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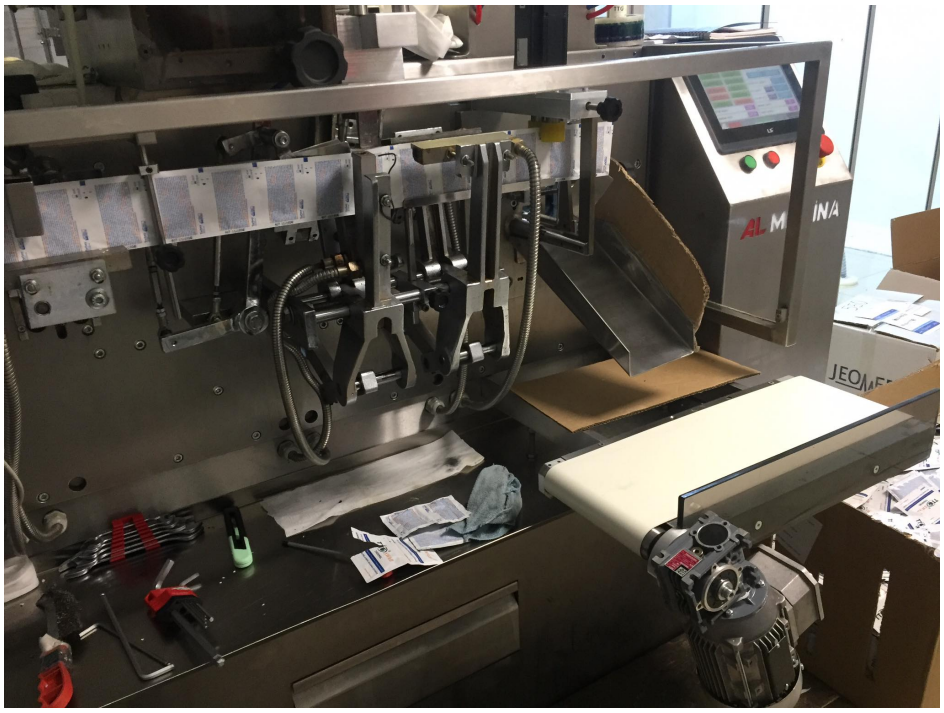

Managing Quality Problems at a small Pharmaceutical Company

A Case Study

Master's thesis in Suppy Chain Management

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Managing Quality Problems at a Small Pharmaceutical Company
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Abstract

Final product quality is greatly dependent on the quality of the incoming purchased materials, thereby managing supplier relations is of great importance influencing customer satisfaction and thereby commercial success of any firm. It is critical to ensure good communication with upstream supply chain members in order to control the input entering focal firms system and to secure desired quality. Conducting this study is valuable for manufacturers to ensure keeping costs under control, quality and to deliver products on-time.

Quality Management (QM) is of high importance for the opportunities it can provide to firms including efficient use of resources, waste and cost reductions. For its impact on improving the company's performance and supporting commercial success, QM attracts attention by firms. Adopting TQM perspective allows firms to creates source of competitiveness by improving their delivery reliability and supplying desired quality.

A bio-pharmaceutical company, Company X, understands that purchasing has a critical role in the customer satisfaction through ensuring product quality as well as profitability of the company. Company X has therefore identified the need of examining causes of high production waste regarding non-sterile product group at the production site. The purpose of the thesis is to identify on-going quality problems at Company X, to investigate state of the supplier relationships and, visualize the impact on Company X's business. Investigation reveals underlying reasons for quality issues, as well as associated consequences and implications. The thesis results help Company X to gain insight regarding on-going operations. Solutions compiled from internal interviews and adapted according to industry best practices are recommended.

Keywords: supplier relationship management, sourcing strategies, single and dual sourcing, bio-pharmacy, best industry practices, total quality management, contract management, power balance, supplier relationship development strategies.

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Furthermore, I would like to thank Jesper Adolfsson and August Sölveland for providing valuable feedback that support the thesis development. I gained valuable perspective to grasp the importance of business operations and relations.

Lastly, I would like to thank Emel Ozbek and Meltem Idig Camuroglu for their support and inspirations during my thesis.

Ozbek, Gothenburg, June 2022

List of Acronyms

Several acronyms have been used throughout the master thesis study. Authors listed acronyms in alphabetical order which can be found down below:

API	Active Pharmaceutical Ingredients
CAPA	Closed Loop Corrective and Preventative Action
CRM	Customer Relationship Management
EOS	Economies of Scale
OTIF	On Time In Full
SCM	Supply Chain Management
SCQM	Supply Chain Quality Management
SRM	Supply Relationship Management
TQM	Total Quality Management

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1
Introduction

Chapter 1 entails background on the concerned subject and presents the purpose of the research and research questions. The research questions are discussed to be answered throughout the thesis. Finally, delimitation, scope and structure of the thesis has been presented.

1.1 Background

Product quality, timely delivery of products and keeping costs under control have constantly been three of the most crucial factors influencing customer satisfaction and thereby the commercial success of any firm. Accordingly, ensuring product quality improves good business relations and strengthens a firm's place in the market and on-time delivery allows firms to drive better cooperation with downstream supply chain members and thereby protect customer loyalty through boosting reliability. In addition, keeping cost under control is vital for business due to the need of lowering overall expenses where 50-60% of the cost of goods sold is associated with purchased materials for manufacturers (Weele, 2018). This reality holds for majority of the firms and thereby the effect of these three elements into profitability must not be overlooked.

According to Ali (2020) the lowest cost of acquiring raw materials may not lead to the lowest cost for the product overall. Poor quality attributed to the supplier side likely incur higher cost related to failures. The situation does not only inflate cost but also reduce satisfaction of the customer, increase issues regarding warranty and disputes.

Firms can achieve competitive advantage through working on product quality (Sousa & Voss, 2002). Because decreasing process variability implies fewer defects and rework, less scrap thereby lower production cost and more stable processes. Additionally, improved product quality possibly results in minimized service costs through less number of warranty and liability issues.

The accuracy and compliance of the products with the standards play a critical role especially in mass production. Additionally, product quality is primarily related to the conformance to requirements in the manufacturing industry (Sousa & Voss, 2002). Therefore compliance with the requirements must be continuously monitored through various means including contracts where the requirements for raw materi-

als are clearly written, and defined relevant key performance indicators (KPIs) to measure suppliers performance. If the quality is not as promised in the contracts, sanctions further should be there in the forms of penalties or termination of the contract. Additionally, social forces including power balance, dependency, trust and attractiveness needs to be considered concerning supplier relationships.

Firms may lose control over operations over time due to certain business strategies taken such as outsourcing. They consider the option of outsourcing manufacturing operations every now and then to preserve a competitive position in the market through benefiting lower labor costs, being close to the supply side and the possibility to enter new markets (Punnakitikashem et al., 2010). However, such business strategies involve potential risks such as loss of control over operations, increased costs and brand damage. Such symptoms may indicate quality issues associated with third-party members and thereby should not be neglected.

Major quality issues in the manufacturing industry lead to risks to manufacturers including escalate waste and inflated production costs, delay in new product introductions, loss of market share, product recalls, damaged reputation, and even much severe consequences due to product non-conformance (Dellana & Kros, 2014; Lee & Li, 2017; Ali, 2020; Fortner, 2021). Therefore, to quickly detect the source of the problem in operations and resolve them promptly is crucial for firms' survival.

Company X, as a small to medium size manufacturer of modern healthcare products is suitable case for this master thesis study in which author is assigned to investigate its particular supplier relations regarding the quality that they provide. Supplier Relations and Quality Management are the core part of this master thesis. Further details about the case company is presented in section 3.3.

1.2 Purpose and Research Questions

The purpose of the thesis is (1) to identify on-going quality problems at Company X and (2) to investigate state of the supplier relationships and (3) visualize the impact on Company X's production. Positive and negative aspects will be studied. The thesis results help Company X to gain insight about on-going operations with the emphasize of the importance of all units working together towards a common goal. The thesis work helps purchasing department to adopt proactive way of performing tasks.

Author formulated five main questions around the research topic. Throughout the research, following questions will be discussed and answered thoroughly.

Firstly, author would like to gather critical elements of managing suppliers to ensure product quality and improve supplier performance. This allow us to formulate the first research question:

RQ1: *What are the elements every successful supplier management program should encompass? What are best practices for ensuring good quality with supplier management based on literature?*

In order to understand ongoing quality problems at Company X regarding finished goods, it is essential to describe what happens at the production. The way operations performed acts as a base reference during the data collection. Therefore, the second research question has been formulated as follows:

RQ2: *What is the quality of supplied materials associated with non-sterile product group?*

Furthermore, it is necessary to detect the root cause of problems connected to ongoing operations at Company X. For instance, does the way the roles and responsibilities defined cause the poor quality? Are the main responsibilities of suppliers clear? Or alternatively, does it because of lack of control mechanism regarding measuring quality e.g. unclear key performance indicators (KPIs)? Additionally, how quality of incoming raw material is communicated to suppliers and managing relationships to improve the quality direct us to formulate third research question:

RQ3: *What are the reasons associated with the quality problems of these materials? How the pharmaceutical company can manage supplier relationships to improve quality of materials?*

The thesis demonstrates how a small-scale problem can have greater consequences. Identifying other problems caused by this situation will play an critical role in demonstrating the significance of the situation. Therefore, the output of the thesis will provide the company concrete justification for modifying ongoing operations. The thesis focuses on over production, waste cost elements and analysis of overall cost. Therefore working on lingering problems along with the quality issues allow us to formulate fourth research question.

RQ4: *What are the consequences and implications of having poor quality of incoming raw materials?*

Furthermore, what actions should be taken by the Company X to resolve this issue should be investigated. How the company and its suppliers are collaborating to resolve the issue will assist us to understand how gap requirements can be fulfilled. Moreover, the comparison between ongoing operations at the company and best practices in the industry allows us simultaneously to identify the gaps in the process. Recommendations and solution proposals for achieving targets without extra costs in production and for establishing effective supplier relationship management to resolve the issues guide us to formulate the last question:

RQ5: *What are the recommendations and solution proposals to the Company X to overcome the quality issues regarding its raw materials?*

1.3 Delimitation

The aim of the thesis study is to identify on-going quality problems in the manufacturing plant in Ankara, Sasmaz and to recommend the way in which Company X resolve these issues and achieve targets without using extra costly production. Nevertheless, the project is concentrated and limited to predetermined supplier relationships, its management and emphasized in quality that they deliver to Company X.

The thesis centers the local operations within the Turkey and the investigation of relationship with local suppliers regarding non-sterile product group. The research will not cover the entire product portfolio which exceed 100 SKUs due to time constraints. Additionally, production processes further will not be studied in this thesis even though they can be accountable as the another reason for the waste in production. Lastly, simultaneous development of sustainability and product quality will not be covered due to time limitations.

1.4 Thesis Structure

The thesis consists of seven chapters in which the introduction includes background, aim of the research along with five developed research questions, and delimitation of the thesis scope. The thesis continued with literature review on supplier-buyer relationships and total quality management. It proceeds with methodology in which readers can find necessary information regarding how research is conducted including research strategy and design and how data is gathered. It progresses with findings and analysis in which author presents data collected through semi-structured interviews and internal documents from Company X. In results and discussion chapters author answers presented research questions and compares real data with literature, respectively. Finally, conclusion and future research will be shared.

2
Literature Review

Chapter 2 entails literature in the field of supplier relationship management and quality management. The thesis work covers single-dual sourcing, power balance, supplier relationship development strategies in the business relationships. Total Quality Management theory was chosen to investigate the effect of ensuring quality on companies' operational performance and on the bottom line. In the last section, the importance of supply quality will be emphasized by blending quality and supplier relations.

2.1 Supplier Relationship Management

In this chapter, author discusses why management of supplier relations is crucial for focal firm, the role of the power balance of supplier and buyer in the relationship, different sourcing strategies, and the way in which supplier development strategies that includes various involvement levels can be applied.

2.1.1 Significance of Supplier Relationship Management

Manufacturers have become highly reliant on its suppliers regarding quality of the sourced materials. Rapid increase in outsourcing can be considered as a reason for this and thereby placing higher responsibility on suppliers and manufacturers for product quality (Lee and Li, 2018). Final product quality is greatly dependent on the quality of the incoming purchased materials (Weele, 2018). In case of a defect with purchased materials which go into production without any inspections, the manufacturer will most likely experience serious quality problems with its final products and possibly large-scale problems will be awaiting at the gate. For this reason, it is critical to ensure good communication with upstream supply chain members in order to control the input entering the focal firm's system and to secure desired quality.

Quality of raw materials sourced by the suppliers may affect day-to-day operations at the manufacturer's plant including line shutdown, rework and expedited shipping which will be reflected in the cost (Ali, 2020; Teli et al., 2012). As the company size increases, cost increases proportional to the company's revenue, thereby it has become a more important issue to focus on (Teli et al., 2012). Therefore it is crucial to manage supplier relations to ensure daily operations at production not to be interrupted. Additionally, in case of severe quality problems, recalling the products

due to a quality problem further damages the brand image. To protect the brand image and prevent undesired outcome, supplier relations and supplier quality management should not be neglected.

Sousa & Voss (2002) contextualizes product quality as product performance level, conformance to requirements, aesthetics. In this thesis, authors will focus on product quality as conformance to requirements in a biopharma industry. Purchasing is the most conspicuous functional area within a company on the managing supplier relationships and communicating the desired quality (Rahman, 2006). In addition, SCM literature points out the importance of coordination of a series of activities ensuring management of the relationships with suppliers and partners effectively. Not only cost but also delivery performance and quality are the main issues that suppliers compete with one another to be the most attractive option for the buyers. Abandoning the mindset of isolated internal focus and adopting a more external perspective allows companies to optimize cost and quality across the supply chain (Salimian et al 2021). Good communication with the suppliers result in not only maintaining the targeted quality but also cost optimised throughout the supply chain.

According to Ali (2020) the lowest cost of acquiring raw materials may not lead to the lowest cost for the product overall. Poor quality attributed to the supplier side likely incur higher cost related to failures. The situation does not only inflate cost but also reduce satisfaction of the customer, increase issues regarding warranty and disputes. Considering how it can influence focal company and downstream of the supply chain members, the importance of having good relations with the supplier is evident.

Clear communication with suppliers and ensuring standards and regulations reduces regulatory compliance cost and risks. In addition, detection of quality problems made “on time” provide cost reduction including preventing penalty cost and/or expedited shipping cost which can be interpreted as SRM is crucial to control cost, and protect company image (Zeng et al., 2008; Teli et al., 2012)).

According to Sousa & Voss (2002) it can be interpreted that companies can achieve competitive advantage through working on product quality. Because decreasing process variability implies fewer defects and rework, less scrap thereby lower production cost and more stable processes (Forza & Filipini, 1998). Additionally, improved product quality possibly results in minimized service costs through less number of warranty and liability issues.

The complexity of supply chains further increase the importance of having good supplier relations. The need for identifying the root cause of a problem points out increase in the importance Quality Management Systems (QMS) and Supplier Performance Evaluation (SPE) for the focal firm (Zeng et al., 2008). The underlying reason is that eventually it is not the supplier but the focal firm who is responsible for the issue in the eye of customers. Tracing down which part causes the problem

at which stage might be complex task as supply chains become more and more complex (e.g. which supplier, what parts ID). Therefore, suppliers needs to be managed carefully to detect quality issues quickly and accurately and to resolve higher-tier supplier failures promptly.

It is critical for manufacturers to have insight into its supplier base to be able to recognize and measure responsiveness, resilience and alignment with manufacturer's value with its current suppliers (Fortner, 2021). Gaining insight into supplier base and aligning the performance of suppliers with corporate targets ensures manufacturers to possess advantage over its competitors. Supply Chain Management (SCM) literature points out the importance of getting everyone on board which allows improvement on the overall performance. Sharing the same vision on quality as of buyer, supplier likely to achieve favorable buyer-supplier relationship which entails superior business within the market (Ali, 2020).

Similarly, resource based theory illustrates that a company builds competitive advantage through using its resources and capabilities effectively (Hong et al., 2019). Where focal company canalize its capabilities on both internal and external practices (e.g. how firms communicate requirements and demands with suppliers and customers, how they collaborate/cooperate, e.g. information exchange, responsiveness), the focal firm possesses competitive advantage over its rivals. Responsiveness, how companies quickly respond to changes, is a highly prized capability. This focus allow focal firm to perform well in an innovative direction because supply chain management supports the firm's innovativeness (Hong et al., 2019). An effective control mechanism is necessary to ensure good quality and possess competitive advantage. SCQM influences positively operational performance where top management involvement supports R&D activities and favors supplier and customer relationships. Supply chain collaboration reinforces the responsiveness of the focal company. The company improves the way they perform operationally through investing in its SCQM capabilities.

To have a competitive position in the market, focusing on the total quality is a must for companies (Hellsten& Klefsjö, 2000). Offering the quality that customers are willing to pay will provide focal company an advantage in the market that the are competing in. To ensure that, focal company must communicate its demands and requirements clear with its suppliers. How effectively a focal company manages its suppliers regarding quality, delivery and costs will return as customer satisfaction and commercial success. For this reason, having an end-to-end solution of (Supplier performance Evaluation) SPE is crucial. However it is good to keep in mind that to be able to achieve the desired outcome players in the supply chain must hold trustworthy and strong relationships among themselves (Salimian et al 2021).

Supplier Relationship Dimension		
No	Operational Level	Strategic Level
1	Actual price vs targeted price	Satisfaction of internal customer
2	Realized Quality vs Expected Quality	Satisfaction of particular supplier
3	Delivery Reliability	Response time of focal firm where supplier request for information
4	Number of times supplier invoice has smoothly	How easy to get a new business

Table 2.1: Measures for supplier performance, *adapted from Weele, 2018*

2.1.2 Elements of successful Supplier Relationship Management

Successful Supplier Relationship Management processes needs to include singling out best suppliers and continuously monitor them, disqualifying ineligible ones, and gathering necessary information regarding potential suppliers in the market periodically or when necessary (Zeng et al., 2008). Questionnaires to be filled up by potential suppliers is used for evaluating suitability (Zeng et al., 2008). Effective and open communication to have clear understanding of supplier capabilities is of high importance in this process. After gaining insight into particular supplier's capabilities and the initial successful evaluation, focal company must proceed with quality audits, sample inspections and quality agreement (Weele, 2018).

Subsequently, product and supplier performance is monitored in operational and strategic dimensions. Regarding product performance, it is of importance to have up-to-date contracts, complete specifications regarding purchased material and described change procedures. Last element is of importance where it describes the way in which the focal company and its supplier act on the off change that it is mandatory to alter the specifications (Weele, 2018). Additionally, the buyer measures supplier performance on both levels through scorecards. Some examples are presented in Table 2.1 (Weele, 2018).

Providing KPIs with suppliers and well-informed them on-time grant supplier time to improve performance by strengthening particular weaknesses (Fortner, 2021). In other words, providing a feedback on supplier performance stimulate the supplier to understand better and take necessary actions to secure the business with focal company.

It is reasonable to encounter unexpected problems in real life and timely detection of the problems are of high concern. Following questions needs to be asked regarding identification of a problem: what are the corrective actions regarding the issue and implementation of these actions to fix the problem (Ali, 2020)? These questions forms the process called Closed Loop Corrective Actions (CAPA).

2.1.3 Sole, Single and Dual Sourcing

In addition to current supplier relationship management, which sourcing strategy is particularly appropriate for a focal firm is an issue to be discussed. Risks of supplying inbound, and benefits of particular strategies, contextual factors must be considered in selection of the strategy.

Sole sourcing is a concept where buying firm have only one supplier due to there is no other suppliers exist in the upstream market to negotiate (Yu et al., 2009). Having no other feasible source exists indicates buying firm is highly dependent on the particular supplier due to the nature of monopoly. On the other hand, single sourcing is where buyer fulfill firm's needs from one supplier by choice (Yu et al., 2009). Dual sourcing is a special case where exactly two vendors are chosen to supplying materials to the buyer's firm (Treleven & Schweikhart, 1988).

Supply disruption is the first dimension to consider when comparing the abovementioned strategies (Berger & Zeng, 2006; Yu et al., 2009). It indicates the risks that can happen to vendor's business including fire destruction, employee strike, and bankruptcy of vendor (Yu et al., 2009; Namdar et al., 2017). The concern regarding the situation of disrupted supply both depend on possibility of occurrence of disruption and impact of it have on the buying firm. Supply disruption cited a great risk against single sourcing especially if materials supplied by a single plant. From this point of view, dual sourcing in which buying firm supply materials from two different entities mitigates the risk and flatten the magnitude of the impact have on the buying firm. (Hines, 2006; Namdar et al., 2017).

Using dual sourcing to offset the risk of supply disruption is a common industry practice where buying firm source large portion of its demand from one supplier, and source a volume from the second supplier just enough to maintain the relationship (Treleven & Schweikhart, 1988). Although dual sourcing seems lessen supply disruption risks, it does not completely eliminate the risk (Treleven & Schweikhart, 1988). Moreover, in single sourcing, supplier might provide early alert for the buying company through close cooperation and enhanced communication in which potential problem can be solved, avoided or planned around, if managed well.

A situation where a buying firm hold on opinion of adopting single sourcing, following considerations needs to be done. Before entering into agreement, candidate supplier must be evaluated if the company is solid in terms of business outlook and financial performance (Treleven & Schweikhart, 1988). The underlying reason is a need of reasonable expectations of the long-term viability of the candidate in the business due to the nature of long-term relationship. Working together certain time of period in the earlier enables them to build trust and remove the concern regarding the possibility of vendor intentionally chooses to cut supply (Krause et al., 2007). For the time being intensive evaluation of the vendor, current practices of precautionary measures required to be assessed.

Developing a contingency plan in sourcing strategy is a further rational action

that explains what steps should be taken in case a disruption in the supply occurs (Treleven & Schweikhart, 1988; Berger & Zeng, 2006). If the needs of the buying company are met by a single sourcing strategy, buying firm must acquire information if supplier is capable of meeting the requirements from another plant. In case if the answer is negative, it must be recognized that the situation poses a risk over buying firms operations and buying firm need to identify alternative source regularly because utilizing different inputs lessen the supply disruption risk.

In summary, considering risk of supply disruption, dual sourcing seems advantageous than single sourcing. Sourcing from different suppliers reduces supply disruption risk due to the fact that the reduced possibility of occurrence of disruption (Berger & Zeng, 2006; Hines, 2006). However, regardless of the selected sourcing strategy, having proper contingency plan in place will result in the degree of the impact of the disruption on companies will decrease and remain at similar levels between the sourcing strategies.

The second dimension to consider is risk of price escalation. It is exactly opposite of the situation where buying firm negotiate multiple suppliers and turns them against each other to obtain the best price. In this situation, if buying firm is not willing to make concessions on price, vendor might threatens to allocate its business to another buyer (Treleven & Schweikhart, 1988).

In dual sourcing, risk of unreasonable price increase is less because the buying firm can procure raw materials from the second vendor in case where the supply is threatened by interruption (Treleven & Schweikhart, 1988). On the other hand, in single sourcing, elimination of the risk requires to establish a relationship of trust between supplier and buyer. Because lack of competition might result in buying firm is exposed to risk of price escalation (Treleven & Schweikhart, 1988). However, if trust has been established and single sourcing strategy implemented in a proper way, the collaboration between supplier and buying motivates vendor to demand a fair price and to share its cost breakdown to reduce the cost jointly.

The third dimension is referring to the way in which movement of the incoming raw material through the buying firm and how inventory is managed (Treleven & Schweikhart, 1988). As the number of suppliers decrease in supplier base, the buying firm's ability increases regarding how deliveries are scheduled (Hines, 2006). Coordinating the shipment as well as production becomes smoother. Improvement on the scheduling have further a positive impact where vendor carry less amount of inventory.

Single sourcing is advantageous when the supplier consistently delivers the correct type of material on time and complete (Treleven & Schweikhart, 1988). Dependability of a supplier escalates proportional to geographical proximity to buying firm. The situation favors single sourcing allow buying company to manage fewer delivery problems as the volume is concentrated in a single supplier. It is cited that concentrated volume also lowers the transportation cost of the incoming raw material

(Hines, 2006). If this condition is not met, then dual sourcing becomes suitable.

The fourth dimension is related to quality of the incoming materials. In single sourcing, as buying firm enforces standards to improve quality, the supplier prioritize conforming to product requirements (Treleven & Schweikhart, 1988; Berger & Zeng, 2006). The communication between supplier and buyer becomes smoother, complete and more accurate where buying firm ensures that supplier understand their needs and requirements (Hines, 2006; Namdar et al., 2017). Dual sourcing, seems disadvantageous as it is possible that buying firm might face with production problems due to nonidentical parts entered into the buying firm's system since it comes from two different sources (Treleven & Schweikhart, 1988). The processes that the incoming raw material goes through may not be the same, and can be difficult to catch before it turns into a problem in the production.

Single sourcing additionally decreases the amount of administration work as the supply base is reduced (Hines, 2006; Namdar et al., 2017). In dual sourcing, it is necessary to manage two different relationships, and entities which increases the administration work at the buying company's office.

The strategies both have benefits and drawbacks and which strategy to choose depends heavily on contextual factors and trade-off between the strategies (Yu et al., 2009).Additionally, developing sourcing strategies requires to be in line with the corporate goals and quality policies.

2.1.4 Power Imbalance between Buyer Supplier Relationship

Classification schemes are taken as a base to form a relationship strategy between buyer and supplier in which it can be based on type of product (Kraljic 1983), relationship between buyer and supplier (Bensaou, 1999; Gelderman and Van Weele, 2000). Risk of supplying material and business impact (i.e. potential to add value) are the two dimensions assist purchasing specialists to classify the product and corresponding suppliers. The illustration can be seen in Figure 2.1 down below. This approach helps buyer to avoid strategic mistakes.

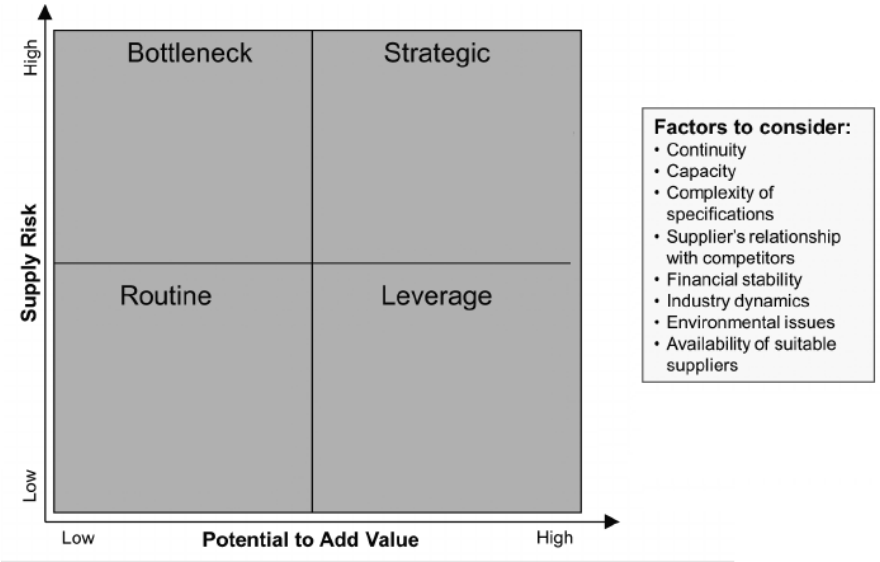

Figure 2.1: Supplier Segmentation based on Product Type sourced from Kraljic Matrix

Later the section, the focus will be centered on relationships and power asymmetry between buyer and supplier to demonstrate the how it might cause potential business hardships.

Power balance between actors involved defines the characteristics of the relationship. If buyer is dependent on the supplier, then the relationship can be characterized as supplier-dominated in which there are fewer suppliers, many buyers, limited substitutes in the market. To the contrary, if the upstream market is highly competitive, consist of many suppliers, range of substitutes, and fewer buyers, then the relationship becomes buyer dominated (Khoja et al. 2011). If supplier is powerful in the relationship, then it might be challenging to convince supplier to work towards buyer's specific requirements (Campbell & Cunningham, 1983).

Another particular element when considering the power balance between particular supplier buyer relationship is the budget size of buying firm's give portion to supplier's (Khoja et al., 2011). The stronger party will have more sanctioning power than the other party. Furthermore, if the buyer's budget do not cover a large part of the supplier's income, the buyer is not in a strong position to exert power.A case where buyer is not powerful and If the buyer is unwilling to invest in supplier, supplier may become reluctant to make investment to resources as supplier consider this investment that makes them vulnerable to opportunism (Krause et al., 2007).

2.1.5 Supplier Relationship Development Strategies

The objectives of the supplier development programs are to achieve enhanced delivery reliability, superior product quality and increase its competitive advantage. To obtain these targets, buying company must develop strategies to motivate the supplier to make commitments that respond its business needs.

The elements of supporting supplier development including information sharing, effective and open communication, building trust should not be overlooked in building relations (Krause et al., 2007). Goals need to be communicated clearly so that they are shared between parties involved to achieve productive efforts (Krause et al., 2007).

The initial consideration is to carefully assess the supplier through evaluations and to provide feedback for performance improvements. This approach supports and ensures that supplier understands buyer's performance expectation. The criteria considered by the buying firm are supplier's managerial competences and operational performances (Sillanpää, 2015).

Another strategy, labeled as "Competitive pressure", is that buying firm motivates particular supplier to keep their performance high by putting pressure of providing information about what other suppliers achieving (Sillanpää, 2015). The underlying reason is that performance quality is a matter of competition among the suppliers and the one who is superior will be rewarded future business with the focal company. It is recommended for firms to source from more than one supplier, i.e. parallel sourcing (Sillanpää, 2015).

The second strategy is labeled as "incentives" where buying firm incentives the supplier through offering higher volume considerations, achieving mutual cost-savings, future business opportunities, or acknowledging the supplier by means of awards (Sillanpää, 2015). For example, buying firm can consolidate volume and offer less number of supplier and demand them to be capable of meeting the requirements through new business volume. In this perspective, supplier is expected to strive for maintaining requisite performance to achieve the reward. If buying firm commit long term business with particular supplier, it motivates the supplier to alter operations to align goals with the buying firm. If not, it is expected the supplier is reluctant to make changes (Krause et al., 2007; Sillanpää, 2015).

The last strategy is termed as "direct involvement" in which buying firm considers invest directly in supplier's operations (Sillanpää, 2015). The strategy might involve supplier's production plant visit to assess the operations and detection of weaknesses, supplier training, or direct investment to the supplier's operations. In that vein, the level of engagement of buyer into supplier development is related to its expectations regarding the relationship continuity.

The above mentioned strategies can be portrayed and summarized as in Figure 2.2 down below. Several strategies can be combined in supplier development to achieve superior performance. For example, if buyer and supplier managed to reduce supplier's cost, this situation contributes to the supplier's customer including focal buyer to have lower prices. In that vein, the achievement made in the upstream supply chain members transferred as benefits to the downstream players (Sillanpää, 2015). In the literature, the advantage has been referred to as gaining more market

share, having superior quality, lower cost, fast product introductions (Sillanpää, 2015).

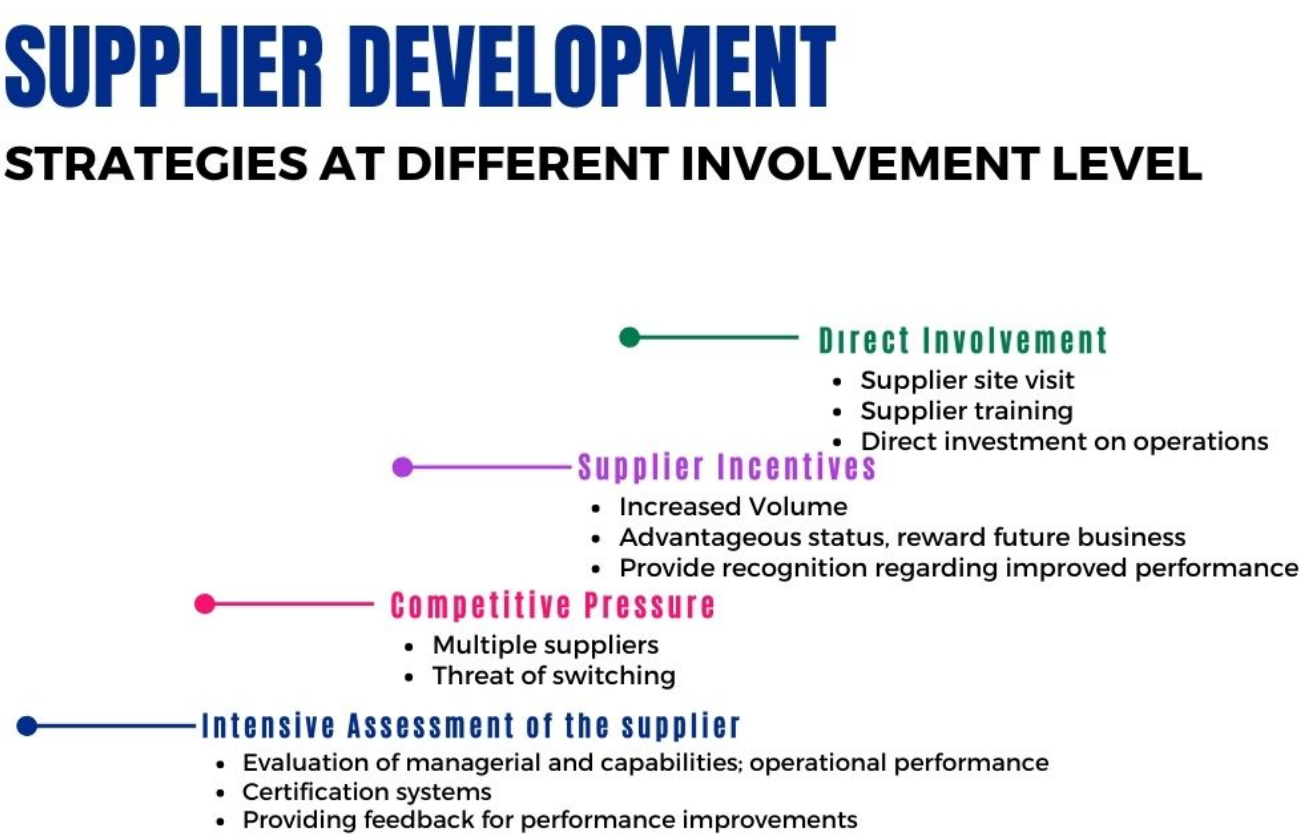

Figure 2.2: Supplier Relationship Development Strategies, *modified from Sillanpää, 2015*

2.2 Total Quality Management

Total Quality Management (TQM) is further a concept in which every company identifies its core values that characterize themselves (e.g. customer focus) and determines techniques that support these core values. This concept is strategically vital as it serves as a foundation for competition (Hellsten & Klefsjö, 2000). QM, if taken as a source of competitiveness, provides companies with a positive impact on a company's performance and commercial success (Punnakitikashem et al., 2010). Managing the quality with having a supply chain perspective is strengthen product quality, and focal company's commercial success. For this reason having sustainable and open communication with both upstream and downstream participants are critical for the company.

Description of TQM and the significance of the philosophy facilitate case company to understand how it influences its performance and to adopt it in the organization. The positive effects of TQM on operational and financial performance of firms will be presented in this chapter.

2.2.1 Definition of TQM

Various definitions of TQM in literature assist author to make own interpretation in which it can be expressed as *a quality management philosophy that aims to improve overall operational performance that applies within the organization and among supply chain participants*. This philosophy which consists of assorted activities, is becoming more and more diffused and accepted by business community (Zehir et al. 2012). The most well-known activities involves *"management leadership" and "supplier quality management"* (Samson & Terziovski 1999; Kaynak 2002; Zehir et al. 2012).

First dimension is about strategic direction set by senior management level. In this vein, it implies possible change in company culture lead by senior management. This dimension also considered as major driver of this philosophy and positive impact on the organizational learning (Samson & Terziovski 1999; Kaynak 2002). Regarding this dimension, input from employees is of priority and employees are empowered to suggest changes the way they perform the tasks.

The second dimension concerns managing supplier relations in regard to quality of the input material. This dimension can be considered critical for manufacturers in which controlling the quality of the inputs has a considerable impact on the output quality.

2.2.2 Impact of TQM on Operational Performance and Financial Results

In situations where buying firm prioritize product quality and delivery, performance of participants involved boosts in line with the relationship effort (Kaynak, 2002). The TQM philosophy encourages companies to reduce supply base and cooperate effectively with few number of suppliers and manage relationship properly (Kaynak, 2002). The philosophy also facilitate supplier development through increased volume (Sillanpää, 2015). This strategy allows the supplier to provide more input as focal company have more time to listen to the suppliers' concerns. Encouraging suppliers to offer potential suggestions and recommendation to the focal firm facilitates solution processes. Expanding knowledge base through involving suppliers suggestions into the way focal company works might have a positive impact on its innovation performance.

Certainly, this situation encourages existing suppliers to strive toward meeting manufacturer's requirements and quality standards, and deliver targeted specifications. Therefore, focal company can secure that inputs from the supplier comply with the end-consumer needs and the strategy facilitates acquiring desired quality of products and services (Powell, 1995; Kaynak 2002).

The inventory levels reduces in line with the effectively managed suppliers (Kaynak, 2002). Therefore, focal company can reach sustainable targets through reducing scrap and adopting more lean operations in the production plant.

Empowering employees to identify problems and solve them quickly is another recommendation from the TQM philosophy by reason of minimize scrap and rework and internalize zero defect mentality. Rather than focusing on inspection and rework, spotting where a defect occurs and understanding and solving it allows companies to reduce waste levels and associated costs thereby provide a positive impact on company's bottom line (Powell, 1995; Kaynak 2002; Zehir et al., 2012). Empowering employees further results in higher employee satisfaction (Powell 1995).

In summary, the philosophy offers product of high quality at a lowered cost through minimized waste. Not only it satisfies customers and employees, but also has an impact positively on the financial results and can be considered as source of competitiveness for any firm (Powell, 1995; Zehir et al. 2012).

If the firm gains a reputation for delivery reliability and supplies excellence quality products to the market, it is possible for demand elasticity to decrease and, in this case, the firm can find buyers for its products at higher prices and increase profit margins, since the increase in price will not cause much loss of customers (Kaynak, 2002). Satisfied customer turns into loyal towards the firm. Furthermore, if less waste is generated, product cost controlled better and can be available to the customer at a more affordable price.

Different sizes of companies including Xerox and Ford regain their market shares and increased their margin by adopting TQM philosophy (Samson & Terziovski, 1999). However, it is recommended to firms that they concentrate their efforts on building a culture in which TQM practices can flourish rather than focusing on tools and techniques. Evaluation TQM rationally according to what firm needs and what kind of resources that they have can be a favorable starting point.

2.3 Supplier Relationship Management and Supply Quality

Underlying reasons for quality defects in the supply side and associated difficulties that the focal firm will face if supplier relationships are not managed well are studied. Thesis progresses with how firms can resolve these problems. Ultimately, how manufacturing companies shift their focus on prevention instead of correction regarding ensuring desired quality is studied (Weele, 2018). The underlying reason is that adopting a proactive approach reduces time to respond and even prevents issues from taking place before it's happening (Fortner, 2021).

2.3.1 Possible Causes of Poor Quality regarding Incoming Raw Material and Production

According to Lee and Li (2018) product quality issues traced back to quality defects of suppliers has increased in recent years. A large part of the quality issues can be characterized as insufficient integration programmes with suppliers, lack of attention in the supplier development and miscommunication between buyer and supplier on product characteristics and required level of quality (Hamid et al., 2021).

Product recalls are connected to quality problems regarding outsourcing. Major quality issues arise from mismanagement of supply chains. It is crucial to manage supplier relationships effectively and keep top management onside (Dellana and Kros 2014).

2.3.2 Possible Issues Caused by Poor Quality

Quality issues regarding third-party members have increased in recent years (Teli et al 2012; Fortner, 2021). Additionally, Ali (2020) asserts that poor performance of the supplier side results in increased cost for the manufacturer through yield loss in production. It demonstrates high scrap cost and low product throughput and non-conformances signals product failures. Absence of oversight into supplier base or poor supplier quality such as non-conformances might result in severe consequences to manufacturers including inflated cost, delay in new product introductions, product recalls, damaged reputation, and even cause loss of lifes.

Mattel can be shown as one example of how failure related quality might cause high levels of product recalls, nearly 20 million toys in USA, due to lead paint being detected in one of the Chinese suppliers. (Roloff and Aßländer, 2010; Lee and Li, 2018). The recall of the product has led to major economic losses and damage to the brand image. Another scandal is related to Boeing Inc. in which the company delayed its 787-Dreamliner launching due to quality issues regarding material that is sourced from one of its suppliers (Lee and Li, 2018). Not only economic losses but also loss of market share is a potential consequence for the focal company.

In one extreme side of the problem includes end-product endangering life of a end customers. For Example, major car manufacturers including Ford, BMW and Toyota, had to recall their vehicles due to problematic airbags supplied by one of the leading airbag manufacturer TAKATA (Ali, 2020). This massive product recall nearly over than one million vehicles by leading car manufacturers could not prevent number of deaths and injuries. This indicates that if the supplier is not well managed, focal company have to deal with lawsuits. This caused high replacement costs regarding one of its major customer, Honda (Ali, 2020).

If focal company follows lean inventory strategies, stockout problem might occur in production due to the material not arriving on time. This might result in line shutdown, rework, extra transport, expedited shipping which is related to damage business operations, severe supply chain risks, financial losses, damage bottom line, decreased profit, reduce market share, tarnish brand image. For these reason, managing relations with suppliers is crucial and can prevent happening these problems.

2.3.3 Possible Actions to be Taken to Overcome Poor Quality

Supplier relations is not one time work and thereby must continuously managed due to its dynamic nature. Companies continuously work on ensuring quality, cost and delivery performance regarding supply side of the operations by periodically evaluating its suppliers through consolidating all the knowledge within the company and vendor performance reports (Zeng et al., 2008; Weele, 2018).

One way to ensure the desired quality of material sourced by the supplier is to inspect, sample, and test (Lee and Li, 2018). In case of a non-conformance detected during the process, documenting is crucial before sending the material to back. Because identifying and presenting evidence allow focal company to disclose the issue and plays a role in speeding up the recovery process. Inspecting strategy allows focal firm to intervene at the source of a problem which prevents the problem from growing.

Focal company needs to have some KPIs, metrics and thresholds for them in order to track non-conformances by using SCARs (Supplier Coorective Action Request) or CAPAs (Corrective and Preventive Action) across its supply base. Focusing on the

improving capability of tracking such issues and implement right actions on time will produce desired results. Regarding KPIs, quantitative metrics can be PPM (Parts Per Million), number of manufacturing issue occurrences, warranty expense of supplied material. Then scorecard must be prepared and following questions needs to be asked: "Are there any recurring issues?" "Do we have an accurate view over the situation?" "Are past identified “corrective actions” effective?" (Teli et al., 2012)

Implementing "Closed-loop corrective action programs" increases the capability of tracking the quality issues regarding raw material over all production plants with all involved suppliers. A further action would be measuring and communicating quality metrics with related suppliers enables continuous improvement in incoming raw materials.

Contracts communicate focal firm's expectations from its suppliers regarding supplier and product performance. Expectations that are written down and documented help ensure that participants will comply with the contract. A case where supplier performs deficiently, informing the supplier about the situation, and expressing requirements clearly is straightforward. In this direction, clear communication between buyer and supplier is critical. A further resort might be to make incentive contracts where focal firm motivates the particular supplier to improve quality through obtaining better quality equipment (Lee and Li, 2018).

Depending on how important the supplier is to the focal firm's business, focal firm can even assist the supplier to improve its operations and performance. This strategy called investing into the suppliers where focal firm provide support and education to supplier to improve the standards and capabilities of the supplier. Such strategies seems favorable because it reduces the impact on operations regarding the whole supply chain and ensure stable product quality (Zeng et al., 2008). Cutting the business relationship with the supplier is not the first step. It is even more critical if there is a smaller number of suppliers for the critical materials (Weele, 2018).

Auditing is an another option for the focal company where it exerts its power. Either focal company itself or 3rd party member guarantees the quality and processes are performed well at the site of supplier's production.

Depending on the supplier performance, the company must take the right actions to synchronize the operations to avoid potential disturbance that might happen to product performance (Zeng et al., 2008). Design of the strategy is based on what type of support focal firm provides to a particular supplier and how the efforts interact between buyer and supplier (Lee and Li 2018). The choice of strategy is not necessarily mutually exclusive, rather it can be combined in a way to build a successful one.

2.3.4 Supplier Quality Assurance

It is often necessary for suppliers to adopt relevant qualification certificates and practices. Because the buying firms frequently use them as a mechanism to ensure that the supplier delivers the promised quality. In this sense, suppliers implement such practices not only to assure buying firm but also to penetrate global market (Punnakitikashem et al., 2010). QMS and ISO9001 are the two well-known certificates in this field and adopting such practices might be the only way for suppliers to achieve what they targeted.

Another way of assuring buying firm is to allow supplier quality audits which is a series of actions taken by buying firms to make sure suppliers operations comply with the specified requirements (Ali, 2020; Weele, 2018). Allowing quality specialist and production manager to visit the production site to reach zero defect quality, through improved communication and settling corrective measures. Overall, various methods to assure quality are illustrated in Figure 2.3.

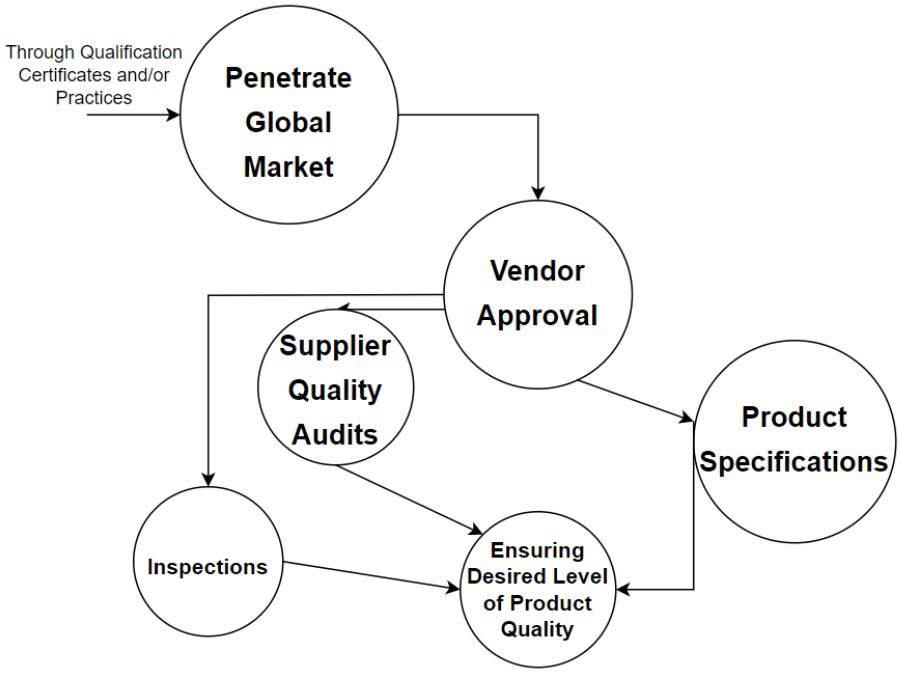

Figure 2.3: Supplier Quality Assurance

After reaching a level that satisfies the needs and requirements, buying firm reduces the inspection level which constitutes large part of the cost (Weele, 2018). Periodic verification is a last step to ensure quality of incoming raw materials. The frequency may vary between every 3 months to once a year (Weele, 2018).

3
Methodology

In Chapter 3, information regarding research strategy, method and case company are presented. The author further explains how data is collected during the thesis and how literature review is carried out. Lastly, study ethics, reliability and validity of the study are covered.

3.1 Research Strategy and Design

The aim of the research is to identify ongoing quality problems at Company X, to investigate three business relationships and to visualize the impact of the quality issues on Company X's production. As the solution proposal will be specific to Company X, it is decided that the thesis work build around a single case study. Regarding research strategy categorization, the approaches divided into qualitative and quantitative research (Krishnaswami & Satyaprasad 2010; Bell et al. 2022). Additionally, Bell (2022) further introduced third approach termed the combination of the two approach to reinforce the research. Finding solutions for the five research questions and fulfill thesis requirements and targets, qualitative approach is found appropriate for research strategy. The motivation behind choosing this strategy is that the nature of the data collection in the case study involves ethnographic studies where author have opportunity to observe operations in person, and interviews to interpret the information gathered during the meetings. Case study further enables bottom up approach to develop theory from the details of the case (Eisenhardt, 1989).

According to Bell et al. (2022) and Sreejesh et al. (2014), in qualitative approach, the thesis work includes certain phases in which identifying the problem (i.e. creating research questions) is significant. The phases include further select relevant subject(s), collecting suitable data, interpreting them and complete the work by summarizing findings and discussion. In this approach, theoretical work indicate additional literature review might be needed before and after data collection, in the light of new information.

The research begins with a formulating research questions which is carried out in collaboration with Company X and thesis advisor. It continues with literature review phase where relevant literature is studied in order to deepen the knowledge. The next phase is data collection through various means in order to gain a better

understanding of the matter being studied. In the third phase, interpreting the data is accomplished through analyzing information at hand and the results in forms of solution proposals are presented to Company X. In the last phase, comparison between literature and results from the case study is performed to fill the gap in the literature. Overall picture of the stages can be seen in Figure 3.1 down below.

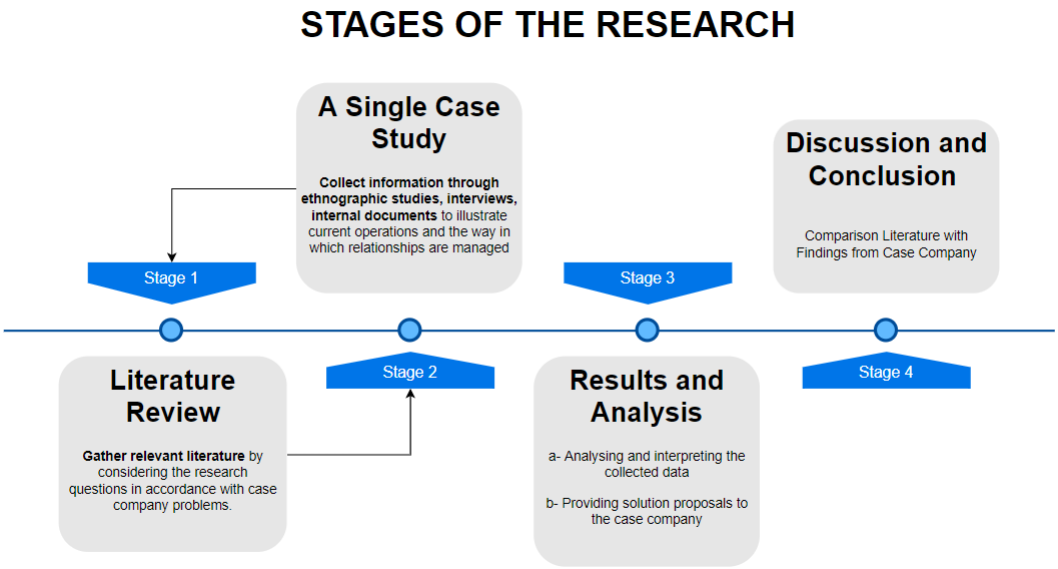

Figure 3.1: Stages of the Research

3.2 Data Collection

Several rounds of semi-structured interviews are chosen as data collection technique where the author provide clear picture regarding which themes the questions are derived from during the interviews. Furthermore, all meetings for interviews are prearranged to provide interviewee a sense of comfort and time for preparation (Bell et al., 2022). To gain comprehensive understanding and to support the data collection process, internal documentations are obtained from relevant department of Company X. During the process, author present interpreted data to receive a feedback and detect the missing information and fill the gaps in the research.

3.2.1 Interviews

Various settings are adopted in interviews. Face-to-face interviews were made to document issues in production visually and to mainly provide one-on-one native conversation with the operators. However, due to Covid-19 and travel restrictions in Turkey, online interviews also carried out through Zoom and support the data collection process. Several interviews are recorded upon consent of the interviewees and transcribed. In both settings, semi-structured interviews is chosen for qualitative data collection. The underlying reason is that this method provide flexibility

to participants involved and allow interviewee opportunity to explain his or her thoughts on the issue, point out and emphasize field of expertise he or she has (Horton et al., 2007).

Semi-structure interviews organized in a way that open-ended questions can result in new questions that emerges from the conversation and therefore main themes can be develop upon responses collected from follow up questions (Bloom & Crabtree, 2006; Kallio et al., 2016). One advantage of using the qualitative approach is to benefit from "snowball" or "chain" sampling where the flexibility and degree of freedom given to interviewee allows him or her to direct interviewer to group of people who have a deeper knowledge of the concerned subject to address the issue (Noy, 2008). In total 12 employees have been interviewed related to the concerned issue where the focal company characterizes as SME.

3.2.2 Internal Documentations

Documents were collected through inquiries for interviewees by authors request. The internal documentations include contracts made with particular suppliers, key performance indicators regarding how Company X measures supplier performance. Additionally, in order to calculate the total cost, what and how much was paid was examined through internal documents from different departments. These documentations assist authors to understand how roles and responsibilities are defined within and between the companies as well as what are the cost elements influences the total cost. Furthermore, they have a complementary function regarding interviews and strengthens quality of thesis work.

3.3 Case Company

Company X, a small to medium size manufacturer, has been outsourcing the assembly of part of its production to Company Y, a small-sized manufacturer of hygiene and cosmetic products. Unsatisfactory performance regarding delivery reliability of the focal firm's supplier has led Company X to switch to in-house production. After this strategical change, Company X realizes profitability issues due to production inefficiencies. The need for investigating the cause of the wastes and which steps need to be taken to resolve the issues are of high importance.

The underlying problem mainly concerns supply side in which quality of incoming raw material seems unsettled and concerned supplier relationships needs to be investigated. The research project has identified following suppliers which are important for non-sterile product group and thereby relations with Company X will be examined thoroughly during the research. Supplier A which is located in Gaziantep provides Company X with textile and fabric products. Supplier B located in Istanbul and supplier C located in Ankara supply Company X with packaging raw materials and printing services, respectively. Overall picture of the supply chain and focus of

this research can be seen in Figure 3.2.

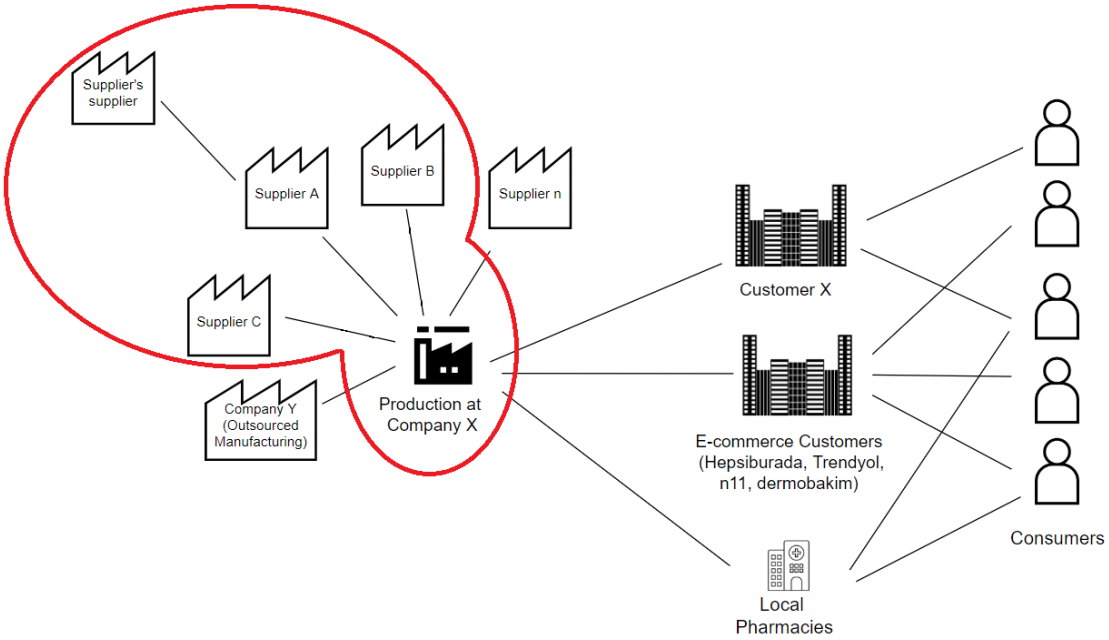

Figure 3.2: The Supply Chain of Company X and the research focus of supply side

Supplier Relationship Management needs to be studied throughout the research. It is not surprising to see quality problems in the final product if there is a quality problem in the supplied materials. Poor quality of incoming raw materials likely incur higher cost related to failures due to possibility of line shutdown, rework, transport, expedited shipping (Teli et al 2012). The reason why SRM research deserves focus is to mitigate the risk of inflated cost, to prevent quality and reliability issues attributed to suppliers, and even to prevent the brand damage of the focal firm. Because large portions of cost of poor quality (COPQ) were attributed to failures of suppliers in the last decades (Teli et al 2012).

3.4 Methods Applied in Literature Review

Supply Quality, Supply Relationship Management and Quality Management are three main topics studied from the literature. Understanding relevant concepts and cases guide author to grasp ongoing problems more thoroughly. Findings gathered from interviews and observations chart out to conduct in-depth literature review reiteratively.

Analysis of the data requires systematic way of working and documenting due to the complex nature of case study research. The academic theories assist author to

build know-how regarding the data collection (Dubois & Gadde, 2002). Researcher must be aware that empirical findings might generate unexpected circumstances in which the need to going back theoretical review and performing additional work is essential. (Dubois & Gadde, 2002). For this reason, author occasionally move forward and backward between literature and findings.

Scientific articles published internationally are used to gain knowledge regarding field of research. These articles are found in certain databases such as Chalmers Online Library, Science Direct, Emerald Insight, International Journal of Production Economics, Wiley Online Library, Routledge Taylor Francis Group, International Journal of Engineering Innovation Research. The reference lists of these selected articles was also reviewed, and relevant studies were searched in depth. The thesis work covers specific scope and following keywords are used to conduct the literature review: Total Quality Management, quality management practices, Supply Chain Management, Supplier Quality Management, Supplier Performance Evaluation, Supplier Relationship Management.

3.5 Ethics

Necessary data has been collected through interviews, observations and written documentations throughout thesis work. It is essential to work under ethical rules and follow fundamental considerations during data collection process. Ethical principles are considered in several dimensions including informed consent, fairness and beneficence (Orb et al., 2000). Regarding the thesis work, author would like to clarify that there is no violation regarding societal and ethical aspects.

First dimension, informed consent involves providing respondents with sufficient information about the study in which they participate (Orb et al. 2000; Crow et al. 2006; Husband 2020). Authors conducted interviews at Company X where all personnel were well-informed regarding the research topic prior to interviews. The purpose of usage of data were shared and were used with the discretion of the interviewees.

Second dimension, fairness indicates that ensuring respondents will not exploited or abused (Orb et al., 2000). During this study, personnel in Company X are treated with respect and will be informed that uncomfortable questions can remain unanswered. Third dimension, beneficence relates to assure respondents receive no harm or distress (Crow et al., 2006; Husband, 2020). Intentions were clarified before interviews in order to prevent harming interviewees' goodwill. To conclude, the thesis work did not favor any unethical matter and there were no harm to the participants during the process.

3.6 Reliability and Validity of the Study

Reliability and validity of research are main criteria regarding assessment of the quality of qualitative research (Morse et al., 2002; Golafshani, 2003; Riege 2003). In this section, each criterion will be examined briefly.

3.6.1 Reliability

Reliability concerns consistency of findings emerged from data collection process (Thyer, 2010). Coherent interpretations from various interviews strengthen credibility and dependability of the research study. Reliability involves internal reliability criterion in which consensus within the research team is of high importance (Thyer, 2010). This criterion is ensured by providing written documents of summaries from interviews with corresponding interviewee to establish agreement on key points. This approach further supports author to obtain feedback and make necessary modifications and additions.

3.6.2 Validity

The degree of truthfulness of findings represents validity of the research study (Whittemore et al., 2001). Validity concerns accuracy of observations and measurements with what one declare that he or she is observing, or measuring (Bell et al. 2022). In order to ensure this criterion, author carries out regular cross-check and verifies the data that has been collected. According to Kirk & Miller (1986), strengthening the validity of the study might be burdensome as the research process iterative due to the fact that data and theory will be compared until motifs emerge. The validity is of importance for author to ensure how well findings from the study supports similarity in findings aside from the study.

4

Findings and Analysis

Chapter 4 entails data obtained from case company through ethnographic method as well as semi-structured interviews and internal documents. Meetings are held with production and purchasing department at Company X in order to illustrate ongoing quality issues and identify the causes of the high level of waste. Lastly, consequences and implications of current quality at operational level are analyzed.

4.1 Current Status of Production and Incoming Raw Materials

4.1.1 Production Processes

The packaging and tissue rolls are supplied and stored in the company. Later on, packaging rolls are sent to another company for printing on the rolls. Printed packaging rolls are sent back to Company X for further storage. Then tissue and printed packaging rolls taken from the warehouse are sent to the production area and are attached to the machine that will produce disposable eye cleansing wipes. Operator who is responsible for production inspects the process and calibrates the machine when necessary. Machine executes paper folding, nicking, tissue cutting, inserting tissue, filling in with chemicals, sealing and cuts to separate products. After production finalized, inspecting is performed on finished goods and scrap is separated. Products that pass quality check are packed and stored in the pallets to dispatch to the customers worldwide. Overall production flow can be seen in Figure 4.1 down below.

An overall view on how various functions work together is as follows: Foreign trade and sales department advertise the products and receives order and releases the delivery. The demand signal from sales reaches production planning department where specialists schedule, and monitor production processes. The right material must be in the right place at the right time in the right quantity so that planned production takes place. Company X has safety stock policy on raw materials, semi-finished goods and finished goods in which inventory levels falls below certain threshold, the signal reaches purchasing department on material needs to place order ensure production is supported.

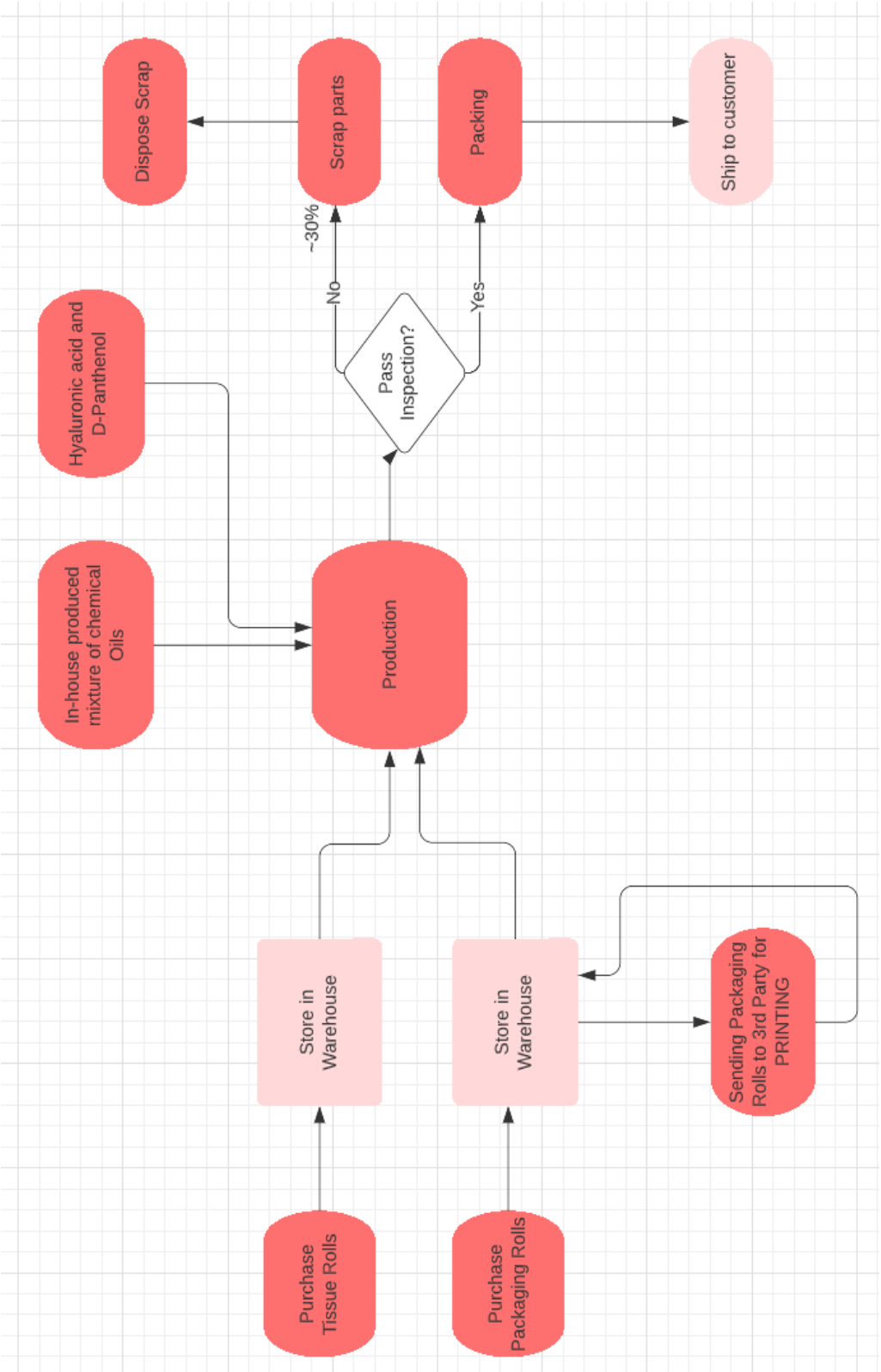

Figure 4.1: Production Flow Chart of Non-sterile product group

4.1.2 Problems Regarding Rolls of Tissue

Several problems are detected during interviews within the company. Products occasionally go through an inspection before they are stored. Because of this, the company is faced with higher costs associated with raw materials. For example, the tissue rolls come unpacked, thereby the rolls may turn out to be contaminated and these need to be determined later to be sent back.

According to the discussion with the machine operator, the quality of the paper is not sufficient and this situation causes delay in production and results in higher costs than expected. The most prominent problem with tissue rolls is its thickness in which some batches end up with tissues coming out of the package being quickly torn as referred in Figure 4.2 and Figure 4.3 down below. The underlying reason is that the company aimed to manufacture products from sustainable materials and to strengthen the image of the company in terms of sustainability.

The width of the tissue roll should have been 16 cm, but it turned out to be 15.7cm. This 3 mm loss signifies that 50-60 meters of paper waste is given to the company and other materials such as rolls of printed packages and chemicals used during the production are wasted. On the whole, it is seen that it is reflected in not only raw materials but also the time of operators, employees as well as electricity, water and other expenses. This has been an important indicator showing how a small issue can cause substantial problems.

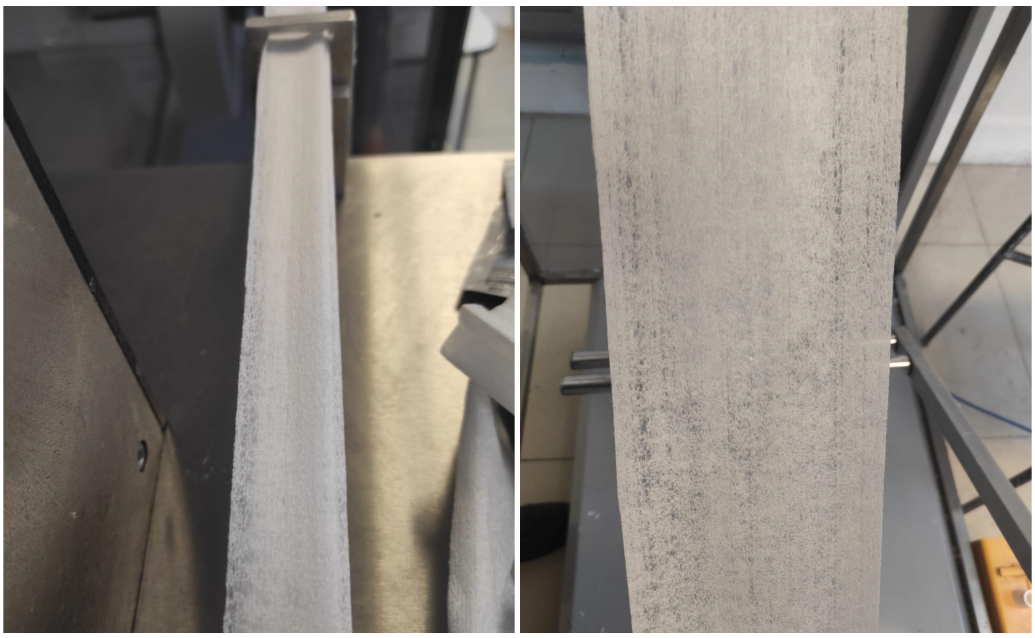

Figure 4.2: Tissue rolls made of recyclable material

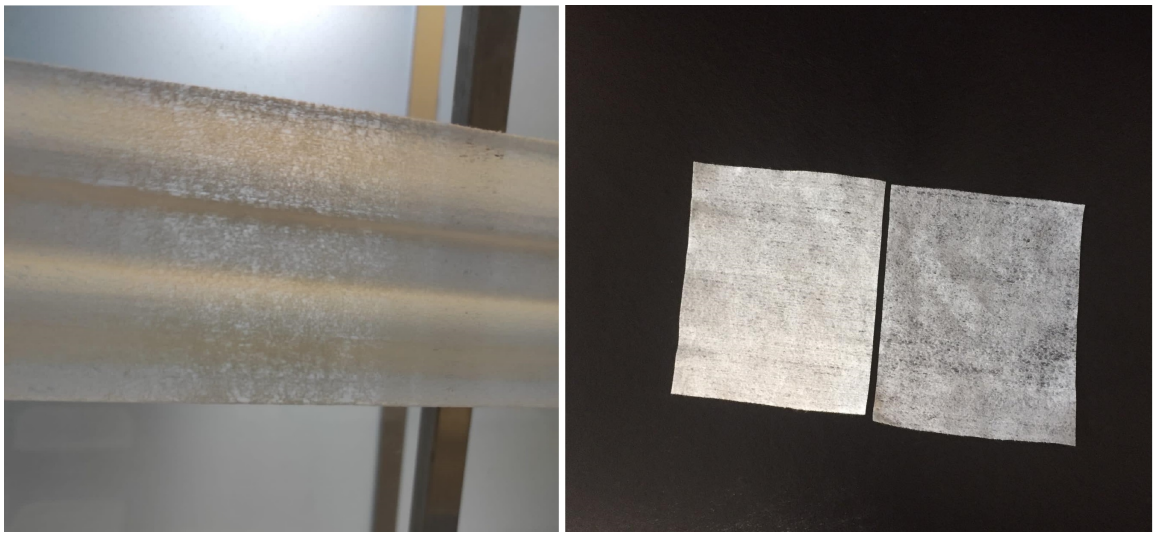

Figure 4.3: Tissue rolls made of recyclable material 2

Another issue regarding tissue rolls is that it has been manufactured by making additions in its production as illustrated in Figure 4.4. This issue is harder to detect visually and requires continuous and close examination by machine operator during the production. In case of a additive layer is detected, production ceases and necessary actions are taken to remove the defective parts from production. This situation causes the need of operator intervention and continuous calibration. Changing the settings of the machines at every joint of tissue rolls causes a loss of time in production. The company aims to terminate buying the additionally produced tissue rolls and to make the production flow smoothly.

Figure 4.4: Reprocessed Tissue Rolls as Raw Materials

4.1.3 Problems Regarding Rolls of Packaging

Thickness of rolls of packaging material causes a problem frequently especially when it is considerably slender. The situation is explained by the machine operator as the packaging rolls are running crooked if it is too thin. In this case, the packaging roll will not be cut from the right place and the cold seal will not be pressed in the right area which can be seen in Figure 4.5 down below. Such problems can lead to deterioration of the quality of the final product. If the WIP is notched or cut from the wrong place, it endangers other products due to the chemicals it contains. In order for the chemical liquid in the package not to come out of it and not to deteriorate the quality, thickness of rolls should be standardized.

Figure 4.5: Packaging Rolls and Seal Failure

Another problem is regarding the company which executes printing. Author collected complaints about the poor quality of the printed rolls of packaging papers. During the observation of the production processes at Company X, it is detected that the blue squares are not completely printed on the printing paper rolls and therefore a smaller area than the resulting square is painted with blue. Secondly, the unequal distance between the blue squares is another problem for the machine sensors. Because these sensors read, process the information and execute regarding action. For example, machines do not cut when its sensors do not see the square, or if the distance between the squares is shorter than it should be, they cut from the wrong place. Several examples where the machine sensor cuts and pierces in the wrong place are presented in Figure 4.6. Authors concluded that standardization is a vital element for mass production.

Figure 4.6: Samples of cuts and pierces from the improper place

Other serious problems with printing operations are that the quality does not meet the requirements of Company X. For example unacceptable variation in color saturation in products can be seen in Figure 4.7. Furthermore, lack of printing necessary information as well as dried print stains are documented in Figure 4.8 regarding printing failures, all categorized as waste and separated from the others for disposal.

Figure 4.7: Printing Colour Saturation Failures

Figure 4.8: Printing Missing Information and Printing Stains

4.1.4 Problems Regarding Chemicals

Another problem regarding the final product is the text on the package dissolves after a certain time. There is no unit taking responsibility for this issue. While the company holds the printing company responsible, the printing company claims that it is because the chemical in it leaked. During investigation, Supplier B and Supplier C further contacted to understand the phenomena and the ways in which solutions can be derived. The focus was on the need of adding a new protective layer of under printing to prevent disintegration of the printing ink material.

Figure 4.9: Chemical Leakage

4.2 The Reasons Behind Poor Quality of Incoming Raw Materials

The underlying reasons to be studied in detail are formed by compiling the information obtained from the interviews and written internal documents. While revealing the general and specific reasons, the relationships between Company X and each of the three suppliers were examined. The main reasons behind the phenomenon can be grouped under two headings, unclear written contracts and lack of control mechanism.

4.2.1 Unclear contracts

The reason of poor quality regarding incoming raw materials is attributed mainly miscommunication between supplier and buyer. First of all, the contracts are not well communicated between suppliers and Company X. Interviews with both sides reveal that suppliers and buyer have different understanding and interpretation regarding matter at hand. This circumstance inevitably leads to disputes and arguments.

Not having all details present results gray areas in the agreement. Expectations from the suppliers are not crystal clear. Particularly, specifications as well as delivery schedules in the contracts are not clearly described between suppliers and Company X. There is a need of adding more dimensions to ensure high quality and on time delivery, i.e. specifying further requirements regarding product characteristics and delivery terms.

When the contracts between Company X and all three suppliers are examined, certain deficiencies may appear to be causing the problem at hand. Regarding supplier A, supplier of tissue rolls, following elements are identified as problem. It is not specified that each roll must come packaged for transportation. Stating that buyer has right to reject and return the product in certain cases, e.g. consideration of the quality is not at the desired level, is a necessity. Furthermore, sustainability ambitions if not monitored well cause quality issues. Metrics such as the length of the roll, the width and length of the tissue paper were determined in the contract and well communicated. However, weight must also be determined due to fact that reusable material enters into the Company X's production. In the contracts made with the suppliers, it is not specified that the buyer should be informed in case of differentiation in the production process, which is the last deficiency related to quality. Due to the fact that Supplier A does not inform the buyer about a change in the production process is reason why additive layer is observed.

Regarding Supplier B, supplier of packaging rolls, no noticeable deficiencies is observed in the agreement. Thickness and weight of packaging rolls is stated clearly and Supplier B is well-informed regarding expectations by the Company X. Both initial packaging rolls and WIP (packaging rolls after printing) are examined visually and necessary measurements are performed. While no quality problem is observed

in raw material regarding packaging rolls, thickness of WIP rolls is proven to be occasionally too thin, thereby is not standardized. In this respect, meetings with supplier C have been set.

Regarding Supplier C, supplier of printing services, deficiencies are observed in the agreement. Although there is a written contract between the two parties, however not in detailed way, Supplier C has poor understanding regarding the level of expectation that buyer has buyer on product performance. The situation between Supplier A and Company X, lack of statement of buyer's right regarding return policy where quality is the concern, resembles to this situation between Supplier C and Company X.

From the quality point of view, lack of clarity on specifications and requirements regarding the characteristics of the product can be cited as the one of the main reasons attributed to quality-related issues. Contracts needs to be written in detail and should be clear to the parties involved. Lastly, communication on the roles and responsibilities should be straightforward.

4.2.2 Supplier's Production Process

A large part of the quality issues can be characterized as insufficient integration programmes with suppliers, lack of attention in the supplier development and miscommunication between buyer and supplier on product characteristics and required level of quality. Unclear or inadequate communication between supplier and buyer is observed regarding Supplier C and Company X. Lack of attention also observed in supplier buyer relationship development.

The main issue is related to production process of the supplier, due to the fact that the heat and pressure applied by the machine during printing differs, variations in the thickness of packaging rolls have been observed. This further results unequal distance between blue squares. Additionally, failure to clean the machine after the previous production batch causes the packaging rolls to become polluted and stained during the next printing.

4.2.3 Lack of Control Mechanism

KPIs are critical because you obtain relevant insights regarding current performance levels. Furthermore, they need to be questioned periodically if they are still relevant to the business. Outdated KPIs should be updated to function well as a real-time tool that navigates company to have better performance. Purchasing department at Company X has established set of KPIs to measure and monitor supplier performance over time. With a scoring system, purchasing team determine whether a particular supplier passes appropriate criteria. Evaluation criteria divided into five categories in which compliance to standards described on order/contract, on time in full (OTIF) delivery, the supplier's pricing and ease of payment, supplier's work

ethics are the main concerns. Each category has a certain penalty point, and if the supplier's score falls below a certain threshold over certain time, the business relationship with the supplier is terminated.

Despite having scoring system and KPIs at hand, some part of the metrics used when measuring product and supplier's performance are not communicated well with the suppliers. This phenomenon causes disputes between the parties involved, make solution process more difficult. Terms of the buyer should be clear to each supplier to ensure providing target performance.

KPIs including OTIF, compliance to standards appear to be most effective metrics. Effective KPIs indicates your performance levels, certainly. However, if you are not using them to inform decisions you make and to improve performance, then, mediocre performance pitfall is inevitable. Observations during ethnographic studies forms that there is a crucial need of understanding for purchasing team why these KPIs exists. Sense of purpose needs to be established in order purchasing team to understand KPIs and thereby develop most effective approaches and strategies to achieving them.

4.3 The Consequences and Implications regarding Poor Quality of Incoming Raw Materials

Quality issues with materials entering the production processes of Company X have caused various problems including to disturbance in production process, decrease profit and cause economical losses. Author begins with investigation of the factors behind damaged business operations and reduced profit margin.

Cross-functional department interviews revealed varied factors contributing the lowered profit margin. First round interviews within the Foreign Trade Department disclose issues of transportation of the goods. They expressed that securing place for sea transportation becomes challenging due to the fact that the end products to be sent are not ready. When the products are ready, it has been determined that the delivery of the product is either delayed for a certain period of time or expedited shipping is made, since there is no available space on particular mode of transportation at that time. Failure to deliver the end products on the promised date result in lowered delivery reliability of Company X in which the condition depicts the company in the customer eye as flawed.

Additionally, demand of eye cleansing wipes around 90.000 units/month. Considering the scrap and waste in the manufacturing, the company produces 100,000 units. Although the company decided on producing more than 10% than actual need, they cannot meet the volume of target qualified end product. This situation further puts extra workload on the production planning division so that they deliver the right amount on time that they agreed upon with international customers. With this

approach, not only the delivery reliability issue remains, but also it created more problems due to resulting in inflated waste and cost.

Interviewee from the sales team affirms that the sales increased over time and expected to increase in the future (Company X, 2022). The underlying reason for this situation was related to the fact that Company X went into e-commerce and started selling its products online shortly before Covid-19 outbreak. During this time, Company X began trade with leading e-commerce platforms including "Hepsiburada", "Trendyol", "n11", "dermobakim" operating in Turkey that provides business-to-consumer sales via the Internet. It was observed that sales increased due to the effect of gravitation towards online shopping and outbreak of pandemic in 2019. As neither the sales volume nor the prices of the products is not the issue, the low profit margin is mostly associated with the inflate in costs.

The company did not recall eye cleansing wipes due to the fact that Active Pharmaceutical Ingredient (APIs) are both produced and controlled through microbiological and product physical chemical tests before they enter into the production. This risk is related to problems that may arise while the consumer is using the product, such as damage to the skin. Thus, Company X eliminates the risk of harm to consumer, product recalls, high replacement costs, potential lawsuits. Despite eliminating this risk, other types of risks exist for the focal firm.

4.4 Cost Analysis

In order to visualize the impact of the issue on the Company X business, waste cost elements are identified, associated costs and total cost is calculated.

4.4.1 Waste Cost Elements

Author has identified the cost elements for the waste which are later further discussed during the interviews. Data collection from various departments including purchasing, production, sales provide valuable insight for calculations of the estimate unit costs. The elements approved by the company are presented in Table 4.1. Estimated unit costs will be utilized to calculate the expected total cost for the company regarding waste.

Five main areas of industrial waste is detected. First area is the cost of purchased raw materials which contains materials that are scrapped and non reusable. The end-product, eye cleansing wipes, has four main input materials including biochemical solution, rolls of tissue and packaging, and printing services.

Second area is associated with transportation of the materials between Company X and its suppliers. In the production process, rolls of packaging transported from one supplier to the focal company to send further another supplier for printing services. After stamp is performed, material requires to sent back to Company X for

production. If end-product If is not suitable for use during last inspection, all these transportation processes will be reflected to Company X as extra costs.

Thirdly, storage costs need to be considered as well. The electricity needed for storing the material at proper condition and the effect of the extended delivery time on the cost and capital tied up to inventory are the main elements of this cost branch.

In the heart of production, cost elements including cost of manpower, running machine, maintenance of the machine, and electricity needs to be considered. Lastly, the waste and scrap of the products must be disposed of. Company X has a contract with a third party to eliminate the industrial waste.

Cost Breakdown			
No	Main Set	Cost Element	Unit costs
1	Raw Material	Chemical Solution Packaging Rolls Tissue Rolls Printing	27.45 EUR/kg 4 EUR/kg 2.85 EUR/kg 1.75 EUR/kg
2	Transport	From supplier to Company X Sending for printing services and transport back	2 EUR/20 DS 2 EUR/20 DS
3	Storage	Electricity The effect of the extended delivery time on the cost	300 EUR/mo 2.5%/mo
4	Production	Hourly labor cost Cost of running the machine Maintenance cost of the machine Electricity	52.5 EUR/h 173 EUR/day 1150 EUR/3mo 600 EUR/mo
5	Elimination	Disposal costs of non-conforming products	173 EUR/3mo

Table 4.1: Cost Breakdown of the Waste and Unit Costs

4.4.2 Predicted Total Cost

1, 1.5, and 2.5 tonnes of tissue rolls, packaging rolls and chemicals used during last six months, respectively. When we look at the average production during last three months, approximately 0.5 tonnes of packaging rolls, 0.75 tonnes of chemicals and 0.4 tonnes of tissue rolls considered as waste. It requires to be reflected this esti-

mate to the annual amount. Total cost has been calculated through adding five cost elements and each computed through multiplying unit costs with total volume. In order to present the degree of impact of waste has on Company X's business, annual cost regarding waste is considered.

Estimated annual waste cost is approximately 58,000 EUR. 42 percent of total cost comes from logistics activities includes transportation and storing the goods. Furthermore, 43 percent of total cost comes from raw material waste in which chemical material constitute approximately 4 out of 5 of the total cost. 10 percent of waste comes from labor cost regarding production.

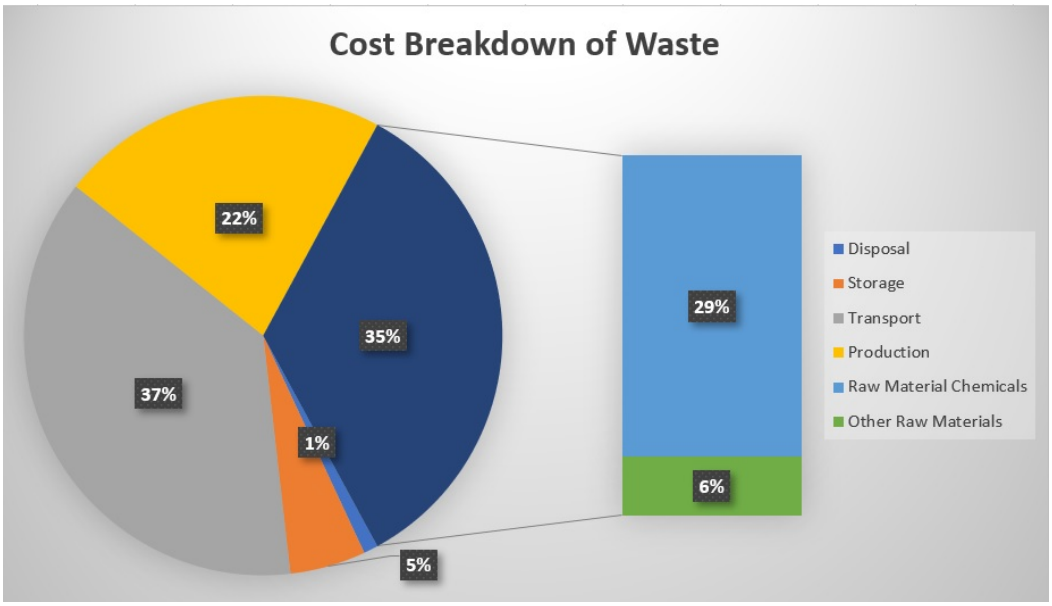

Figure 4.10: Cost Breakdown of Total Waste Cost

5
Results

This chapter is dedicated to find solution for the research question constructed in the first chapter. Each question is handled in a detailed and separated way. Lastly, potential solution proposals are compiled, discussed and presented.

5.1 Best Practices in Supplier Relationship Management

Collecting critical elements of managing supplier relations to ensure product quality and improve supplier performance is the one of the most critical points of this research. To find the answer to first research question down below, literature review was conducted and the best industry practices are compiled from literature.

RQ1: *What are the elements every successful supplier management program should encompass? What are best practices for ensuring good quality with supplier management based on literature?*

In the overall picture, buyer must single out best suppliers, continuously assess current suppliers performance, disqualify ineligible ones, and gather necessary info regarding potential suppliers periodically or when necessary (Zeng et al., 2008). It allows the buyer working with the right suppliers over time.

Every successful supplier relation stems from having effective communication. To be able to achieve that, buyer must first define business requirements clearly through involving cross-team communications prior to seek candidates. Purchasing strategy reinforcing company's overall strategy to reach its goals and objectives returns as large advantage in establishing buyer-supplier relationship. Thereafter, effective and open communication for expressing requirements clearly with suppliers will become an advantage. This further supports having a clear understanding of supplier's capabilities. It is of high importance to have knowledge on supplier capabilities. Lack of oversight will lead to disputes and conflicts between buyer and supplier in the future.

Another important element in having successful supplier relations is to determine the right strategy toward a particular supplier. Because not all supplier relations are similar and thereby this situation creates a necessity to differ management approaches toward supplier base. For that, supplier segmentation is needed and a must which can be achieve through different techniques mentioned in section 2.1.4.

Kraljic Matrix is one of the tools to segment suppliers and derive strategy for each group. This approach helps buyer to avoid strategic mistakes.

After deriving the right strategy and expressing expectations clearly, the focus should be on eliminating all gray areas in the agreement. Additionally, during the negotiation process, it is beneficial to discuss how buyer and supplier will act in the event of a change. Discussing change procedures allow both sides to act collectively on how to adapt to a change. Lastly, before incorporating new suppliers into the system, candidates must go through a series of evaluations in terms of financial soundness and suitability to buyer.

The supplier relationship management does not end with solely writing the clear contracts. As it is mentioned in section 2.1.2., supplier management is a dynamic process where buyer must continuously monitor and evaluate supplier performance with relevant performance metrics. In performance management, product and supplier performance assessments are essential to ensure quality and steady flow of supply. To be able to achieve this, the evaluation system must be transparent. It is crucial to explain how buyer measure supplier's performance to its supplier base. Therefore, KPIs determined by the buyer must be provided with the supplier in advance. It will allow the supplier to understand what is important for its customer and improve its performance.

In-house expertise at the buying firm is also a crucial element in achieving successful relations with suppliers. Therefore, the ways in which raising internal expertise should be a consideration for managers to give strategic importance to. The methods including in-house training, e-learning, and knowledge sharing must be encouraged to maintain superior supplier relations. Through encouragement and information sharing, purchasing specialists can analyze past corrective actions in case of an issue and analyze if they have sufficient visibility of the issue. Not only increasing expertise, but also defining roles and responsibilities is a critical success factor for the buying firm. This approach will reduce conflicts through clearly defined responsibilities. SRM maturity level is also a key determinant of strategy and defining processes in supplier relationship management.

While this section focuses on the elements for successful supplier management, the next section illustrates the supplier-related quality problems present at the focal company.

5.2 Ongoing Quality Issues

The objectives of conducting the first six interviews were to present the current state of quality regarding particular product group. Interviews with representatives from both Company X and all three suppliers were used to answer the second research question.

RQ2: *What is the quality of supplied materials associated with non-sterile product group?*

Six interviews were made in total to compile quality issues. Identified set of issues are explained in detail in chapter 4 and is presented down below in Table 5.1. Firstly, wooden pallets including 10 rolls are packaged all together, however, every tissue roll must be packaged individually before sending them to prevent the risk of contamination in the product. Secondly, sustainability targets should not be included in the current plan. On the contrary, the priority should be ensuring high quality and improving current supplier relationships or establishing new one(s). Thirdly, miscommunication between Company X and Supplier A on production processes result in additions in tissue rolls. Regarding production process of Supplier A, it should be explained and communicated that no additions are allowed to be made with a new roll where the previous tissue roll ends.

Remaining quality issues are related to the communication difficulties between Company X and Supplier C. Variation in thickness regarding rolls of packaging occurs by cause of heat and pressure differences applied by the machine during printing process. It has been determined that as the thickness differences occur, thereby it extends in millimeters in length. As mentioned in section 4.2.2, the non-standardized production process of Supplier C result printing the blue squares read by optical readers at non-equal intervals. This further results cut, piercing consecutively, and/or seal at the wrong places. Additionally, further failures regarding printing including color saturation, dried print stains and missing information are summarized in Table 5.1.

Material	*Quality Issue*
Rolls of Tissue	Contamination due to poor packaging
	Sustainability targets vs quality requirements
	Reprocessed material (additions)
Rolls of Packaging	Non standardized thickness of the material
Printing on Packaging	Printing Failures (regarding sensors)
	Variation in color saturation
	Dried print stains on the material
	Missing Information

Table 5.1: Compiled Set of Quality Issues

5.3 Underlying Reasons for Quality Issues

Four interviews were made with Company X and representatives from three suppliers that are used to grasp the underlying reason why there are quality issues in

the final product. Internal documents including current contracts with suppliers, supplier evaluation forms are used to support the results. Interviews and internal documents are used to answer the third research question:

RQ3: *What are the reasons associated with the quality problems of these materials? How the pharmaceutical company can manage supplier relationships to improve quality of materials?*

The underlying reasons can be gathered in three main headings which are (1) unclear contracts, (2) lack of communication between buyer and suppliers, (3) lack of control mechanism. Regarding the first group, the main issue is a lack of clarity in contract clauses, e.g. requirements regarding specifications of product characteristics. There is a need of adding clauses related to situations requiring Company X's approval. In case of Company X's supplier changing its own supplier, or its own production processes, suppliers need to notify and must be approved by Company X.

Implementation of these additional clauses regarding obtaining approval depends on the power balance between the buyer and suppliers. The challenge in finding substitute materials, number of suppliers in the upstream market, whether Company X is a critical customer for that supplier, are considered. Company X is not in a strong position to exert power for the current suppliers due to the fact that the abovementioned factors are not in favor of the Company X. Therefore, it is expected for Company X to have business hardships in terms of obtaining favorable terms and conditions. Although the balance of power does not allow for adding such clauses, it is a fact that the expectations from the product can be controlled by writing in detail and communicated clearly.

Secondly, lack of communication between buyer and suppliers is observed. Roles and responsibilities are not clearly developed. There has been disputes on who is going to take responsibility of a certain problem. Employees criticize a different role because no particular department or person does not take responsibility. Therefore, it is a need to divide roles and responsibilities clearly and must be documented. Additionally, suppliers are not fully aware of performance metrics and how Company X measure their performance.

Thirdly, control mechanism does not function adequately. The responsible purchasing specialist does not see the importance of tasks with the current suppliers and is unaware of the situation and its consequences. Being insufficiently involving in control indicates that this purchasing specialist does not prioritize the tasks in her operational and strategic workflow. KPIs should be communicated to the purchasing specialist. There is a need to work on updating metrics to ensure their relevance to the business, and monitor suppliers attentively. Identified set of rationale is summarized and presented down below in Table 5.2.

	Unclear Contracts	Lack of Control Mechanism	Lack of communication between buyer and suppliers
Rationale	**Contracts involving Gray Areas** • Unclear **specifications** regarding product characteristics • Unclear delivery schedules • **Requirements** are not written **in detail** • **Missing clauses** related to situations **requiring buyer's approval**	**Issues** regarding monitoring supplier performance • Clarifying significance of KPIs to the purchasing team • Requirement of updating metrics to ensure their relevance to the business	• Division of roles and responsibilities are not communicated well • Supplier **unfamiliar to performance metrics**, how buyer measure suppliers' performance. • Lack of informing buying firm under certain circumstances (e.g., supplier change of supplier, change of raw material, or alteration in production process)

Table 5.2: Compiled Set Rationale Regarding Quality Issues

5.4 Consequences and Implications of Ongoing Quality

Five interviews made within Company X including production planning, purchasing, sales, logistics departments are used to compile consequences and implications of having poor quality and high level of waste. Interviews are used to answer the fourth research question:

RQ4: *What are the consequences and implications of having poor quality of incoming raw materials?*

Current status of the quality regarding incoming raw materials cause damage in business operations including shutdown of the machine and production stops. Despite high production levels, most of the times, the target volume cannot be produced on time and option of expedited transportation has to be made or late delivery to the customer has accepted. Due to safety stock policy, stock-out problem is not observed. Neither rework is possible because it is a single-use packaged product.

Secondly, the situation influences bottom line as it reduces total profit margin regarding non-sterile product group. One comment regarding production is that Com-

pany X has a strategy of producing more than the actual need the to mitigate the risk of not delivering on time. This further leads to high scrap costs through yield loss. In case of expedited shipping, due to the change in the transport mode from sea to air, transportation costs increase. Expected total cost of having poor quality is presented in a detailed way in section 4.4.2.

Thirdly, in the eyes of the business customers of Company X, there is a loss of brand value due to current delivery reliability performances. It is difficult to calculate the cost of losing customer for Company X. However, as it is a critical element, should not be overlooked. Observation of sales increase can be explained through two reasons: effect of gravitation towards online shopping and outbreak of pandemic in 2019. The reason why market share loss is expected but not seen is that Company X enters e-commerce platforms and gain high visibility by end-consumers. Lastly, product recalls, high replacement costs, potential lawsuits regarding harm to consumer is highly cited in the literature. However, as Company X has qualified chemical engineers and in-house production of chemical solutions, these problems have not been observed. Consequences and implications are summarized in Table 5.3 down below.

	Consequences and Implications
1	**Damage business operations (Ali, 2020)** • Production shutdown • *Rework ** • Extra Transport / Expedited Shipping • *Lean inventory strategies? Stockout problems? **
2	**Damage bottom line / Reduced profit margin** • High scrap cost, i.e., yield loss (Ali, 2020) • Delay in Shipment or Expedited Shipping
3	**Damage Reputation in Reliability (in case of a delay)** • *Reduce market share ** • Tarnish brand image
4	**Harm to consumer, product recall, high replacement costs, potential lawsuit * (Roloff and Aßländer, 2010; Lee and Li, 2018)** • Negative. Active Pharmaceutical Ingredients (APIs)-microbiological and product physical chemical tests

Table 5.3: Compiled Set of Consequences and Implications

5.5 Solution Proposals

Three interviews were carried out with purchasing team and CEO where the focus was to what can be done. Results from the interviews used as input to answer last research question:

RQ5: *What are the recommendations and solution proposals to the Company X to overcome the quality issues regarding its raw materials?*

The solution proposals for the raw materials and associated suppliers are discussed down below. Firstly, possible solutions will be explained. These solutions will then be discussed to find and implement the best solution and recommendations will be given in accordance with the literature.

5.5.1 Solution Proposals regarding Rolls of Tissue

Interviews reveals that Company X purchases rolls of tissues from 2nd tier supplier which make adjustments in the product. The current supplier, Supplier A, purchases in large volumes and then resells them to other producers. Among several options, first one is to discuss ongoing problems with Supplier A with the possibility of rewriting contract to clarify expectations from the supplier. One advantage of having updated binding contracts forces participants to comply with the new conditions and terms. Regarding quality, it can be communicated that Company X demands each piece of tissue to be 12cm x 10 cm x 45g, no addition is allowed, and packaging for each 17m tissue rolls for preventing contamination. Even though Company X decided to increase inspections before incorporating the raw materials into its production system, it is recommended them to discuss above mentioned problems with Supplier A before ordering a new batch. Company X observed to be willing and open to arrange meetings and debate problems regarding the product performance and expectations from its supplier.

Second alternative is to pursue single sourcing strategy with a new supplier. Interviews conducted with purchasing team reveal several possibilities in which it could be achieved through bypassing supplier A and directly source from the manufacturer, or finding a completely new supplier in the upstream market. Sourcing directly from the manufacturer is equivalent to single sourcing strategy as Company X deliberately prefer to have one supplier. Alternative supplier options exists in Istanbul region.

Company X started evaluating if it is possible to make special orders directly to the manufacturer. In this perspective, Company X is required to consider higher purchasing volumes. Current volumes are 250 kg and Company X states that they are ready to increase the volume up to 2 000 kg to and then keep the stock in its storage. Company X, further consider special orders, i.e. demanding 50m rolls instead of 17m in case establishing business with the supplier of Supplier A. Increase in volume in

purchasing expected to have an increase in power of Company X in the negotiations.

For company X to customize special orders from the manufacturer, increasing purchase volume is a requirement. This prerequisite should not be overlooked in the decision making process.

Having a strategy of single sourcing toward supply side regarding non sterile product group has its own advantages and disadvantages for Company X. Therefore, third option is to consider dual sourcing. Regarding this strategy, Company X needs to consider distributing the volume between the two entities.

Even though Company X is willing to discuss expectations, and to redetermine terms and conditions, on-going meetings demonstrates that Company X is unable to reach agreement with Supplier A due to lack of compromise from supplier side. It is highly possible that Supplier A anticipate that the change will not be effective due to previous conflicts and disagreements. Therefore, the remaining options, single and dual sourcing, needs to be analyzed to establish the one which in line with Company X best interests.

The manufacturer, as well as other supplier options in the upstream market, have single plant to supply raw materials to Company X which poses potentially a higher risk regarding supply disruption for buying firm. In other words, the probability of arising issue at the two entities at the same time is expected to be less in dual sourcing. For this reason, if Company X prefers to continue its strategy of working with a single supplier, it should be aware of the risks and develop contingency plans with the new supplier to mitigate the risks. One explanation why Company X is inclined to have a single supplier is that the business impact of the non-sterile product group is relatively low, and thereby this risk is expected to be less important for the company.

Risk of price escalation is another dimension needs to be considered. Concept of working with a single supplier will create higher risks to Company X regarding unreasonable price levels, especially considering the manufacturer, the supplier of Supplier A, and Company X has a lack of business relations before. In other words, trust has not yet been established between parties involved. While the idea of joint cost reductions seems like a reasonable goal, less competition on the supply side exposes Company X to price escalation risk.

Regarding logistics and inventory management dimensions, single sourcing is advantageous due to Company X expected to achieve higher ability on scheduling deliveries, coordinating the shipments, and make production smoother. Since fewer variables enter the process, the management of the operations will be easier. There will be higher possibility to have less number of delivery issues due to consolidation of the volume and having less number of deliveries. Geographical proximity is relatively same as the manufacturer and Supplier A located in the same city. However, other supplier options being located in Istanbul, is approximately 300km closer than

the manufacturer and Supplier A. In case of selecting a completely new supplier in Istanbul, it should be taken into account that the transportation costs expected to be reduced.

Amount of administrative work expected to be comparatively higher in dual sourcing. Additionally, enforcing standards to improve quality becomes harder as business volume is divided into between two different entities. On the contrary, consolidating volume in single entity, facilitates Company X to motivate supplier to conform to product requirements and work towards shared goal.

5.5.2 Solution Proposals regarding Rolls of Packaging

Internal documents including contract between Company X and Supplier B and supplier evaluation forms are reviewed. The contract is well communicated between parties involved and demonstrates that the way Company X set clear demands. Furthermore, both Company X and Supplier B observed to being open to communication which enables mutual development. During one of the meetings with Supplier B, on going issue has been brought it up and discussion initiated regarding how participants can solve the problem.

It is detected that the thickness of the paper and unequal spacing between blue squares occur as a consequence of stretching the rolls of packaging while printing. Heat and pressure differences while printing in various lots are the main indicators why some rolls of packaging stretch.

Holding another party accountable when there is a problem both distracts participants from understanding the problem, harms business relations. Incorporating supplier's knowledge within the process of the issue strengthened effectiveness of the solution. During the meetings with Supplier B, cooperation between Company X and its supplier enabled detection of the root cause of the problem.

If standardization is achieved in WIP production, it is expected that the problem will resolved. Therefore, it would be more appropriate to concentrate on the solution process with supplier C instead of supplier B. There is not much can be done about this issue in the eyes of supplier B. Only temporary solution that Company X can do is to put effort on the detection of stretch and motivate the machine operator calibrates the machine in millimeters and makes sure where to cut manually.

5.5.3 Solution Proposals regarding Printing

Several rounds of meetings are held with Supplier C, providers of printing services on the packaging rolls, to discuss the problems regarding product failures. Supplier C does not currently acknowledge that certain issues comes from differences in their production processes. Representatives from Supplier C does not accept the respon-

sibility of current quality issues and instead points to Company X as responsible.

A temporary solution that Supplier C and Company X suggested was printing a smaller area in the packaging in order for sensors to capture blue boxes better and perform certain activities accurately. It can be done by having the printing machine zoom in by 5 %. Furthermore, the supplier accepted some of the quality issues including color saturation and missing information failures. Company X informed Supplier C regarding product performance and gives a warning to improve product quality in all dimensions in the future.

Even though Company X holds Supplier C accountable regarding issues concerning non standardized WIP of packaging rolls, printing ink stains and chemical leakage, the supplier rejects that the root cause attributed to their production processes. Although some resolution processes provide a temporary solution, it seems that a long-term solution cannot be agreed upon.

Furthermore interviews within the quality control department at Company X reveals that even though the chemical solution is not as strong as acetone and ethanol, the mixture of Tea tree oil, St. John's Wort oil, Wild Sea buck thorn oil, Hyaluronic acid and D-Panthenol is a strong enough to dissolve the printing material. In other words, it leaks out and deteriorates the printing quality. The urgency regarding the need for a solution to this issue is high.

According to the interview within the quality control department, two possible solutions are derived to avoid risk of leakage in production and sending wastes to extermination. The first option is to demand Supplier C to make additional protective layers. The second option is to search for a new supplier who can provide requested printing service solutions with additive securing layer. In the second option, single and dual sourcing options will be discussed. However, first action should be evaluating whether the problem at hand can be resolved with the current supplier, because, switching supplier, and breaking on-going business relations must not be the first possibility.

During meetings with Supplier C, Company X requests if it is possible for the supplier to add an extra layer to protect printing. Supplier C states that they do not possess such a technology in their facility and thereby they are currently not able to provide such services to Company X. Considerable degree of investment must be made in such technology to meet buyer's requirements. Company X is open to increase purchasing volume and communicate price increase towards its own customers if it is a possibility. However, as buying firm's purchasing volume constitutes not large part of supplier's income, it is not strategically attractive option for the supplier to expand its services. The reason why they are not willing to invest in such technology can be explained low strategic return of the investment.

It should not be overlooked that they also do not take responsibility regarding several issues including non standardized thickness of packaging rolls caused by printing

as well as dried stains on the packaging. The meetings between Company X and Supplier C demonstrate that it is not possible to reach agreement due to following reasons: increased expectations of buying firm, reluctant behaviour of supplier. As a result, viability of the business relation is being questioned.

As a single sourcing strategy, a candidate company offers located in Istanbul that they can put on an additional layer to guarantee leakproof of packaging. This layer called UV LAK prevents substance diffusion when applied onto packaging rolls. UV LAK layer can be thought of acting as a cellophane paper which ensures the sealing and impermeability. This candidate company also provides UV printing technology which uses ultraviolet light to dry the coating and ink at the same time when it hits the packaging rolls. Thus, the undesirable effects of the active ingredient of the Company X's product on the printing can be eliminated.

Dual sourcing is not an attractive solution for Company X for several reasons. First of all, they do not have enough volume to divide. In other words, Company X might face with higher prices as a result of buying lower quantities per supplier. Additionally, maintaining relations with higher number of suppliers might increase transaction cost. In conclusion, this strategy is not appealing for SMEs like Company X as they cannot use volume to leverage own advantage.

Working with a new supplier seems an inevitable action for Company X. However, certain consideration needs to be assessed. Overall recommendations for Company X will be shared in the section 5.5.4. below.

5.5.4 Overall Recommendations

Regarding tissue rolls and printing services, the first and foremost recommendation is to consider working with new suppliers due to insurmountable problems with existing suppliers. Continuation business with supplier B for packaging rolls is supported.

Regarding rolls of tissue, the material has low unit cost and low volume, thereby business impact can be characterized as low. Additionally few suppliers in the upstream market and absence of substitute for the material characterizes supply risk as high. Accordingly, production should not be interrupted. Place of the material in the Kraljic Matrix has been determined as bottleneck and shared down below in Figure 5.2. It can interrupt production and create a crisis even though low level of business impact. In this respect, securing supply must be a priority for Company X through actively developing new suppliers.

Literature further assists us to make right strategic decision tailored to Company X. The most cited risk in the literature, supply disruption, has been the biggest factor in decision making (Treleven & Schweikhart, 1988; Berger & Zeng, 2006; Yu et al., 2009; Namdar et al., 2017). As Company X currently works with only one supplier, its supplier having a sole plant, not having a contingency plan in place put Company

X in higher supply risk. It is recommended Company X to have the strategy of dual sourcing regarding rolls of tissue. As the current volume levels, cost benefits through EOS are unlikely to be achieved, thereby consolidating volume to a single supplier expected not to create strategical advantage. If Company X adopts dual sourcing, risk of price escalation also reduced. Especially when there is no trust established between buyer and supplier yet, dual sourcing expected to be effective method preventing opportunistic behaviour of supplier and ensuring reasonable price levels for Company X due to its suppliers are aware of each other. The only disadvantage pursuing dual sourcing strategy is that administrative work regarding scheduling and coordinating expected to be increased. Furthermore, volume is recommended to divide between the suppliers based on their capacities and annual return ratios.

If Company X decides to work with a single supplier, contingency plan must be done between Company X and its candidate supplier and risk of supplier's opportunistic behaviour must be acknowledged.

Regarding rolls of packaging, business impact of the material is characterized as low for the exact same reasons. However, there are relatively more options in the upstream market. Therefore, the material placed in between bottleneck and routine items in the Kraljic Matrix in Figure 5.2. Crisis or disruption at production is not expected due to the fact that it seems possible to find a new supplier until the inventory runs out as they work with quarterly inventory. In this respect, priority for Company X should be in between standardization, efficient purchasing processes and securing supply.

Company X currently works with only one supplier for rolls of packaging, and Company X and Supplier B does not have a contingency plan in place. Supply risk can be characterizes as relatively low compared to rolls of tissue due to higher number of supplier. It is recommended Company X to pursue single sourcing strategy and develop a contingency plan with the Supplier B regarding supply disruption risk. This risk is low due to the fact that Company X has ability to initiate business with other suppliers in the market. Furthermore, risk of price escalation is low due to the fact that Supplier B and Company X doing business for more than 5 years, and trust between them is established. Company X expected to gain more ability to schedule deliveries and coordinate shipments and ensure smoother production.

Buying printing services has both low business impact and supply risk because of low volume and unit costs, and abundance of suppliers who can provide this particular service. Therefore, it is characterizes as routine/non-critical item in the Kraljic matrix in Figure 5.2. In this respect, priority for Company X should be in standardization, efficient purchasing processes. Single sourcing is convenient. There is neither high risk regarding supply nor the risk of price escalation due to convenience for Company X to find a replacement. There will be less administrative work regarding single sourcing.

Regarding ensuring standards to improve quality for every supplier, Company X do

not have the power to impose sanctions because the volume is not large enough. Furthermore, regarding rolls of packaging and printing services, it is recommended to Company X to assess candidate suppliers intensively regarding managerial capabilities and operational performances. Therefore the recommended supplier development strategy falls within the first level of involvement with the supplier. However, regarding rolls of tissue, as it is bottleneck item for the company, increasing volume, reward supplier with future business can be an advantage which requires higher involvement (e.g. supplier incentives) from the Company X.

Lastly, it is necessary to prepare new contracts regarding rolls of tissue and printing. It is recommended to write clear and detailed contracts and to eliminate gray areas in the agreement. It should be noted that it takes time and effort to prepare a good contract. To remove potential disagreements, supplier should be encouraged to ask questions and demand clarification for the things unclear to them prior to signing the contract. Furthermore, KPIs should be clearly mutually determined with suppliers to allow them to understand what is acceptable or not regarding the levels of performance. Ultimately, consequences should be stated clearly as well.

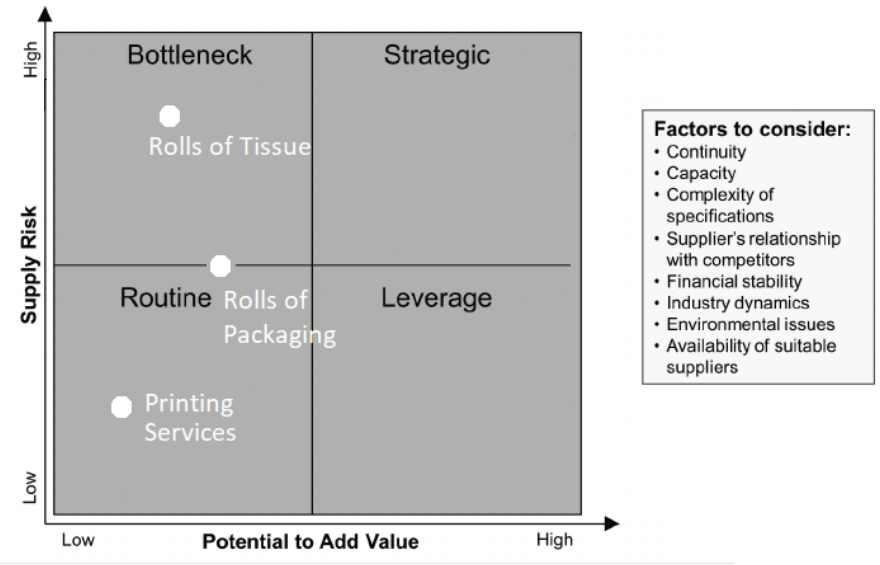

Figure 5.1: Supplier Segmentation

6
Discussion

Chapter 6 involves interpretation regarding results and findings. It further includes comparison between case company results with the relevant literature.

Theoretical frameworks of Kraljic (1983), Treleven & Schweikhart (1988), and supplier development strategies from Sillanpää (2015) helped author to develop certain suggestions for the focal company. The way in which ongoing operations works as well as overall findings demonstrates the shortcomings in strategy formulation toward some parts of its supply base. The focal company does not demonstrate much similarity in theory, which can be explained through purchasing officer having insufficient knowledge on the subject, low impact of non-sterile product group on the focal company business. Results explain underlying reasons of having such problems and point out that the current way of managing business relations with some part of its supply side is insufficient.

First and foremost contribution from the study is to provide new insight to the case company to take into consideration in decision making how to move forward. The thesis studied current supplier relations to make Company X to build a plan to proceed and strategizing its sourcing activities. Implications of the findings in analysis part are case specific, thereby are unique to the focal firm circumstance. However, results can be beneficial to other SMEs in similar situation. In such situation, the study will help SMEs to become aware of possible risk factors regarding supply, what to pay attention to, and how to secure supply, and the what steps need to be taken to ensure good business relations with supplier.

6.1 Managerial Impacts and Weakness of the Study

It can also be deduced how such issues are a result of the size of the company and how they do not really have the resource to appropriately understand how to work with supplier relations in a structure manner. This provides an insight regarding supply operations for companies that do not have the maturity in their supplier relationship strategy. In large corporations, they already have incorporated employees who are specialized in the field, and have necessary systems and education in place. Such large companies have a budget to train its own employees if deemed necessary. In this respect, main conclusion is to provide direction and demonstrate what kind of steps should be taken for SMEs who do not have sufficient resources.

One weakness of the study is that connecting research project to theory, providing an entry point to academical relevance rather than purely conducting it as consultancy assignments. It can be further questioned that whether or not focal firm should have such a diverse portfolio of products if they cannot really monitor their suppliers effectively. Argument being that perhaps they should make sure to assure quality within some key product categories and create good routines before diversifying into having many suppliers and many product categories.

The study also implies that there are major inter-dependencies among decisions. For example, how many suppliers to have, where should they be located, how much inventory should the buying firm have, how much the purchasing volume should be, when to buy, where to store and etc. Production, purchasing, inventory management considerations should reinforce the overall strategy, and there is no single way to achieve it.

Another takeaway from the study is that every strategy has its own trade-offs. Firms may decide to work with multiple suppliers or holding higher inventory levels to mitigate the supply risk. The presented strategies are shaped by examining the different dimensions mentioned by Treleven & Schweikhart (1988), and consideration of supply segmentation from Kraljic Matrix (1983) and supplier development strategies from Sillanpää (2015).

The study also indicates that SMEs might not have the position to exert power on suppliers to comply with its business demands due to its volume levels. Thereby acknowledging the situation in communication and negotiations will reduce disputes to some degree. Furthermore, suppliers do not have incentives to prioritize the problem when the buyer does not have purchasing volume. In other words, they keep selling and earn more revenue as SMEs had to purchase more.

As it is mentioned above results are applicable other SMEs in similar circumstances when dealing with suppliers. Therefore, the presented considerations can be used to prevent falling into same pitfalls and how to deal with relations. The study helps developing a business minding approach for SMEs.

7

Conclusion and Future Research

Chapter 7 recapitulates purpose of the research briefly and answers five main research questions. Main takeaways from the study will be shared. Lastly, possible research topics for future will be discussed.

7.1 Conclusion

The purpose of the thesis was threefold: to identify on-going quality problems at Company X, investigate state of the each supplier relationships and visualize how the situation impacts Company X. During the thesis study, interviews were held across various departments at Company X and site visits has been made to grasp what is happening at the heart of the production regarding non sterile product group. Reviewing industry best practices in the literature was essential and formed a basis for recommendation to Company X. For this reason, best practices in supplier relations and quality management are studied, while simultaneously revealing ongoing problems along with underlying reasons, consequences and implications to the focal company. The following research questions are discussed thoroughly and answered. The answers to these questions are studied and answered thoroughly in chapter 5:

RQ1: *What are the elements every successful supplier management program should encompass? What are best practices for ensuring good quality with supplier management based on literature?*
RQ2: *What is the quality of supplied materials associated with non-sterile product group?*
RQ3: *What are the reasons associated with the quality problems of these materials? How the pharmaceutical company can manage supplier relationships to improve quality of materials?*
RQ4: *What are the consequences and implications of having poor quality of incoming raw materials?*
RQ5: *What are the recommendations and solution proposals to the Company X to overcome the quality issues regarding its raw materials?*

The focal company has problems with its supplier relationships in which the issue revealed after terminating outsourcing production to another party. Company X perhaps has not paid enough attention to the suppliers and their management which cause serious quality issues and thereby financial losses. Solution proposals

and overall recommendations are further presented to Company X and shared in section 5. Purchasing and quality management perspectives as well as best industry practices assist author to identify gaps in current operations and further illustrate key takeaways from the research.

The thesis results provide Company X to gain insight about on-going operations and helps purchasing department to manage supplier relations more competently, and adopt proactive way of performing tasks.

There is a risk when new supplier relationship emerge due to new business decisions (e.g. outsourcing) in which buying company is not enough prepared for managing these suppliers relationships. In other words, such emerging situations requires allocation and/or adding resources to managing these relationships. Therefore, there may be serious consequences if buying firm have scarce resources. Main findings of the research is that SMEs might not have the resource to appropriately understand how to work with supplier relations in a structure manner. This provides an insight regarding supply operations for companies that do not have the maturity in their supplier relationship strategy. One takeaway is that this study will provide direction and demonstrate what kind of steps should be taken for SMEs who do not have sufficient resources.

7.2 Future Research

Due to time limitations and complexity of the subject matter, boundaries of the scope were determined in the earlier phase of the research. First limitation is to exclude production processes involving perspective of resources such as capital equipment (e.g. problems with the machine and its sensors), labor (e.g. employee competence and learning curve effect). Analysis of production process can be the next step of the research where production methods and creation process can be studied in detail to reduce waste levels further.

The second limitation is to rule out simultaneous development of sustainability and product quality regarding non-sterile product group. One recommendation regarding future research is to explore the ways in which that is possible to develop sustainability in product design and preserving targeted quality simultaneously. How can Company X create a green image through which ways and maintaining the quality promised to the customer at the same time? In summary, the ways in which sustainability can be achieved without compromising quality, the benefits of having such strategy and challenges to achieve it for Company X can be another possibility for future research.

Another limitation is to focus on a particular product group. i.e. non-sterile products. There are three more main classes for product range which are (1) Sterile, (2) patent, (3) innovative. There might be room for improvement regarding other product groups and associated supplier relations if Company X demands to examine

supplier relations for these groups.

Studying supplier relationships is viewing from one side of the picture. It is possible to reverse the picture and consider the other end, customer relationship management (CRM). This is another crucial aspect for companies, business growth, where they need to maintain relations and manage interactions with customers and create business opportunities with potential customers through series of strategies. How to communicate the improved cost at a higher cost, or to study what customers need or pay attention to in fact can be another study topic for the future research.

Since this is a case study, large part of the aspects are specific to Company X. Aspects that have strategic importance for Company X such as sustainability considerations or role of purchasing department within the company might be of less importance for others. Every company interprets the function of a particular department differently according to its business model and needs. In this respect, the subjects to be studied are company specific and require managers to adapt recommendations and solutions to their own business needs.

Bibliography

[1] Ali, K.A.M. (2020), "The nexus between supplier quality management and organization's competitive advantage: An empirical evidence", LogForum, Vol. 16 No. 1, pp. 161-170. http://doi.org/10.17270/J.LOG.2020.389

[2] Bell, E., Harley, B., and Bryman, A. (2022). Business research methods, Sixth edition, Oxford: Oxford University Press

[3] Bensaou, M. (1999), "Portfolios of Buyer-Supplier Relationships", Sloan Management Review, Vol. 40 No. 4, pp. 35-44.

[4] Berger, P.D., and Zeng, A.Z. (2006), "Single versus multiple sourcing in the presence of risks", Journal of the Operational Research Society, Vol. 57 No. 3, pp. 250-261., https://doi.org/10.1057/palgrave.jors.2601982

[5] Bloom, B., and Crabtree, B. F. (2006), "The qualitative research interview", Medical Education, Vol. 40, pp. 314-321., https://doi.org/10.1111/j.1365-2929.2006.02418.x

[6] Campbell, N.C.G., and Cunningham, M.T. (1983), "Customer Analysis for Strategy Development in Industrial Markets", Strategic Management Journal, Vol. 4 No. 4, pp. 369-380. https://doi.org/10.1002/smj.4250040407

[7] Cannon, J.P., and Perreault, W.D.J. (1999), "Buyer–Seller Relationships in Business Markets", Journal of Marketing Research, Vol. 36 No. 4, pp. 439-460.

[8] Dellana, S., and Kros, J. (2014), "An exploration of quality management practices, perceptions and program maturity in the supply chain", International Journal of Operations Production Management, Vol. 34 No. 6, pp. 786-806., https://doi.org/10.1108/IJOPM-03-2013-0105

[9] Dubois, A., and Gadde, L.E. (2002), "Systematic Combining: An abductive approach to case research" Journal of Business Research, Vol. 55 No. 7, pp. 553–560., https://doi.org/10.1016/S0148- 2963(00)00195-8

[10] Eisenhardt, K. M. (1989), "Building theories from case study research" Academy of Management Review, Vol. 14 pp. 532–550.

[11] Fortner, Z. A., (2021), "Mitigating Third-Party Risks: The Benefits of Extending Quality to the Supply Chain", Pharmaceutical Technology, Vol. 45, Issue 9, pp. 56-60.

[12] Forza, C., and Filippini, R. (1998), "TQM impact on quality conformance and customer satisfaction: A causal model", International Journal of Production Economics, Vol. 55, Issue 1, pp. 1-20

[13] Golafshani, N. (2003), "Understanding Reliability and Validity in Qualitative Research", The Qualitative Report, Vol. 8, No 4., pp. 597-607.

[14] Gustaver, M. (2020), A Chalmers University of Technology Master's thesis template for LaTeX.

[15] Hellsten, U., and Klefsjö, B. (2000), "TQM as a management system consisting of values, techniques and tools", The TQM magazine, Vol. 12 No. 4, pp. 238-244.

[16] Hines, P. (2006), "Network Sourcing: A Hybrid Approach", Journal of Supply Chain Management, Vol. 31, pp. 17-24. https://doi.org/10.1111/j.1745-493X.1995.tb00199.x

[17] Hong, J., Liao, Y., Zhang, Y., and Yu, Z. (2019), "The effect of supply chain quality management practices and capabilities on operational and innovation performance: Evidence from Chinese manufacturers", International Journal of Production Economics, Vol. 212. No. C, pp. 227-235., https://doi.org/10.1016/j.ijpe.2019.01.036

[18] Horton, J., Macve, R., Struyven, G. (2007), "Chapter 20: Qualitative Research: Experiences in Using Semi-Structured Interviews", pp. 339-357., https://doi.org/10.1016/B978-008043972-3/50022-0.

[19] Kallio, H., Pietilä, A. M., Johnson, M., Kangasniemi, M., (2016), "Systematic methodological review: developing a framework for a qualitative semi-structured interview guide", Vol. 72, pp. 2954-2965., https://doi.org/10.1111/jan.13031

[20] Kaynak, H. (2003), "The relationship between total quality management practices and their effects on firm performance", Journal of Operations Management, Vol. 21 No. 4, pp. 405–435.

[21] Khoja, F., Adams, J., and Kauffman, R. (2011), "The inside story of relationship development: power asymmetry in a buyer–supplier relationship", International Journal of Integrated Supply Management, Vol. 6 No. 1, pp. 73–91.

[22] Kirk, J., Miller, M. L. (1986), "Reliability and Validity in Qualitative Research" Sage University Series on Qualitative Research Methods, Vol. 1.

[23] Krishnaswami, O.R., Satyaprasad, B.G., (2010). Business Research Methods, Himalaya Publishing House.

[24] Krause, D.R., Handfield, R. B., and Tyler, B.B. (2007), "The relationships between supplier development, commitment, social capital accumulation and performance improvement", Journal of Operations Management, Vol. 25, pp. 528-545,. https://doi.org/10.1016/j.jom.2006.05.007

[25] Kumar, N. (1996),"The Power of Trust in Manufacturer Retailer Relationships," Harvard Business Review, Vol. 74 No.6, pp. 92-106.

[26] Lee, H., and Li, C. (2017), "Supplier Quality Management: Investment, Inspection, And Incentives", Production And Operations Management, Vol. 27 No. 2, pp. 304-322, https://doi.org/10.1111/poms.12802

[27] Lenning, J., and Gremyr, I. (2017), "Making internal audits business-relevant", Total Quality Management Business Excellence, Vol. 28 No. 3, pp. 1-16., https://doi.org/10.1080/14783363.2017.1303891

[28] Morse, J. M., Barrett, M., Mayan, M., Olson, K., and Spiers, J. (2002), "Verification Strategies for Establishing Reliability and Validity in Qualitative Research", International Journey of Qualitative Methods, Vol. 1, pp. 13-22.

[29] Namdar, J., Li, X., Sawhney, R., and Pradhan, N. (2018), "Supply chain resilience for single and multiple sourcing in the presence of disruption risks", International Journal of Production Research, Vol. 56 No. 6, pp. 2339-2360, https://doi.org/10.1080/00207543.2017.1370149

[30] Noy, C. (2008), "Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research", Vol. 11, pp. 327-344., https://doi.org/10.1080/13645570701401305

[31] Powell, T.C. (1995), "Total quality management as competitive advantage: A review and empirical study", Strategic Management Journal, Vol. 16 No. 1, pp. 15–37.

[32] Prajogo, D.I., McDermott, P. and Goh, M. (2008), "Impact of value chain activities on quality and innovation", International Journal of Operations Production Management, Vol. 28 No. 7, pp. 615-635. https://doi.org/10.1108/01443570810881785

[33] Punnakitikashem, P., Laosirihongthong, T., Adebanjo, D., and McLean, M. (2010), "A study of quality management practices in TQM and non-TQM

firms : Findings from the ASEAN automotive industry", International Journal of Quality Reliability Management, Vol. 27, pp. 1021-1035., https://doi.org/10.1108/02656711011084819.

[34] Rahman, S. (2006), "Quality management in logistics: an examination of industry practices", Supply Chain Management, Vol. 11 No. 3, pp. 233-240., https://doi.org/10.1108/13598540610662130

[35] Riege, A. M. (2003), "Validity and reliability tests in case study research: a literature review with hands-on applications for each research phase", Qualitative Market Research, Vol. 6, No. 2, pp. 75-86.

[36] Salimian, H., Rashidirad, M., and Soltani, E. (2021), "Supplier quality management and performance: the effect of supply chain oriented culture", Production Planning Control, Vol. 32 No. 11, pp. 942-958., https://doi.org/10.1080/09537287.2020.1777478

[37] Samson, D., and Terziovski, M. (1999), "The relationship between total quality management practices and operational performance", Journal of Operations Management, Vol. 17 No. 4, pp. 393–409.

[38] Sillanpää, I., Shahzad, K., and Sillanpää, E. (2015), "Supplier development and buyer-supplier relationship strategies - A literature review", International Journal of Procurement Management, Vol. 8, pp. 227-250. https://doi.org/10.1504/IJPM.2015.066283

[39] Sousa, R., and Voss, C. (2002), "Quality Management Re-Visited: A Reflective Review and Agenda for Future Research", Journal of Operations Management, Vol. 20, pp. 91-109., https://doi.org/10.1016/S0272-6963(01)00088-2

[40] Sreejesh, S., Mohapatra, S., Anusree, M. R., (2014). Business Research Methods: An Applied Orientation, Springer publishing.

[41] Teli, S.N., Majali, V., Bhushi, U., and Deshpande, A. (2012), "Knowledge based Supplier Quality Management System for Automobile Industry", International Journal of Engineering Innovation Research, Vol. 1, pp. 327-331.

[42] Terpend, R., Krause, D. and Dooley, K.J. (2011), "Managing Buyer-Supplier Relationships: Empirical Patterns of Strategy Formulation in Industrial Purchasing", Journal of Supply Chain Management, Vol. 47 No. 1, pp. 73-94., https://doi.org/10.1111/j.1745-493X.2010.03215.x

[43] Thyer, B. A. (2010), "The handbook of Social Work Research Methods", Second Edition SAGE Publications.

[44] Treleven, M., Schweikhart, S. B., (1988), "A risk/benefit analysis of sourcing strategies: Single vs. multiple sourcing", Journal of Operations Management, Vol. 7, Issue. 3–4, pp. 93-114, https://doi.org/10.1016/0272-6963(81)90007-3.

[45] Weele, V. (2018), "Purchasing supply chain management : Analysis, strategy, planning and practice", Andover Cengage Learning Emea.

[46] Whittemore, R., Chase, S. K., and Mandle, C. L. (2001), "Validity in Qualitative Research", Qualitative Health Research, Vol. 11 No. 4, pp. 522-537., https://doi.org/10.1177/104973201129119299

[47] Yu, H., Zeng, A. Z., and Zhao, L. (2009), "Single or dual sourcing: Decision-making in the presence of supply chain disruption risks", Omega, Vol. 37, No. 4, pp. 788-800.

[48] Zehir, C., Ertosun, Ö.G., Zehir, S. and Müceldilli, B. (2012), "Total Quality Management Practices' Effects on Quality Performance and Innovative Performance", Procedia Social and Behavioral Sciences, Vol. 41, pp. 273–280.

[49] Zeng, S., Cohen, M.A., Steele, B.J., and Sairamesh, J. (2008), "A Supplier Performance Evaluation Solution for Proactive Supplier Quality Management", IEEE International Conference on e-Business Engineering, pp. 367-373, https://doi.org/10.1109/ICEBE.2008.90

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