, the interviewee is asked to describe their job position within the purchasing group, as well as the University Medical Centre they are employed with.

General PSQ experience

In this section, the purchasers are asked about their general experience with the tendering process including the PSQ. They are asked whether they thought it was particularly difficult or easy, and whether they prefer this tendering process or the old one.

Evaluating PSQ

In this section, purchasers are asked about the ease of assessment of the PSQ answers, and if they think the answer format is feasible.

Sustainability questions

In this section, purchasers are explicitly asked about the sustainability questions in the PSQ. It is explored whether they thought the questions were realistic to ask, and whether important topics have been missed in the PSQ.

Weighting and outcome tender

This section considers purchasers' opinion on the scoring, weighting and outcome of the tender. It is explored whether the purchasers think certain aspects of the PSQ should be weighted differently. Additionally, the purchasers' opinions are asked on implementing categories for the PSQ. This is a design element that the researcher has come up with after it became clear from the supplier interviews that there was a lack of context for the PSQ questions.

Green purchasing behaviour

This section will explore the antecedents of the intention to engage in green procurement behaviour according to the TBP as described in chapter 2. Questions discuss the attitude, subjective norm, perceived behavioural, and intention in related to green purchasing behaviour. The questions are based on a guideline for constructing a TPB questionnaire by Azjen (2010)[4], as well as adaptations of the constructs used in the study on TPB by Hinterhuber and Khan (2025)[5], as these constructs were reported to have a reliable Cronbach's alpha (> 0.7) and are considered reliable.

Conclusion

In the conclusion the interviewee is asked if any relevant information was not yet discussed during the interview. If so, the interviewee is asked to elaborate on this information. It is also asked if the interviewee would like to receive the recording and interview notes for verification, if the interviewer can contact them in case of follow-up questions, and whether the interviewee knows other people that would be appropriate as interviewee. The latter is also referred to as the 'snowball effect'.

---

[4] Fishbein, M., & Ajzen, I. (2010). Predicting and changing behavior: The reasoned action approach. New York: Psychology Press.

[5] Reference can be found in references chapter of this thesis

Introduction	Thank you very much for participating in this research. This interview is about both the recent UMCPG tender in the context of sustainability and green procurement behaviour.
	
	Do you agree to have this interview recorded? If not, I will take notes.
	• Which UMC do you work for?
	  o What is your position within the hospital?
	  o How long have you been in this role?
	  o How long have you been working in the pharmaceutical industry?
	• What is your role within the UMCPG?
	  o How long have you been in this position?
	• How would you describe your day-to-day responsibilities?

General PSQ experience	First, we'll discuss the UMCPG tender for the contracts starting in February 2026. The product packages involve oncological and antimicrobial drugs. The tender included a questionnaire as a new element, featuring questions about sustainability. I have printed the questionnaire for reference (see thee appendix).
	
	• Can you confirm that you were involved in this tender?
	  o If yes, for which package?
	  o What was your role during this tender?
	• What was your overall experience with this tender? For example, did you think it went well or poorly?
	• Do you prefer the previous tender process or the renewed process with the questionnaire?
	  o Why?

Evaluating PSQ	When you look at the questionnaire… [interviewees receive a printed version of the PSQ]
	• Did you find the assessment overall easy or difficult?
	  o What did you find difficult?
	  o What did you find easy?
	• Do you find the answer options realistic?
	  o Would you have offered other or additional answer options to the suppliers?

Sustainability questions	The questionnaire included questions about sustainability. For example, there were questions about environmental management systems (questions 4–6) and about the sourcing and processing of raw materials (questions 9–10). • Do you think the sustainability questions are realistic to include in the questionnaire, compared to industry developments? o Why or why not? • Do you feel there were relevant sustainability questions missing from the questionnaire that would have been important in evaluating suppliers?

Weighting and outcome tender	• What do you think of the current weighting of price versus the questionnaire?
	  ○ Would you propose a different weighting?
	• What do you think of the current weighting of each question within the questionnaire?
	  ○ Would you propose a different weighting?
	• Do you feel that sustainability is assigned enough weight?
	  ○ Should it be assigned more or less weight?
	• Do you feel that delivery reliability is assigned enough weight?
	  ○ Should it be assigned more or less weight?
	• Do you feel that price is assigned enough weight?
	  ○ Should it be assigned more or less weight?
	
	• What would you think of breaking the weighting into the following categories: price, delivery reliability, sustainability, and product requirements?
	  ○ *Here, delivery reliability refers to questions about stock and its allocation. Sustainability refers to questions about environmental management systems, origin of active ingredients, and location of production. Product requirements refer to questions related to the products, such as barcode, density, declaration of cleanliness, production standards, etc.*

Transparency	• What would you think if the UMCPG were to be transparent about its weighting system toward suppliers? • What would you think if the UMCPG were to be transparent about each supplier's individual score? Note that this would not involve sharing the scores of other suppliers. ○ Do you think that knowing their individual score would help suppliers improve their sustainability performance?

Green Procurement Behaviour	• Could you briefly explain in your own words what sustainability means to you?
	  ○ What associations do you have with sustainability?
	  ▪ What are your positive associations?
	  ▪ What are your negative associations?
	  ○ What does sustainability mean in the context of your job?
	  ○
	By green procurement behaviour, I mean that procurement is conducted in a way where sustainability plays a significant role in the purchasing process. For example, this could mean choosing a supplier (partially) due to their sustainability performance.
	
	First, I'd like to talk about your personal views on green procurement.
	• Do you appreciate it when sustainability plays a significant role in the procurement process?
	• Do you believe it is responsible or wise for sustainability to play a significant role in procurement?

	• Do you think it is beneficial when sustainability plays a significant role in procurement?
	
	Next, I'd like to discuss the social norm around green procurement.
	• Whose opinions are very important to you? These don't have to be work-related — think of friends, family, colleagues, etc.
	  ○ What are their views on sustainability and specifically on green procurement?
	  ○ Do these people expect you to engage in green procurement behaviour?
	  ○ Would these people engage in green procurement behaviour if they had a similar job to yours?
	• Are there other parties — possibly work-related — that hold an opinion on whether or not green procurement behaviour should be practiced?
	  ○ Is this opinion positive or negative?
	  ○ What behaviour do these parties expect from you?
	  ○ What behaviour do these parties exhibit themselves when it comes to green procurement?
	Third, I'd like to talk about your ability to engage in green procurement behaviour and thus contribute to a green procurement policy.
	• Is it easy for you to exhibit green procurement behaviour?
	  ○ Why or why not?
	• Do you have the opportunity to engage in green procurement behaviour?
	  ○ Why or why not?
	• Do you have the resources to engage in green procurement behaviour?
	  ○ Why or why not?
	• Do you feel that your individual behaviour influences the final (green) procurement policy?
	  ○ Why or why not?
	• Are there factors that hinder you from engaging in green procurement behaviour?
	  ○ If yes, which?
	
	Lastly, I'd like to ask about your intentions to engage in green procurement behaviour in the near future.
	• Do you want to pay more attention to sustainability in your work in the near future?
	  ○ Why or why not?
	• Do you want to demonstrate more green procurement behaviour during the procurement process in the near future? In other words, would you steer more toward suppliers with a more sustainable business operation than competing options?
	  Why or why not?

Conclusion	The interview has come to an end. • Is there anything that was not covered in this interview that you believe is relevant to this topic? ○ If so, could you tell me more about it? • Would you like me to send you a summary of the interview for verification? • May I contact you in case I have follow-up questions about this interview?

Appendix D. Interview Guide: Suppliers' experience with PSQ and green manufacturing and distribution practices

---

Interview guide: sustainability pilot from suppliers' perspective and green manufacturing practices

---

This interview guide is designed to explore two topics.

First, the interview is conducted to gain more insight in the suppliers' perspective on the sustainability pilot that the UMCs' purchasing group for medicine has introduced in 2024-2025, for the contracts that will be effective from February 2026. The sustainability pilot involved the introduction of a questionnaire, including sustainability questions, to the standard procurement process of the UMCs' purchasing group. The goal of this interview is for the researcher to get in-depth insight into the experience of the suppliers that participated in the pilot. The interview will explore the overall experience with the questionnaire the suppliers were asked to fill out during the tender, as the questionnaire was completely new. Aside from the overall experience, the interview will go more in-depth on the questions that were related to sustainability. Understanding the overall experience mainly has practical relevance for the purchasing group, whereas the view on the sustainability questions is of particular interest for the researcher.

Second, the interview will explore the green manufacturing practices currently being implemented by suppliers. This will give the researcher insight into the feasibility of the sustainability criteria that are included in the sustainability pilot. Moreover, it might provide insights for new sustainability criteria to include in the standard procurement process. It will help the researcher to gain more understanding of the manufacturing field of pharmaceuticals, and current sustainability practices. This will aid in the design process, as it will become clearer to what extent the sustainability criteria are feasible and realistic. The researcher will be further referred to as the interviewer in this interview guide.

Interviewees

Appropriate interviewees for this topic are representatives of the suppliers that participated in the tender of the sustainability pilot that was set out by the UMCs' purchasing group. This will include the pharmaceutical manufacturers of generic medicine, as brand name medicines ('spécialité') were deemed unfit due to the lack of a competitive market. Due to time constraints, it is not feasible to interview all suppliers (± 60). Hence, a survey will be sent out to the remaining suppliers. The survey consists of a questionnaire that corresponds with the questions in the interview guide, with adjustments to ensure suitability for the survey format.

Subtopics

The interview consists of a few subtopics which will be discussed below.

Introduction

The introduction serves to inform the interviewee on the topic of the interview. Second, consent to recording the interview will be asked. If no consent is given, the interviewer will solemnly take notes. Finally, the interviewee is asked to describe the core business of the supplying firm, and their job position within the firm.

Pilot

The first topic of the interview will be the interviewee's overall opinion on the questionnaire that was part of the sustainability pilot. First, the interviewee will be asked to verify that the firm has indeed participated in the tender and what their role was during the tender process. The interviewee will be provided with a printed version of the questionnaire for reference. Then, the interviewee will be asked to share their general opinion on the questionnaire. This is meant to ease the interviewee in the topic and help activate associations related to the tender. Additionally, it will be asked whether the interviewee prefers the tender process as it was during the pilot, or the regular process. The answers to the questions in this section will inform the researcher on the attitude towards the pilot of the interviewee, which can range from negative to positive.

Questionnaire

In this phase, the interviewee will be asked in-depth about all thirteen to fourteen questions that the questionnaire consisted of. The discrepancy in number of questions has to do with the type of medicine the questionnaire was used for. For antimicrobial agents there are thirteen questions, and for Oncolytics there is one additional question. These are the only two types of medicine packages the pilot was applied to. The interviewer has access to the answers of the supplying firms on the questionnaire and will prepare this beforehand. This enables the interviewer to ask more informed follow-up questions, as well as aiding the memory of the interviewee if needed. First, the interviewee will be asked which questions were both easy and difficult to fill out. Then, the interviewer will ask about the questions that the supplying firm did not provide an answer to. After that, the interviewer will ask if there were any questions that were unclear and if it would have been helpful if background information was shared beforehand. This will inform the interviewee on the practicality of the questionnaire for suppliers. Finally, the interviewee will be asked about their thoughts on the (up until then) undiscussed questions. This ensures each question is evaluated.

Sustainability questions

In this phase, the interviewer will go more in-depth about the sustainability questions of the questionnaire. If discussed in the previous section, the interviewer will ask more follow-up questions on the given answers. If not, the questions as stated below will be followed. The interviewee will be asked whether they think the sustainability questions were feasible and realistic to include in the questionnaire. Feasibility refers to the likelihood that a supplying firm can comply with the desired sustainability action in practice. Finally, the interviewee will be asked whether there are any sustainability questions that were not asked, but the supplier could have given an answer to. This already probes the interviewee to think about the second topic of

green manufacturing. Additionally, this gives the interviewer more insight on new criteria that are potentially suitable to include in the solution design.

Changes and comparison

In this phase, the interviewee is asked whether they would like to change anything about the questionnaire or the purchasing process as a whole. This gives the interviewer even more in-depth insights on what aspects of the renewed process did not seem to work well for the supplier in practice. Furthermore, the interviewee is asked to compare the purchasing process of the UMC purchasing group with other purchasers and purchasing groups. It is also asked if the interviewee is familiar with the Nordic Pharmaceutical Forum (NPF). This is a procurement alliance between Nordic countries, who develop green procurement processes together. The UMC purchasing group has adjusted and downsized the elaborate questionnaire for sustainable medicine procurement that was designed by the NPF to use for the sustainability pilot. Hence, the UMC purchasing group was interested in whether the suppliers are aware of the existence and work of the NPF. Finally, the suppliers are asked what they think of the idea that all purchasing groups will use a national, uniform questionnaire for the procurement of medicine. The UMC purchasing group is actively working towards realizing this ideal by collaborating with other purchasing groups. They expect that this idea would reduce the workload for suppliers in practice, as they can then provide every purchasing party with the same information. Including this question will provide insight on this assumption.

Transparency

In this section, the interviewer will briefly ask about transparency within the tender process. During conversations with the purchasing group, it has become apparent for the researcher that the lack of transparency is believed to be a point of dissatisfaction for the suppliers during the purchasing process.

Green manufacturing

In this phase, the interviewer will go more in-depth about the green business and green manufacturing practices of the supplier. First, the interviewee will be asked whether sustainability is an important focus point for the supplier and whether there are job roles dedicated to sustainability. This will give the interviewer an overall sense of the importance of sustainability for the supplier. As a guidance for the topic of green manufacturing, the questions are based upon two sustainability standards that are defined for production companies.

First, the interviewees are asked whether they are familiar with the twelve green chemistry principles (Anastas & Warner, 1998). Green chemistry refers to the design of chemical products and processes such that the negative environmental impact of chemistry is reduced. The principles include (but are not limited to) waste prevention, energy efficiency, and designing chemicals for degradation. Even though the green chemistry principles were founded in 1998, the pointers are still relevant for green production to this day. A full overview of all principles can be found in figure 1.

Second, the targets of Sustainable Development Goal (SDG) 12: Responsible Production and Consumption are utilized. The SDGs are defined by the United Nations, which has created these goals to achieve the Agenda for Sustainable Development by 2030. They are aimed to end

issues like poverty and inequality, tackle climate change, and preserve our planet. Examples of targets are sustainable waste management, efficient use of natural resources, reusing and recycling, sustainable procurement, and reporting on sustainability progress (United Nations, 2025). The inclusion of sustainable waste management in the SDG illustrates how the aforementioned green chemistry principles are still relevant today.

Conclusion

In the conclusion the interviewee is asked if any relevant information was not yet discussed during the interview. If so, the interviewee is asked to elaborate on this information. It is also asked if the interviewee would like to receive a summary of the interview for verification, if the interviewer can contact them in case of follow-up questions.

Figure 1. Green Chemistry Principles (ACS, 2025)

Introduction	• Do you consent to me recording this interview?
	  ○ If not, notes will be taken instead
	• Which firm do you work for?
	  ○ Can you provide me with a short description of the core business?
	• What is your job position in the firm?
	  ○ How long have you been working in this job position?
	• How would you describe your day-to-day activities?

Pilot	First, we will discuss the tender for the contracts of February 2026 (NL: tender) that was completed UMCPG recently. This bid included a renewed question list, including sustainability questions. I have printed the questions for reference. • Can you confirm that your firm participated in this tender? ○ What was your role in the tender?

	• What was your overall experience with this tender? Did you think it was particularly good or bad?
	  ○ How does it compare to the previous tenders?
	• Do you prefer the previous process of tendering, or the renewed process including the question list?
	  ○ Why?

Questionnaire	When looking at the list of questions… [interviewees received a printed version of the PSQ]
	• Were there questions that were particularly easy to fill out?
	  ○ If so, which ones are these?
	  ○ Why were these easy?
	• Were there questions that were particularly difficult to fill out?
	  ○ If so, which ones are these?
	  ○ Why were these difficult?
	• Your firm has not filled out questions … (interviewer will prepare which ones in advance)
	  ○ Why is this?
	• Were there any questions that were particularly unclear?
	  ○ If so, why?
	  ○ Would it be helpful if some background information on the questions will be provided?
	• We have not discussed questions … (determined during interview). What were your experiences with those questions?

Sustainability criteria	In the question list, there were also questions related to sustainability. For example, there were questions on waste management systems (Q4-6) and sourcing (Q9-11)
	• Were the sustainability questions easy or difficult to fill out?
	  ○ Why?
	• Do you think those questions were realistic and feasible to include in the question list?
	  ○ Why so OR Why not?
	• Do you feel as if there are relevant questions regarding sustainability that were not asked, but your firm could have answered?

Changes and comparison	Now that we have discussed the questionnaire, I am interested in possible changes to the tendering process and how the process compares to those of other purchasing groups.
	• If you could propose changes for the list of questions, what changes would you propose? Would you for example remove or add questions?
	  ○ Why those changes?
	• Are there any other aspects of the tendering process that you would like to change?
	  ○ Why those changes?
	• How does this tendering process compare to those of other purchasers or purchasing groups?
	  ○ Is a lot of different information requested per purchaser or purchasing group?
	• Are you familiar with the Nordic Pharmaceutical Forum?
	  ○ If not, it is an alliance of Finland, Iceland, Sweden, Norway, and Denmark. The alliance is developing sustainable solutions for pharmaceutical procurement. The questionnaire used by the UMCPG is derived from the Forum's practices on green procurement.
	• What do you think of the idea that all purchasing groups will utilize the same questionnaire in the tendering process?

Transparency	• Do you feel that the UMCPG is transparent in their tendering process?
	  ○ If not, why?
	  ○ Can you give me an example where you would like more transparency?

Green manufacturing	In the final phase, I would like to discuss green manufacturing practices
	• In general, is sustainability an important focus point for your firm?
	  ○ Why so OR Why not?
	  ○ Do you wish to focus more on sustainability compared to the current state?
	• Are there people whose job roles specifically include sustainability?
	  ○ If so, what are those job roles?
	• Who do you view as relevant stakeholders in moving towards more sustainable business processes?
	  ○ Why?
	• Does your firm report on sustainability?
	  ○ If so, do you use a particular reporting framework or standard?
	• Are you familiar with the Green Chemistry principles?
	  ○ If not, these principles were established in 1998 to design and improve materials, products, processes and systems involved with the chemistry industry. Examples are prevention of waste, design for energy efficiency, and design for degradation.
	  ▪ [Principles are explained to interviewee] Considering the principles, which ones apply to your current business operations?
	  ○ If so, to what extent are the principles integrated in your business operations?

	• Are you familiar with the Green Deal for Sustainable Healthcare? In particular, are you familiar with the pointer of a sustainable pharmaceutical supply chain?
	  ○ If not, the Green Deal for Sustainable Healthcare is a government initiative to work towards a climate neutral healthcare and decrease the negative environmental impact on climate and environment. Within the Green Deal, there are initiatives for a sustainable pharmaceutical supply chain that focuses on a sustainable production chain, reducing packaging waste, sustainable sourcing, and decreasing medicine waste in water.
	  ▪ Considering this explanation, to what extent do the mentioned practices apply to your current business operations?
	  ○ If so, to what extent are such pointers integrated in your business operations?
	• Are you familiar with the Sustainable Development Goals? In particular, are you familiar with Goal 12: Responsible production and consumption?
	  ○ If not, the United Nations has created these goals to achieve the Agenda for Sustainable Development by 2030. They are aimed to end issues like poverty and inequality, tackle climate change, and preserve our planet. Examples of targets are sustainable waste management, efficient use of natural resources, sustainable procurement, and reporting on sustainability progress.
	  ▪ Considering this explanation, to what extent do the mentioned practices apply to your current business operations?
	  ○ If so, to what extent are the targets of the goal integrated in your business operations?
	• What other efforts does your firm make in terms of green production? For example, what initiatives are developed or in development to make less of a negative impact on people and the planet? Initiatives can be on different levels like sourcing, product, process, transport.
	  ○ How long have these initiatives been in place?
	• Do you collaborate with customers, suppliers, or other stakeholders to invest in sustainability initiatives?
	  ○ If so, can you give me an example?
	• In comparison with competing firms, how do you feel your firm performs regarding green manufacturing practices? Do you feel you are behind, on the same level, or a forerunner?
	  ○ Can you elaborate on your answer?

References

United Nations. (2025). Goal 12 | Department of Economic and Social Affairs. Consulted on 29 March 2025, from https://sdgs.un.org/goals/goal12

ACS. (2025). 12 Principles of Green Chemistry - American Chemical Society. American Chemical Society. Consulted on 1 April 2025, from https://www.acs.org/green-chemistry-sustainability/principles/12-principles-of-green-chemistry.html

Appendix E. Supplier survey

Beste deelnemer,

Hartelijk dank voor uw deelname aan deze enquête. Dit onderzoek wordt uitgevoerd als onderdeel van mijn scriptie voor de MSc in Supply Chain Management.

De enquête duurt ongeveer **10 - 15 minuten** om te voltooien. Het doel van deze enquête is om inzicht te krijgen in

- uw ervaringen als leverancier met de vragenlijst van de meest recente tender die is uitgezet door [redacted] voor oncolytica en antimicrobiële middelen, met betrekking tot de contracten die ingaan per februari 2026;
- de ontwikkelingen van uw firma op het gebied van groene productie.

De feedback van uw firma is daarmee zeer waardevol voor mijn onderzoek.

Het wordt aangeraden om de enquête vanaf een desktop in te vullen en de antwoorden op de vragenlijst van de tender bij de hand te hebben.

Uw deelname aan deze enquête is geheel vrijwillig. U kunt op elk moment stoppen en hoeft hiervoor geen verklaring te geven. Alle verzamelde gegevens zijn vertrouwelijk en worden **anoniem** verwerkt. De resultaten van deze enquête worden uitsluitend voor academische doeleinden gebruikt.

Als u vragen heeft over deze enquête, neem dan contact met me op via c.wolfaart@lumc.nl

Hartelijk dank,

Christiane Wolfaart

Geef hieronder aan of u toestemming geeft voor uw deelname in deze enquête.

◯ Ik geef toestemming

→

Voor welke firma werkt u?

Kunt u kort de kernactiviteiten van uw firma omschrijven?

Wat is uw functie in de firma?

Hoeveel jaar ervaring heeft u in deze of een soortgelijke functie?

- ◯ 0 - 3 jaar
- ◯ 3 - 5 jaar
- ◯ 5 - 10 jaar
- ◯ 10+ jaar
- ◯ Anders, namelijk

Hoeveel jaar ervaring heeft u in de farmaceutische industrie?

- ◯ 0 - 3 jaar
- ◯ 3 - 5 jaar
- ◯ 5 - 10 jaar
- ◯ 10+ jaar
- ◯ Anders, namelijk

Het eerste blok gaat over de vragenlijst die is geïntroduceerd door [redacted] in de recente tender. In de vragenlijst zijn ook vragen over duurzaamheid opgenomen. Voor uw gemak is de vragenlijst hieronder weergegeven, en op de volgende pagina's.

[PSQ is presented]

Kunt u bevestigen dat uw firma heeft deelgenomen aan de tender waarin deze vragenlijst is gebruikt?

- ◯ Ja
- ◯ Nee

Wat was uw algehele ervaring met deze tender?

	Helemaal mee oneens	Sterk mee oneens	Oneens	Neutraal	Eens	Sterk mee eens	Helemaal mee eens
Ik heb de tender als makkelijk ervaren	◯	◯	◯	◯	◯	◯	◯
Ik heb de tender als moeilijk ervaren	◯	◯	◯	◯	◯	◯	◯
Ik heb de tender als duidelijk ervaren	◯	◯	◯	◯	◯	◯	◯
Ik heb de tender als onduidelijk ervaren	◯	◯	◯	◯	◯	◯	◯

Wat vond u van deze tender in vergelijking met vorige tenders zonder de vragenlijst?

Het volgende onderdeel gaat over de vragenlijst in het algemeen. Er wordt u gevraagd welke vragen u als moeilijk, makkelijk of onduidelijk heeft ervaren.

←

→

[PSQ is presented]

Following questions (3):

Welke vragen vond u makkelijk om te beantwoorden? Er zijn meerdere antwoorden mogelijk.

Welke vragen vond u moeilijk om te beantwoorden? Er zijn meerdere antwoorden mogelijk.

Welke vragen heeft u niet beantwoord? Er zijn meerdere antwoorden mogelijk.

Answer format:

- [ ] Vraag 1
- [ ] Vraag 2
- [ ] Vraag 3
- [ ] Vraag 4
- [ ] Vraag 5
- [ ] Vraag 6
- [ ] Vraag 7
- [ ] Vraag 8
- [ ] Vraag 9
- [ ] Vraag 10
- [ ] Vraag 11
- [ ] Vraag 12
- [ ] Vraag 13
- [ ] n.v.t.

Kunt u uw keuzes toelichten?

[PSQ is presented]

Waren er nog vragen die u onduidelijk vond? Er zijn meerdere antwoorden mogelijk.

- [ ] Vraag 1
- [ ] Vraag 2
- [ ] Vraag 3
- [ ] Vraag 4
- [ ] Vraag 5
- [ ] Vraag 6
- [ ] Vraag 7
- [ ] Vraag 8
- [ ] Vraag 9
- [ ] Vraag 10
- [ ] Vraag 11
- [ ] Vraag 12
- [ ] Vraag 13
- [ ] n.v.t.

Kunt u uw keuzes toelichten?

Zou het hebben geholpen als u meer uitleg had gekregen over deze vragen, zoals context of achtergrondinformatie?

- ◯ Ja
- ◯ Nee
- ◯ Weet ik niet
- ◯ n.v.t.

Het volgende onderdeel gaat over de vragen in de vragenlijst van [redacted] die betrekking hebben op duurzaamheid.

← →

Een aantal vragen zijn gericht op duurzaamheid.

- Vragen 4, 5 en 6 zijn gericht op milieumanagementsystemen en duurzame afvalverwerking.
- Vragen 9, 10 en 11 zijn gericht op duurzame inkoop en productie

[PSQ is presented]

Wat vond u van de vragen over duurzaamheid?

	Geheel oneens	Sterk mee oneens	Oneens	Neutraal	Eens	Sterk mee eens	Geheel mee eens
Ik vond de vragen makkelijk om in te vullen	○	○	○	○	○	○	○
Ik vond de vragen moeilijk om in te vullen	○	○	○	○	○	○	○
Ik vond de vragen duidelijk gesteld	○	○	○	○	○	○	○
Ik vond de vragen onduidelijk gesteld	○	○	○	○	○	○	○
Ik vond de vragen realistisch gezien de ontwikkelingen in de industrie	○	○	○	○	○	○	○

Heeft u het gevoel dat er relevante vragen over duurzaamheid zijn die niet in de vragenlijst stonden, maar waar jullie als firma wel antwoord op hadden kunnen geven?

Het volgende onderdeel gaat over eventuele veranderingen die u graag zou willen zien aan de vragenlijst of het inkoopproces, en hoe u het inkoopproces van andere inkopers en inkoopgroepen ervaart.

← →

Zijn er aspecten die u zou willen veranderen aan de vragenlijst of het inkoopproces van [redacted]

Bent u bekend met de Nordic Pharmaceutical Forum?

- ◯ Ja, ik weet wie ze zijn en wat ze doen
- ◯ Ik heb er wel eens van gehoord, maar ik weet het niet wie ze zijn of wat ze doen
- ◯ Nee

Wat vind u van het inkoopproces van [redacted] in vergelijking met andere inkopers en inkoopgroepen? Vraagt elke partij bijvoorbeeld veel verschillende informatie?

Ik vind het een goed idee als alle inkopers en inkoopgroepen zouden werken met een landelijke, uniforme vragenlijst als onderdeel van de tender
(0 = heel slecht idee, 10 = heel goed idee)

0 1 2 3 4 5 6 7 8 9 10

De volgende vraag gaat over transparantie in het inkoopproces

Op een schaal van 1 tot 7, hoe transparant vindt u dat [redacted] is tijdens het inkoopproces?
(1 = niet transparant, 7 = heel transparant)

Op welk onderdeel of onderdelen in het inkoopproces zou u meer transparantie wensen? Kunt u uw antwoord toelichten?

←

→

U bent aangekomen bij het laatste onderdeel. Dit onderdeel gaat over groene productie binnen uw firma.

←

→

In hoeverre zijn de volgende stellingen van toepassing op uw firma?

	Geheel mee oneens	Sterk mee oneens	Oneens	Neutraal	Eens	Sterk mee eens	Geheel mee eens
Duurzaamheid is een belangrijk thema voor onze firma	◯	◯	◯	◯	◯	◯	◯
Onze medewerkers vinden duurzaamheid een belangrijk thema	◯	◯	◯	◯	◯	◯	◯
Onze firma werkt samen met leveranciers op het gebied van duurzaamheid	◯	◯	◯	◯	◯	◯	◯
Onze firma werkt samen met klanten op het gebied van duurzaamheid	◯	◯	◯	◯	◯	◯	◯

Is uw firma bekend met de 12 principes van *Green Chemistry*?

◯ Nee

◯ Zo ja, in hoeverre mate wordt dit toegepast in de bedrijfsprocessen?

Is uw firma bekend met *Sustainable Development Goal 12: Responsible Production and Consumption*?

◯ Nee

◯ Zo ja, in hoeverre mate wordt dit toegepast in de bedrijfsprocessen?

Welke duurzame initiatieven heeft uw firma ontwikkeld om de negatieve impact op milieu en mensen te minimaliseren? Denk bijvoorbeeld op het niveau van product, proces, inkoop en transport.

Rapporteert uw firma over de impact op mens en milieu door bedrijfsprocessen?

- ◯ Ja, de richtlijnen die wij volgen zijn...

- ◯ Nog niet, maar we zijn dit wel aan het ontwikkelen
- ◯ Nee

In vergelijking met andere firma's, zijn wij op het gebied van duurzaamheid...

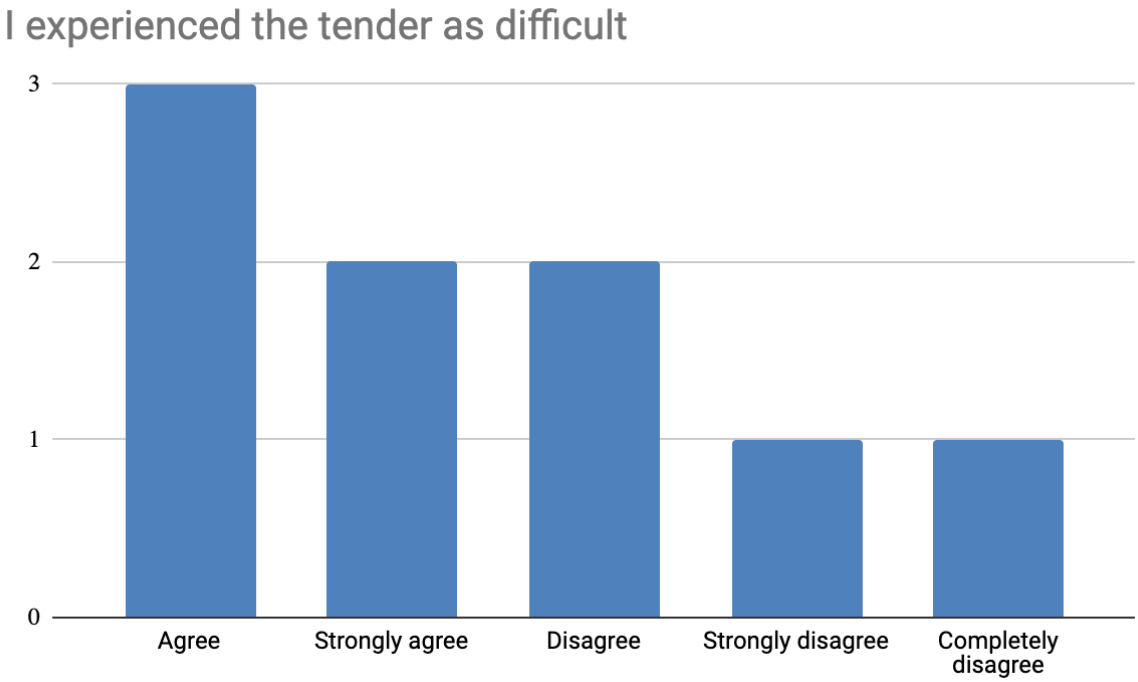
- ◯ Een voorloper
- ◯ Op het zelfde niveau
- ◯ Hebben wij een achterstand
- ◯ Anders, namelijk

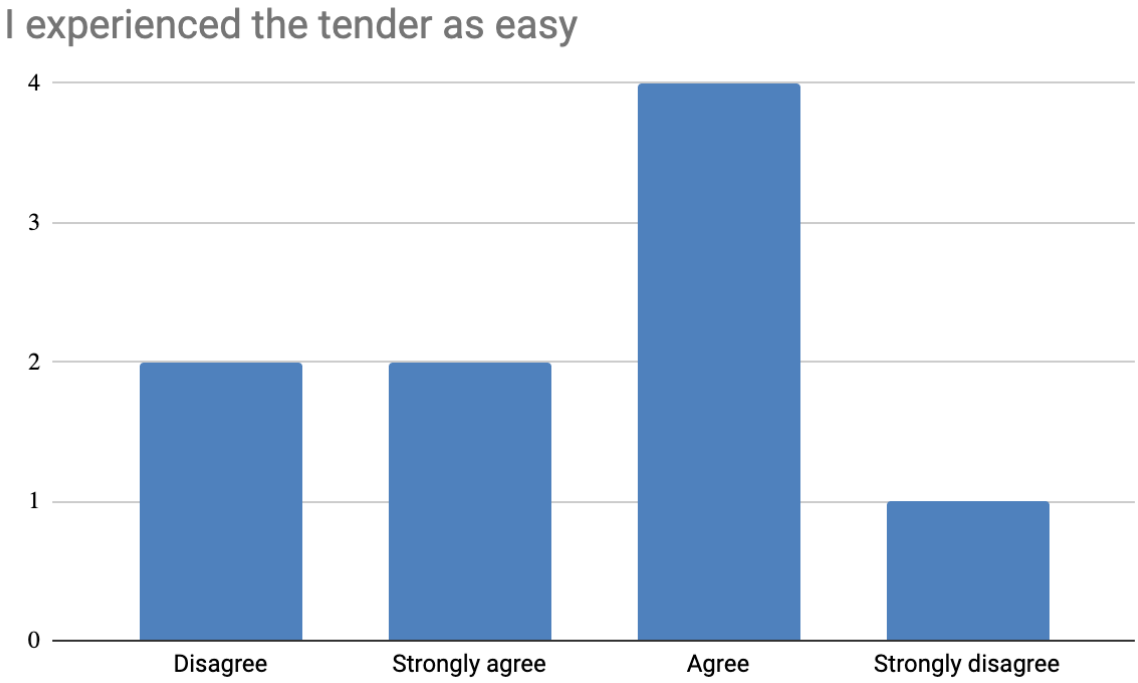
U bent aan het einde gekomen van deze enquête.

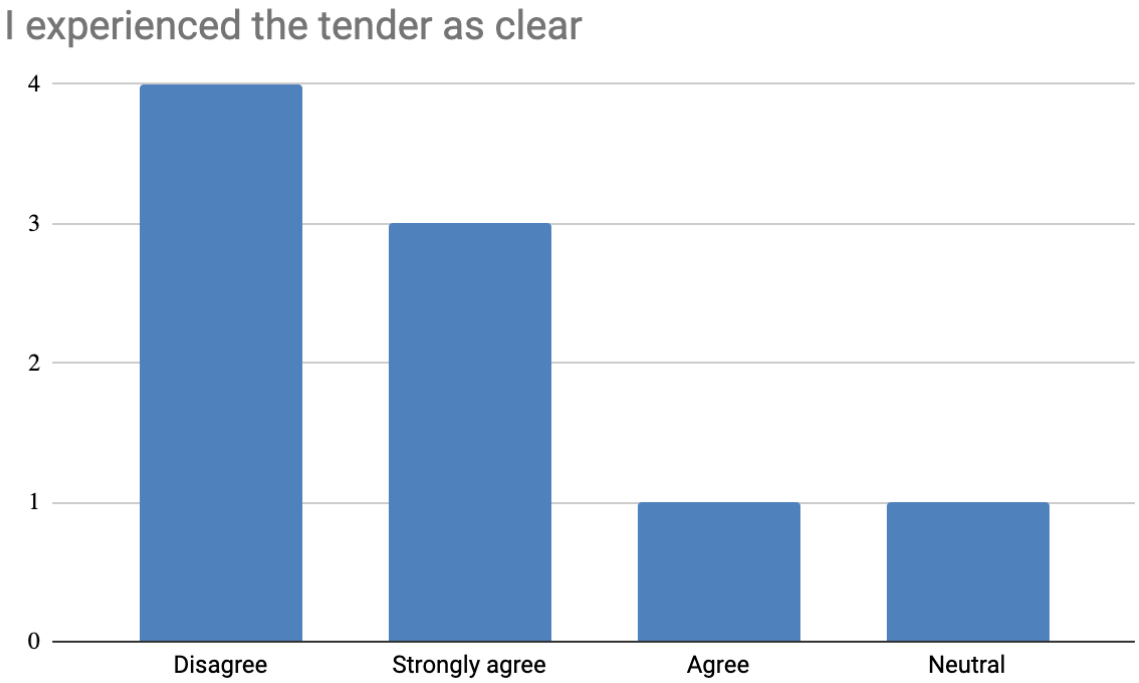
Uw antwoord is opgeslagen. Nogmaals hartelijk dank voor uw deelname!

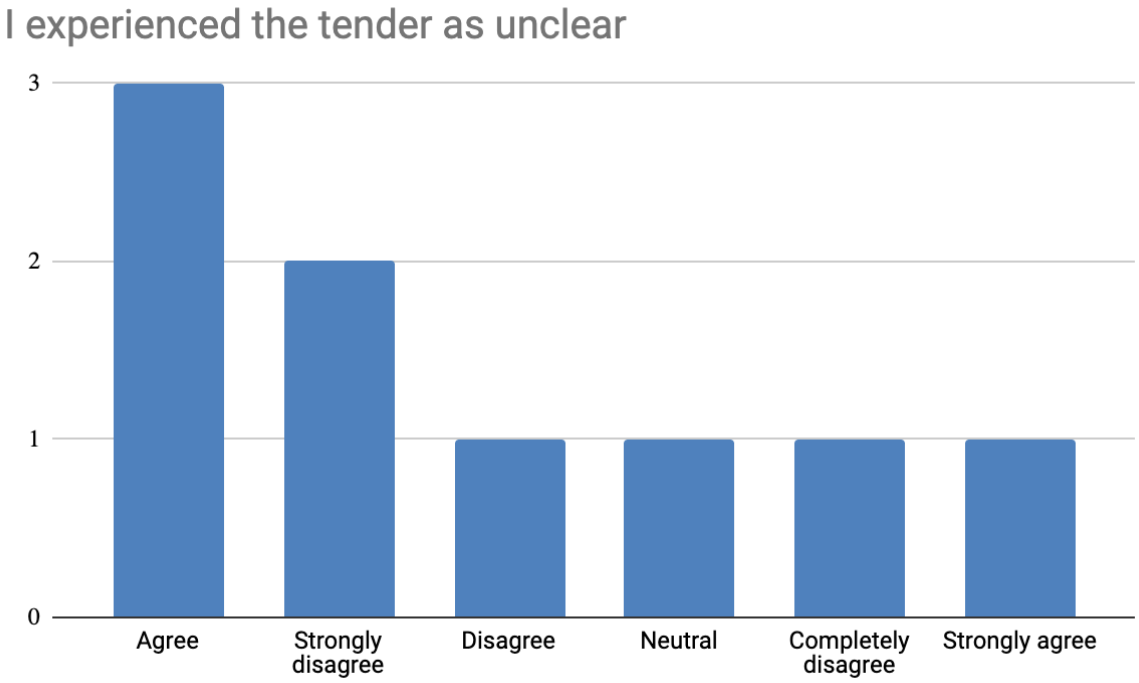
Appendix F. Survey results closed-ended questions

General PSQ experience

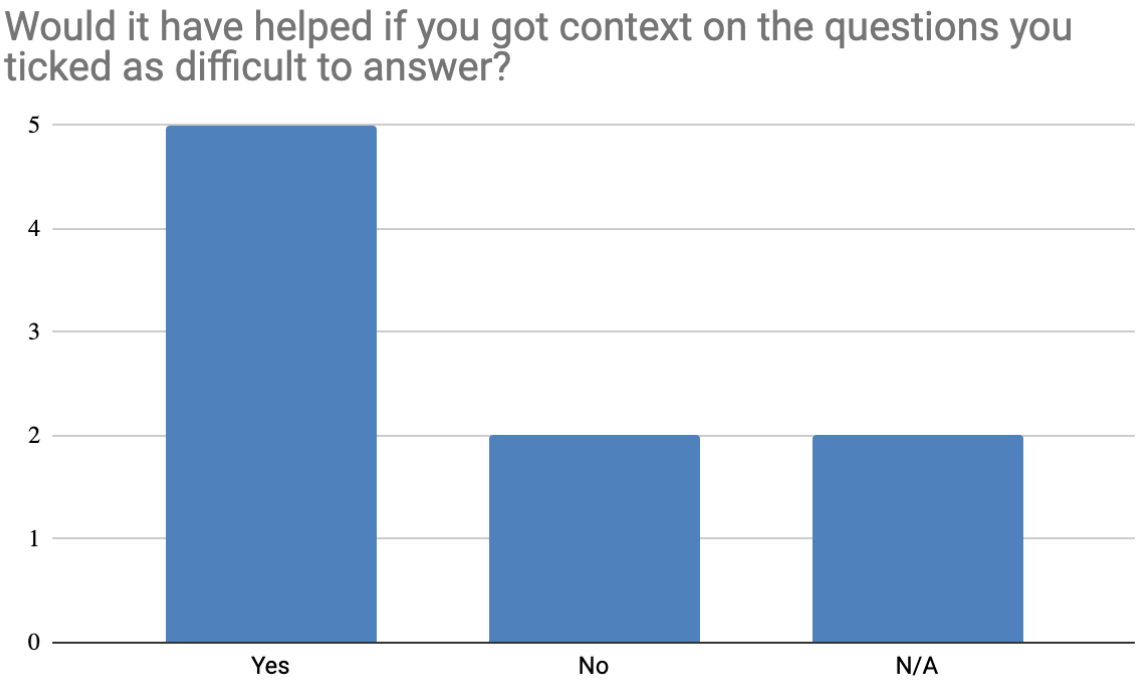




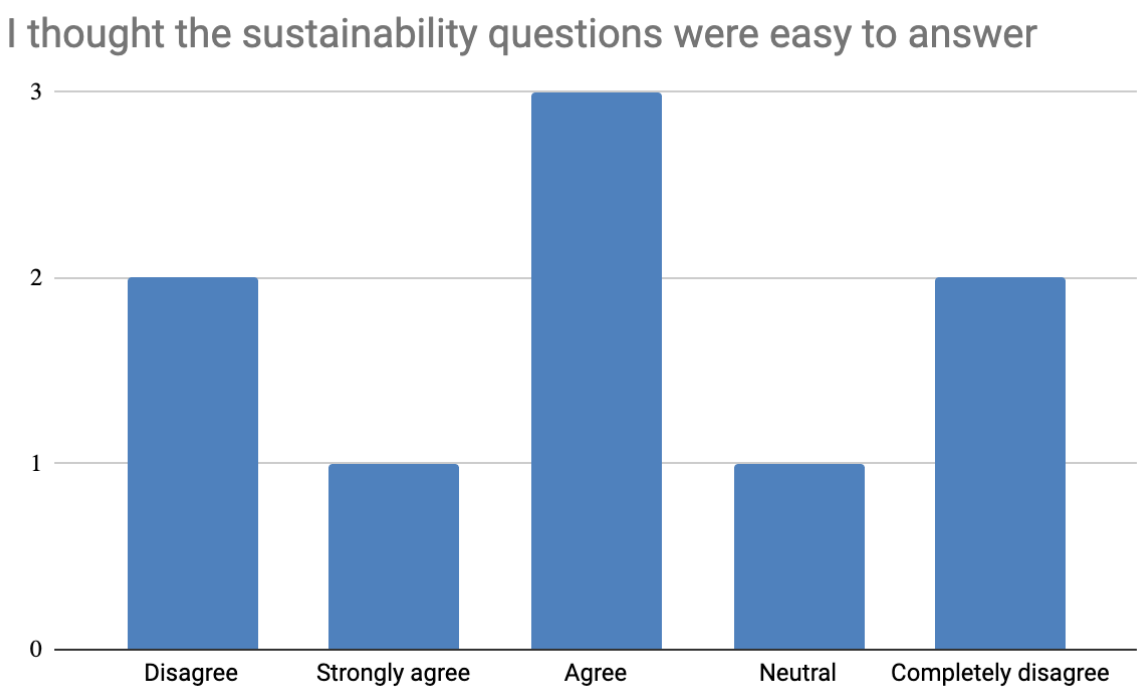

I experienced the tender as clear
4
3
2
1
0
Disagree
Strongly agree
Agree
Neutral

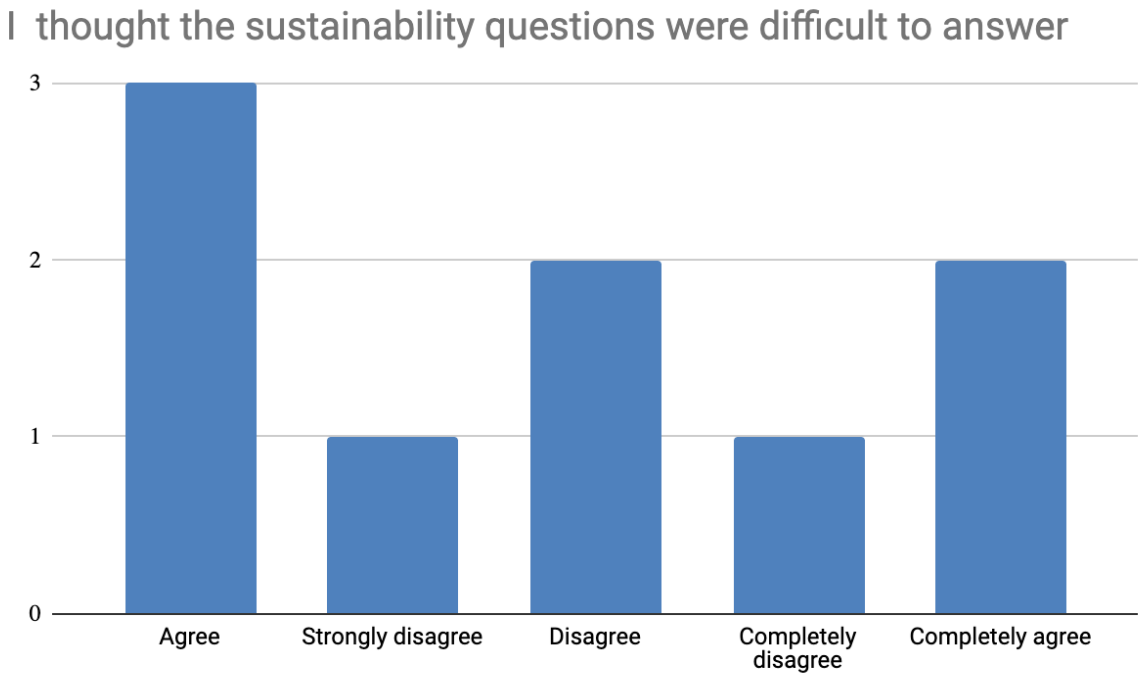

I experienced the tender as unclear
3
2
1
0
Agree
Strongly disagree
Disagree
Neutral
Completely disagree
Strongly agree

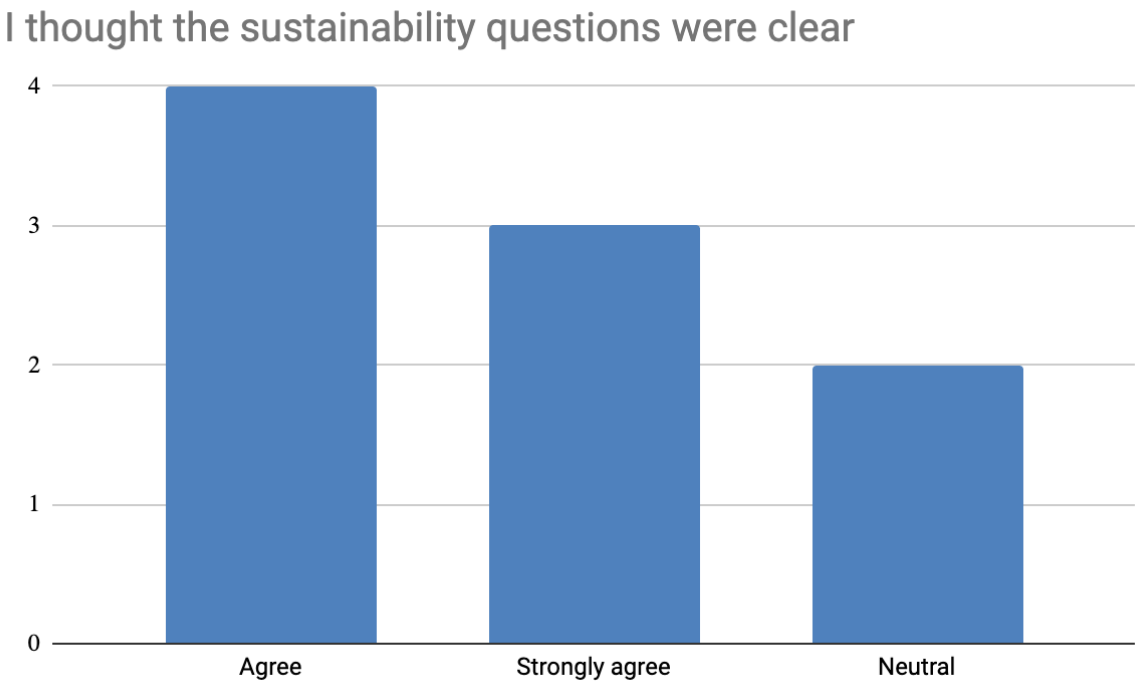
Context questions PSQ

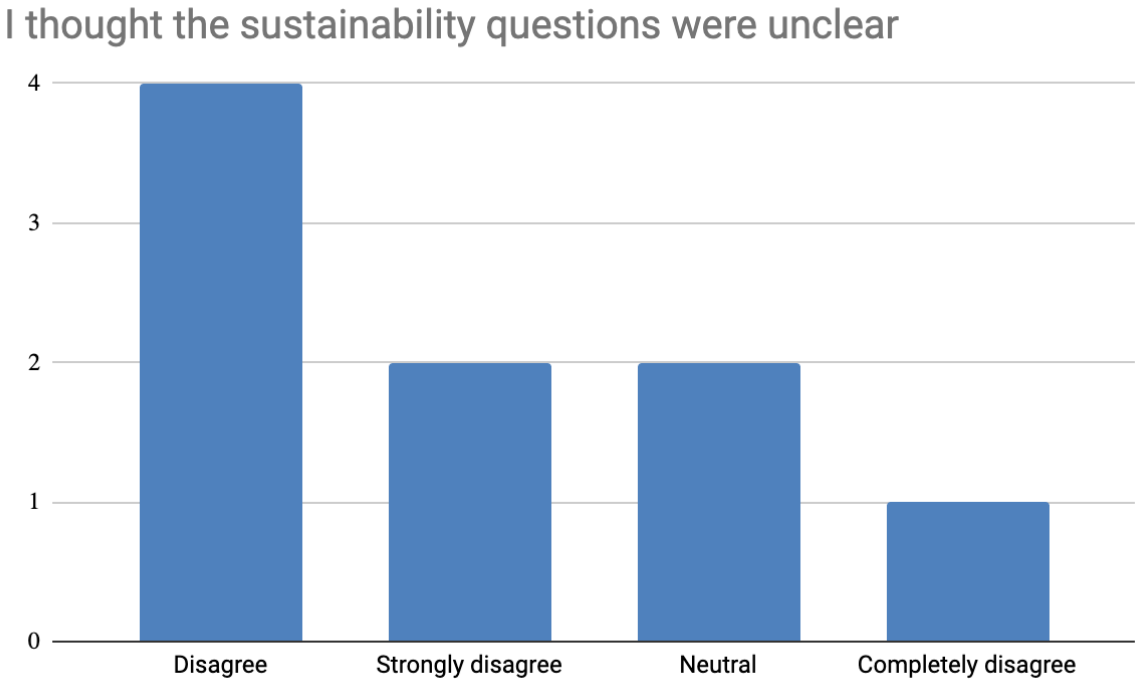


Sustainability questions PSQ

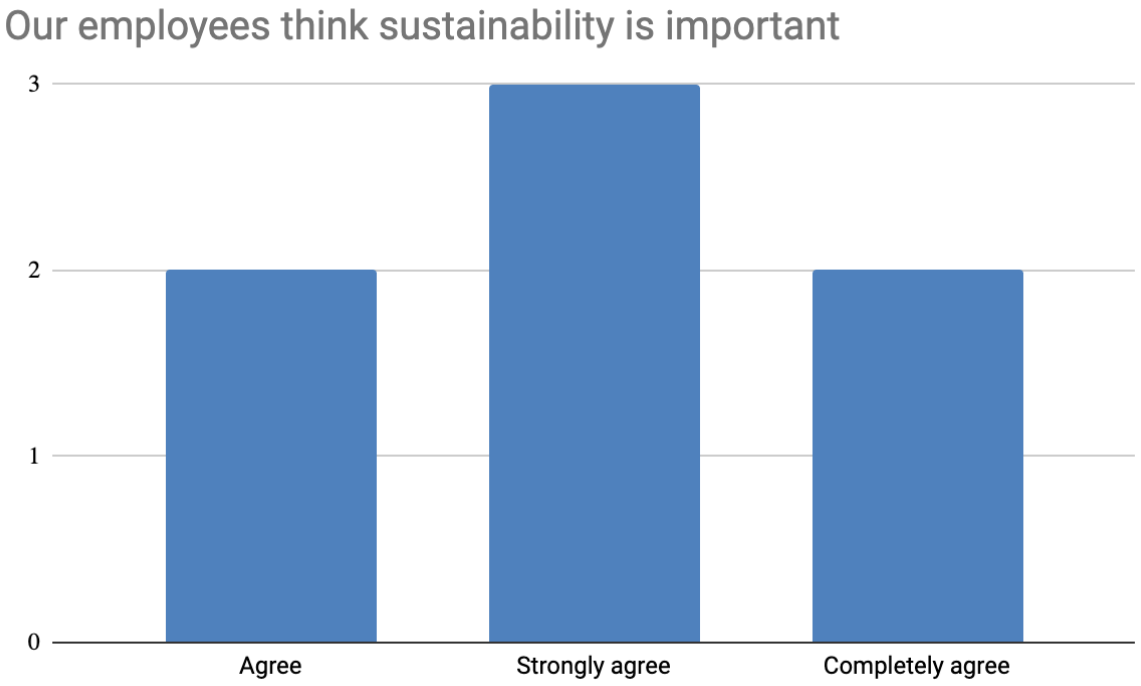


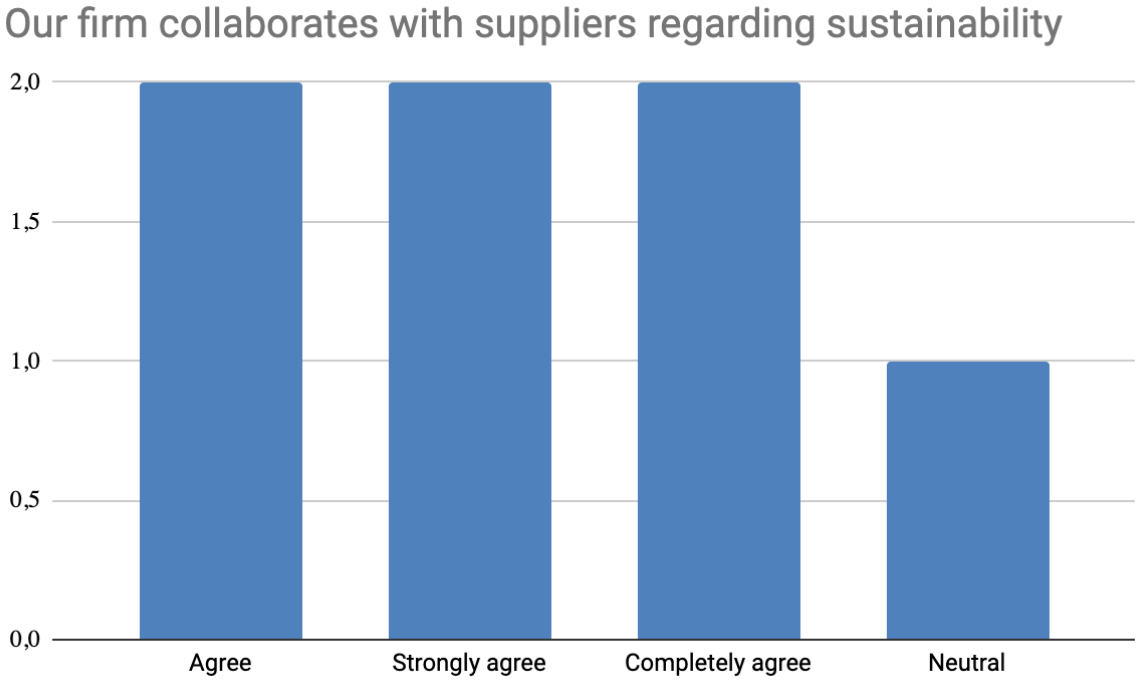


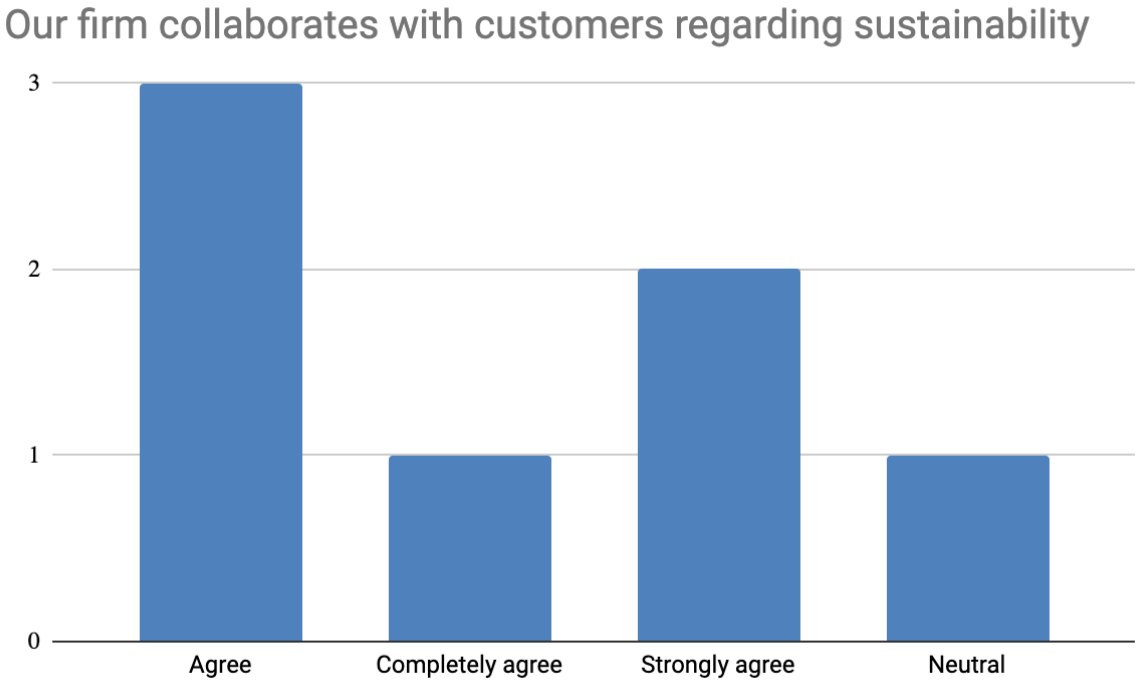

I thought the sustainability questions were clear
4
3
2
1
0
Agree
Strongly agree
Neutral


I thought the sustainability questions were unclear
4
3
2
1
0
Disagree
Strongly disagree
Neutral
Completely disagree

Importance sustainability for firm




Our firm collaborates with suppliers regarding sustainability
2,0
1,5
1,0
0,5
0,0
Agree
Strongly agree
Completely agree
Neutral


Our firm collaborates with customers regarding sustainability
3
2
1
0
Agree
Completely agree
Strongly agree
Neutral