

Developing a Tool for Evaluating the Suppliers' Risks: A Case Study

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Abstract

Objective: This research aims to recognize the risks that the case study company faced from its suppliers and to develop a tool to assess those risks. To achieve this purpose, the research will propose tool for the company in order to identify and evaluate the supplier risks and make the process more transparent. Since there are no detailed structured ways for this purpose in the case study company and the consequences can be very costly.

Methodology: The qualitative method is used in this research. The main data sources include the case study company internal documents and the semi-structured interviews with the key members involved in the research topic.

This research uses the thematic analysis to analyze the qualitative data. Based on this analysis the main weaknesses of the current procurement operations are defined. Also, the researcher used the available knowledge in the literature review to develop a conceptual model for supplier risk evaluation.

Findings: The outcome was an Excel-based tool that helps the case study company procurement employees of the case study company to identify their suppliers' risks, assesses levels of risks, and suggests response plans to deal with these risks. Accordingly mitigate the negative impacts of the supplier's risks.

Keywords: Supply chain Risks, Supplier Risk Tools, Purchasing Process.

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1. Introduction

Many international companies have increased their outsourcing levels and have become more dependent on their supply chain network as a basis for competitive advantage (Ting, et al., 2008). Companies have downsized and focused more on their core competencies while using the capabilities and technologies of their suppliers (Kannan and Tan, 2002). The purchasing and sourcing role in a company is crucial and shifting toward a strategic direction. Professional sourcing of raw materials and services can be an enabler in an aggressive competition situation and in a different business environment. Since companies

depend more on suppliers, poor decision-making can have significant consequences (Gonzales, et al., 2004). Inappropriate selection of suppliers can weaken the financial and operational stability of a company (Herbon, et al., 2011).

In working with suppliers, manufacturing companies now face significant disruptive risks. These risks are rising because manufacturers are increasingly dependent on suppliers. With more than 50% of production budgets spent on suppliers (Joshi, 2009), a typical manufacturer today is more in "the assembling business than in the business of producing the components required to create the end product" (Joshi, 2009). In addition

to these risks, suppliers' failure rates around the world have reportedly increased by 30 percent due to the current economic crisis in recent years (McKinsey and Company Operations Extranet, 2010). With the downturn on the economy, the risks for suppliers to buying companies will not be reduced but will probably continue to increase.

1.1 Problem Statement

As most of companies become more dependent on the suppliers and consider them as a partner of their successes, it will be important for companies to know what risks they are exposed from those suppliers and how-to response to them. Ignorance of risks that come from suppliers may result in disastrous consequences.

So, there is a need to develop a tool that helps the case study company in the identification and evaluation of a supplier's risks. The purpose of this tool is to assist the case study company in identifying the areas with the most potential risks and assessing those risks. This tool must be able to conduct an evaluation of the supplier's risks and then pass the results of that evaluation to all the department's employees.

1.2 Research Objectives

The aim of this research is to better understand the risks that the case study company faced by its suppliers and to develop a tool to assess those risks.

This tool that helps the case study company procurement employees to identify their suppliers' risks, assesses levels of risks, suggest response plans to deal with these risks and reporting the risks arising from the activities of the suppliers in order to avoid future problems. Accordingly avoid the negative impacts of the supplier's risks.

There are many advantages to building tools in Excel, including ease of use and access, ability to store information in a database and allowing users to perform many formulas that help in building the desired tool, for these reasons, the tool has been developed as an Excel-based tool.

2. Literature Review

2.1 Purchasing Process

Van Weele (2010) provides a model of basic purchasing process that is widely cited and used in procurement literature. It consists of six basic phases: defines specifications, select suppliers, contracts, orders, expediting and evaluations, the steps in the purchasing process however vary greatly depending on the company uses.

This model of purchasing process, provided by Van Weele (2010), is combined with the supply process model provided by Johnson et al. (2011). Figure 2.1 shows the modified purchasing process model. The following paragraphs give the most accurate description of each phase.



Figure 2.1 Purchasing Process (Van Weele, 2010, p: 9).

Define Specification

The demands and requirements of the internal customer are an input and trigger of the purchasing process. The purchasing process begins by creating a purchase requisition (PR) and defining the necessary material or service specifications for the internal customer or system (Van Weele, 2010). Internal customers are able to provide procurement department their needs with help of PRs under the agreed accounting checks (Johnson, et al., 2011).

Select Supplier

The next phase in the purchasing process is the selection of the supplier after creating appropriate specifications. Johnson, et al., (2011) state that the most important decision made during the purchasing process by procurement personnel is the selection of suppliers.

Contract Agreement

The next step is to draw up a contract when the supplier has been selected (Van Weele, 2010). In the Contract, parties agree on the purchase transaction and establish the terms and conditions

that refers to both parties' rights and obligations (Baily, et al., 2008).

Ordering

It is possible to actually start a purchase process after all terms and conditions have been agreed and documented. Ordering means that the purchaser places a PO under the terms and conditions agreed previously. A purchase order is a lawfully binding document containing all required information, such as contract number, PO number, product or service description, unit price, number of units required, delivery date expected, delivery address and the invoicing address (Van Weele, 2010). The supplier must confirm the order by sending an order confirmation (OC) upon receipt of the PO. (Van Weele, 2010).

POs should always have an appropriate contractual form to avoid legal complications and ensure better documentation. Moreover, without a written or electronic PO document no material or services should be purchased. This guideline also contains urgent telephone orders. A written or electronic confirmation should follow the telephone order (Johnson, et al., 2011).

Expediting

The aim of the expediting is to ensure that the supplier delivers the goods or services purchased as confirmed in the order confirmation (Van Weele, 2010). No monitoring can take place in lower value purchases, or electronic systems can be supported by informing purchasers that any exceptions exist. For the delivery of services, internal customer who has a better understanding of past commitments and deadlines may be responsible for delivery follow-up (Johnson, et al., 2011).

Delivery Reception

The aim of delivery reception is to confirm the right quantity and good condition for the delivered material or service. In addition, the shipment is forwarded to its internal destination and the receipt documentation is recorded on the system (Johnson, et al., 2011). Since the world of business is not ideal and there are many types of purchasing problems, the reporting systems should have problems with delivery, quality and invoice. Problems arising from the activities of the supplier should be reported to the supplier

immediately in order to avoid future problems (Van Weele, 2010).

Invoice Clearing and Payment

The Procurement department may be responsible for invoice clearance. This allows rapid action because the original order has been placed by the procurement department. If the company wishes to guarantee internal control and comply with the check and balance principle, the accounting should be assigned an invoice clearance (Johnson, et al., 2011). The check and balance principle is very linked with the concept of duties segregation. It means that the research and responsibilities are adequately segregated between the parties in order to ensure internal control and prevent malpractices (Kobelsky, 2014).

2.2 Sourcing as a Strategic Function

Sourcing has gained a strategic importance among most companies, because it is a critical part of the value Chain (Pressey et al., 2007). In view of the large increase in outsourcing of business activities, sourcing has become a functional part of strategic management (Van Weele, 2014).

Lysons (2000) shows that the business operation has two types of sourcing. Sourcing can be strategic or tactical /operational. Tactical and operational sourcing involves lower level decisions, and usually involves non-critical goods which have high profit and low risk (Lysons, 2000). Tactical sourcing also covers short-term adaptation decisions, such as how certain supplier needs have been met and where they have been met (Lysons, 2000).

On the other hand, strategic sourcing aims to establishing a long-term procurement plans (Carr and Smeltzer, 2000) and cooperation with suppliers (Paulraj and Chen, 2007). It was defined as "the process of creating a value-adding (or optional) mix of supply relationships to provide a competitive advantage" (Lysons, 2000). The strategic sourcing should be high-level and long-term decision-making (Su, et al., 2012). The final objective of strategic sourcing is to increase the core competences and competitive efficiency of the company (Carr and Pearson, 2002).

Purchasing has been moving its tactical function to a core section for strategy. Which means that

the activities of purchasing extend the traditional, tactical procurement characteristic to a complex and sophisticated role, which include the definitions of long-term plans, the competitive priorities of organizations and alignment of purchasing, and assistance for supply chain strategies and worldwide operations? Biazzin (2019).

Strategic sourcing considered as key for successful and effective global supply chain

Strategic Sourcing Process

As discussed earlier, strategic sourcing aims to managing the supply base with beneficial long-term supply relationships more efficiently. It is very important to have a wide picture of the whole sourcing process in order to achieve the target results of strategic sourcing. However, there have been numerous studies focused on the evaluation of suppliers, the selection of suppliers, etc. (Eltantawy and Guunipero, 2013).

Handfield, et al. (2009) developed a strategic sourcing process for deciding, from whom the goods and services should be bought, together with what kind of relationships should be established.

Moreover, Mentzer, et al. (2007) presents a different way of structuring the sourcing process. According to Mentzer, et al. (2007) Different firms such as Tesco, American Express and many others have experienced this process.

Two processes have five different stages. The procedures go from an initial agreement to the supplier selection, the contract signing and the performing of the supplier relationship management activities in the same order. Although the steps are not exactly the same, the activities and goals are the same. Detailed information:

“Analyze opportunities and gather data” in Mentzer et al.’s process (2007) is similar to two steps combined in Handfield et al.’s process (2009), which are “Build the team” and “Market research”. Both processes emphasize the importance of the understanding of purchasing needs in relation to the business objectives and the strategy, strengths and weaknesses of the potential supplier. Various subjects are to be addressed, including the spending analysis, buyer and

management. As the main challenge of supply chain management is to remove the existing barriers between the organization and its customers and suppliers in order to preserve financial position development, customer service quality and operational expenses optimization, strategic sourcing emerges as a significant factor to integrate and support the suppliers into the supply chain. Biazzin (2019).

supplier power based on the five Forces model of Porter (Handfield, et al., 2009), the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis (Mentzer, et al., 2007), as well as value chain analysis (Handfield, et al., 2009).

There is a step in both processes “Strategy development” or “Develop strategy”. All data from the previous market research phase must be combined and analyzed using various evaluation measurements. The aim of this step is to divide the suppliers and decide the type of relationship to move forward with them (Handfield, et al., 2009; Mentzer et al., 2007).

The fourth step is “Contract negotiation” In Handfield et al.’s process (2009), This step is the drafting of the legal agreement following the definition of the sourcing strategy. The process involves selecting suppliers, negotiation between two parties, and the final aim is for both companies to conclude and sign their contracts. In comparison with Mentzer, et al.’s process (2007), this step is divided in two different steps including “Screening suppliers and selection” and “Negotiate and finalize agreements”. According to them, it is important for the company to define the main selection criteria based on its strategic needs and various production or quality requirements. Then the firm can select the best suppliers following those criteria before any contract negotiation occurs. Nevertheless, at the end of this step, these two processes aim to finalize the agreements.

The last step in Handfield et al.’s process (2009) is Supplier Relationship Management. This step is relatively in line with “Implementation and management” – the last step in Mentzer et al.’s process (2007). According to Handfield, et al. (2009), After the agreement is signed, the strategic sourcing process does not stop. Moreover, the

entire sourcing cycle begins as the partners develop the relationship (Handfield, et al., 2009). It also indicates that a member of the sourcing team normally collaborates with the supplier in the role of a supplier relationship manager. In this step, regular assessments, meetings, measurement of performance and the sharing of results are key components according to both researches.

Generally, I can see that a strategy source process can be structured in a variety of ways, but the key steps are still outlined in all the processes. It is particularly important that the supplier relationship management process is the last stage in that it is the company's long-term management of the suppliers.

2.3 Supplier Types and Roles

Grondys (2015) authpresented a list of key purchasing options for different suppliers related to the number, geography and strength of relationships.

A division based on the number of suppliers is:

- Single source, which uses a single supplier, even though many other options exist.
- Dual Source, two preferred suppliers of the same type of part or service are used.

Depending on the original part:

- Unit sourcing where specific and simple products are purchased with final product details.
- Multi sourcing of collective order.

The supplier's geographical activities:

- Local or regional sourcing; logistics cost, political and social circumstances are the main drivers for selection here.
- Global Sourcing offers the globe as a major supply base. Transformation from local to global has been supported by the Internet and e-business.

The strengths of the different types of relations are:

- Approved suppliers, if other suppliers are not available, random purchases done.
- Preferred suppliers, regular orders with clearly defined terms and practices.
- Strategic supplier or partner, the supplier has a definite position as the business

partner, this is based on individual cooperation and establishment.

2.4 Supplier Risk Identification

The identification of the supplier risk factors has a critical impact on the effectiveness of the proposed supplier evaluation and selection process. Various methods were used in the literature for the identification and definition of supplier risks. Some of these methods include literary literature review, questionnaire, rating method, and discussion.

Faisal (2009) suggested risk categories in the SC are based on the following four sub-chains:

- Physical sub-chain risks: risks associated with the inbound and internal flow of products, services and resource with respect to the supplier, and the flow of goods and services between suppliers and purchasers.
- Financial sub-chain risks: financial transactions risks and supplier obligations that have an effect on the supplier's downstream SC.
- The information sub-chain risks: the information flow risks from or to the supplier, which have an influence on the supplier's downstream SC.
- Risks in the relational sub-chain: Risks concerning the relation between the buyer and the supplier as well as possible relational issues with SC members downstream from the buyer stemming from the supplier's actions or from products delivered or produced by the supplier.
- Risks in the relationship sub-chain: risks related to buyer-supplier relations, and potential related problems to SC members downstream of buyers arising from the proceedings of the supplier or the products delivered or produced by the supplier.

The categories are used only to help identify relevant risks. While the most of risks collected based on the risk consideration in manufacturing SCs, they are combined sufficiently to also be considered in service SCs. However, between the two types of SCs, risks interpretation and sub-

risks definitions may vary significantly. The risks from recent literature are shown in Table 2.1.

Table 2.1 Supplier risks (Govindan and Jepsen, 2015)

SN	Risks	Examples	Studies considering the risk source or a related risk driver
Physical sub-chain			
1	Supplier's supply risk	Risks upstream from the supplier, for example, supplier's supply sources or inbound transportation unreliable, energy/ raw material shortages and power outages at the supplier.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011), Tummala and Schoenherr (2011)
2	Capacity risk	High capacity utilization at supplier. Technological and/or skill constraints affecting the supplier's ability to adapt to significant changes in volume.	Bandaly, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011) Tummala and Schoenherr (2011)
3	Product design risk	Supplier not able to quickly adapt to design changes or is incapable of incorporating design changes. Supplier unable or has problems to conform to product/service quality/safety specifications.	Bandaly, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011) Tummala and Schoenherr (2011)
5	Inventory and storage risk	Inefficient inventory management at the supplier. Insufficient storage capacity or inappropriate storage conditions.	Deleris and Erhun (2011) Tummala and Schoenherr (2011)
6	Breakdown risk	Machine/equipment/facility failure at the supplier.	Bandaly, et al. (2013) Deleris and Erhun (2011)
7	Hazard risk	Hazards, such as fire, chemical/nuclear spills, product, contamination, and so on affecting the supplier's operations.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011)
8	Human and organizational errors	Human and organizational errors and misunderstandings.	Deleris and Erhun (2011)
9	Socio-political risk	Labor strikes, labor availability issues. Changes in regulations affecting the supplier's operations, such as environmental regulation and trade regulations.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011) Tummala and Schoenherr (2011)
10	Transportation, logistics and transfer points risk	Reliability of 3PL provider(s) and/or common/private carrier(s). Customs delays or confiscations. Labor strikes at transfer points, transfer point capacity issues and many transfer points. Theft, sabotage, handling damage, and so on.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011) Tummala and Schoenherr (2011)
11	Catastrophic risk	Natural disasters and epidemics. Geopolitical events (terrorism, war and political instability).	Tummala and Schoenherr (2011)
Financial sub-chain			

12	Business risk	Supplier bankruptcy or supplier as victim of a take-over.	Curkovic, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011) Tummala and Schoenherr (2011)
13	Competitive risk	Supplier unable/unwilling to reduce costs/prices in order to keep prices competitive, for example due to long-term vs. short-term contractual issues.	Bandaly, et al. (2013) Tang and Musa (2011)
14	Market risk	Price fluctuations due to characteristics of the market in which the supplier operates.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011)
15	Exchange rate and interest rate risk	Exchange rate fluctuations in relation to the country, in which the supplier operates.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011)
16	Tariff/Tax risk	Changes in tariffs or taxes in relation to the market and the country in which the supplier operates.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011)
17	Logistics cost risk	Risk of increased transportation costs, for example due to changes in oil price, 3PL provider prices, common carrier prices or poor logistics planning.	Tummala and Schoenherr (2011)

Informational sub-chain

18	Forecast risk	Inefficient demand forecasting procedures at supplier. Information distortion—Bullwhip effect.	Deleris and Erhun (2011) Tang and Musa (2011) Tummala and Schoenherr (2011)
19	Information risk	Lack of information from the supplier concerning pending problems. Slow or missing feedback from the supplier.	Bandaly, et al. (2013) Curkovic, et al. (2013) Tang and Musa (2011)
20	IT/IS systems risk	Supplier's information systems are outdated, unreliable or insecure.	Bandaly, et al. (2013) Curkovic, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011) Tummala and Schoenherr (2011)
21	IT infrastructure risk	Information infrastructure breakdowns.	Curkovic, et al. (2013) Tang and Musa (2011) Tummala and Schoenherr (2011)

Relational sub-chain

22	Reputational risk	Moral issues like child labor, labor health, safety, environmental issues and welfare in developing countries in relation to the supplier's operations.	Curkovic, et al. (2013) Deleris and Erhun (2011) Tang and Musa (2011)
23	Lack of trust and opportunism risk	Strained relations with the supplier. Opportunistic behaviour from the supplier, such as prioritizing other customers.	Tang and Musa (2011) Curkovic, et al. (2013)
24	Dependency risk	Lack of alternative suppliers.	Bandaly, et al. (2013) Tummala and Schoenherr (2011) Tang and Musa (2011)
25	Legal risks	For example: Risk of litigation from supplier (for example, contractual issues). from buyer's customers in relation to	Curkovic, et al. (2013) Deleris and Erhun (2011)

		products/services acquired from supplier (for example, due to safety issues with products/services acquired from/through the supplier).	
26	Intellectual property rights risk	Loss of control and risk of losing proprietary information shared with the supplier.	Curkovic, et al. (2013) Tang and Musa (2011) Tummala and Schoenherr (2011)
27	Cultural/language risk	Cultural and language barriers between buyer and supplier.	Curkovic, et al. (2013) Tang and Musa (2011)

If a company uses the same approach to manage the risk on all of its suppliers, the risk is that critical suppliers are evaluated too lightly and not critical suppliers too thoroughly time and effort of employees will be wasted. So, it is very important to understand when the company has to identify the risks and act upon.

2.5 Supplier evaluation and selection theories

The selection process for suppliers is the basis of strategic sourcing. The main aim of the evaluation process is to minimize purchasing risk and maximize the purchaser's overall value (Monczka, et al., 2011). In most cases a formal evaluation and qualification process is used when the supplier selects a complex or costly one-time contract and when a long-term partnership is established (Sollish and Semanik, 2011). The supplier selection process starts when there is a need for a new supplier (Ozfirat al., 2014).

Supplier evaluation is the process used to evaluate the performance of the current suppliers based on a set of criteria over a period of time (Salam, 2011). The purpose of the supplier evaluation is to ensure that the technical, financial and financial requirements of a potential supplier are met (Lysons and Farrington, 2012).

The evaluation and selection theories in the literature suppliers may be divided into two different categories: process theories and model of supplier's assessment criteria.

2.5.1 Supplier selection and evaluation process theories

The supplier evaluation and selection process according to (Monczka, et al., 2011) (Figure 4.2) consists of seven steps: the first step in the supplier evaluation is define the evaluation

categories. These categories are high-level topics that relate to the supplier performance in areas that important to buyer. Zhang, et al., (2020) showed that only the economic criteria (such as price, delivery, and quality) are considered to reach at a prioritization or final selection of suppliers in the traditional supplier selection process. Also, the most commonly used criteria are resource consumption, price, quality, green design, greenhouse gas emission, and environmental management system. The most important criteria in the economic dimension are quality, price, and cost in the selected studies. In the environmental dimension the most frequently used criteria environmental are management system, resource consumption, and green design. Moreover, the top three social criteria are health and safety, interests and rights, and information disclosure. It can be seen that environmental, green, management, quality, cost, capability, and delivery are the major green evaluation criteria taking over notable points. The second step is to assign weight to each category as some supplier performance areas are more important than the other to buyer. The third step goes into more details of each category by define subcategories and weight them. Step four defines the scoring system for the main categories and subcategories. It can be for instance scores from 1 to 5 or 1 to 10. In order to make scoring consistent, it is important to carefully determine the differences between each score. Next, the buyer must visit the supplier facilities and evaluated them directly. This will enable the buyer to evaluate some things (for example how modern the production line is) by themselves, and not having to trust the supplier to provide honest information. Step six is a reviewing of the results and makes a selection, next monitoring the

supplier performance based on the criteria used for selecting them.

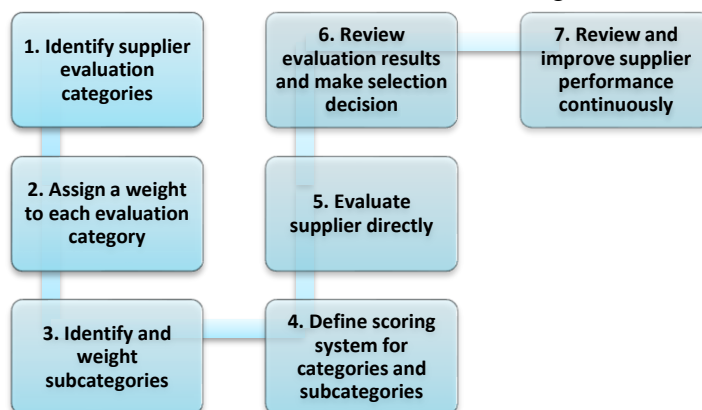


Figure 4.2 Development of a Supplier Evaluation and Selection Survey (Monczka, et al., 2011).

The supplier evaluation and selection process according to Monczka, et al. (2011) is simple and easy to scale depending on the needs and requirements of each instance of supplier selection process. It is a high-level process, but it nevertheless brings together all necessary elements of the supplier evaluation and selection steps.

Johnson, et al. (2011) describe steps to identify, evaluate and classify potential sources in their supplier selection process model. A new need in an organization has three potential supply options. The first option is to do it internally. Secondly, a current supplier should be used. Thirdly, a possible new supplier will be found. The potential supplier is analyzed on three levels: strategic, traditional and current additional. The strategic assessment includes analyzes of potential resources against the company's procurement policies and risk analysis using Pareto analysis and portfolio analysis models (Johnson, et al., 2011).

According to Johnson et al. (2011) the first step in supplier selection process is a making or buying analysis. The use of a current supplier is easy, but not always the best option. This model of process can not to note that preferred suppliers should be considered. Otherwise the purchaser may end up using suppliers whose delivery or quality is poor or whose financial situation is risky. This type of product categorization and risk analysis has already been excluded from this research because the amount of care needed goes beyond the limits

of this study. Subsequently, the process is similar to that of Monczka, et al. (2011).

2.5.2 Supplier evaluation criteria models

The SOCCER supplier evaluation model (Rogers, 2009) includes strategy elements, operational capacity, customer approach, costs structure, economic performance, and research development. According to Monczka, et al. (2011) the evaluation criteria are: cost or price, quality and delivery, management capability, employee capability, cost structure, total quality performance, systems and philosophy, processes and technology capabilities, sustainability and compliance with environmental requirements, financial stability, scheduling of production and control systems, e-commerce capabilities, supplier capability long-term relationship potential. Lysons and Farrington (2012) states that potential suppliers should be evaluated under ten different perspectives: finance, insurance, capacity for production and facilities, or capacity for supporting services, quality, health and safety, environmental management, existing contracts and performance, organizational structure and staff, subcontracting and procurement capabilities and supply chain management.

Depending on which type of supplier must be evaluated, it is easy to scale up or down the SOCCER model. The SOCCER model, which is a critical criterion in the evaluation of suppliers, lacks an environmental management aspect. Monczka, et al. (2011) introduces main supplier

selection evaluation criteria but allow the reader to determine which areas are more important. No actual model exists, but instead a list of various types of criteria. The SOCCER evaluation model (Rogers, 2009) fails to identify sustainable development and environmental compliance criteria. There are specific tips on how the financial stability of a supplier should be analyzed and guided.

The evaluation criteria of Lysons and Farrington (2012) address the key areas for evaluating a supplier when selecting. The SOCCER model (Rogers, 2009) suggests that the core competences of the supplier should be analyzed. This leads to an evaluation of the manufactured products of the suppliers and purchased products of the supplier from an outsourced partner. Capability of procurement is described as an independent aspect which is often forgotten when a supplier is evaluated. In order to purchase materials and components for use in case company products, skilled technical understanding is required. Lysons and Farrington's (2012) criteria lack the analysis of cost and cost structure. Total costs are a traditional part of the supplier selection process. The evaluation criteria model of Lysons and Farrington (2012) is not as a SOCCER (Rogers 2009).

2.6 Probability- impact matrix

I need to define the risk in general before I create a tool for evaluating supplier risks. Waters (2011) describes the risk as a result of uncertainty about future events. The likelihood is multiplied by the severity or impact of a given event as described in Manners-Bell (2014). The term 'risk' is used, A commonly used tool helping to visualize the risk the probability-impact matrix. Companies can use these matrixes to put different risks to evaluate their respective importance. This is one of the main tools used because of its efficiency and simplicity. Table 2.2 below shows the Risk Probability and Impact Matrix.

Table 2. 2 Risk Probability and Impact Matrix
(red: very high risk; orange: high risk; yellow: medium risk; green: low risk)

	Impact					
Probability	.05	.10	.20	.40	.60	.80

there is every time uncertainty about any future outcome (Tranchard, 2018).

In order to evaluate the risk, the estimated probability and the impact of that risk should be determined. While the risk can be widely diversified and complicated, Waters (2011) states that two key factors for risk evaluation which are the likelihood of a risky event occurrence and the impact of risk consequence.

Consequently, supply chain risk management has come to be an important and necessary strategic process to identify supply chain specific risks that might occur within the supply chain of business (Meyer et al., 2019).

Then the value of risks by the following equation:

$$\text{Risk} = \text{Impact} \times \text{Likelihood}$$

Where:

Likelihood: measures the possible occurrence of the event. It may be difficult to calculate the exact possibility unless historical data are available to determine the occurrence of the event. The company can also rely on experts' opinions to use a degree of belief or a subjective likelihood.

Flage et al. (2018) established a critical perspective on the use of particular probabilities in risk analysis process, showing how integrating probability bounds may develop the analysis performance.

Impact: measures the company's consequences if the event happens. This impact can be directly measured, for example, in dollars. It can also be measured in scale, such as zero to one, where zero is a little negative consequence and one is a very bad consequence.

.90	.05	.09	.18	.36	.54	.72
.80	.04	.08	.16	.32	.48	.64
.70	.04	.07	.14	.28	.42	.56
.60	.03	.06	.12	.24	.36	.48
.50	.03	.05	.10	.20	.30	.42
.40	.02	.04	.08	.16	.24	.32
.30	.02	.03	.06	.12	.18	.24
.20	.01	.02	.04	.08	.12	.16

This matrix combines the probability and impact into an overall value. In order to reduce confusion, the rating will therefore be referred to as a "Risk Score" which refers to the combined probability and impact score of the risk in relation to targets.

On the left, the probability goes down from top to bottom, reducing from 1 (a 100% certain shot chance) to 0. Similarly, the impact goes to the top left to the right, gradually from (no impact) to 1. The values in the above table cells are the multiplying value of the risk probability and impact I consider as “Risk Score”.

In this matrix, the “RED” color means High risk; “YELLOW” means Moderate risk and “GREEN” means Low risk. The risk will remain green if the impact or probability is low. However, the higher their colors, the more alarming their colors are.

Risk responses are planned according to the resulted Risk Priority Number (RPN), risk

threshold for the RPN is considered to be 0.05, accordingly risks considered with high and medium priority must have responses and action plan. Low priority risks maybe accepted but need to be monitored continuously, once the response type is decided, a details action plan is established the actions and responsibility.

Hallikas, et al., (2002) conclude that the risks that are important for a particular company and that priority should be identified in order to focus resources effectively. Experts in the respective fields should assess the importance.

2.7 Conceptual Framework of Supplier Risk Evaluation

The Conceptual Framework is given in Figure 2.3 presents important aspects that require attention once creating a Supplier Risk Evaluation tool.

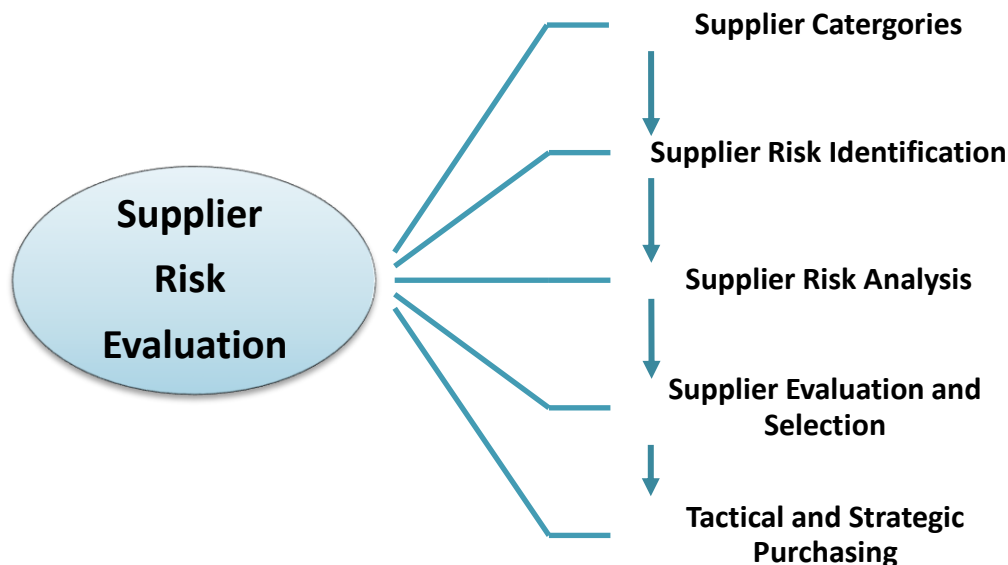


Figure 2.3 Conceptual Framework of Supplier Risk Evaluation.

3. Methodology

3.1 Research Method and design

A qualitative research design was adopted for this study. Qualitative research includes the mapping of processes and meanings that are not previously thoroughly investigated or measured, causing in a lack of theoretical support. The method

emphasizes the socially constructed nature of reality and gives us an opportunity to have an analysis and a better understanding of the contexts. This method is especially suitable for providing new information on an unclear topic (Denzin and Lincoln, 2011). The informant is the

expert and the scientist can allow the informant to affect him or herself and vice versa (Yin, 2014).

One of the main reasons for choosing a qualitative method to achieve the objective of this research is that researcher want to go into the depth of the phenomenon. This is best done with longer interviews. The method also prioritizes direct contact and seeks to interpret the subject rather than to find relationships between cause and effect. And the data collected and analyzed in this research cannot be measured in units.

There are several options for the design of the research in qualitative methods, namely experiments, longitudinal, cross-sectional, comparative research or case studies. The options for collecting data are e.g. Interviews, direct observation, participant observation, archival records, documentation and physical artifacts (Yin, 2014). Based on what I want to achieve with this study, I have chosen a case study approach with two methods of data collection, such as interviews and documentation.

Case Study

Yin (2014) defined a case study as "... an empirical inquiry that investigation contemporary phenomenon in depth and within its real-world context".

There are many reasons why case studies are being used. According to Yin (2014) a case study design should be considered when:

- The study focuses on answering "how" and "why" questions.
- You cannot manipulate the behavior of those involved in the study.
- You want to cover contextual conditions because you think they are relevant to the phenomenon under study.
- The boundaries between the phenomenon and the context are not clear.

3.2 Data Collection

The interviews and internal documents were the data collection methods for this research

Interview

The use of interviews as a method of data collection is considered effective and in a short time gives a large amount of relevant data. It

makes it very easy to focus on the research topic and the researcher has the opportunity to ask questions in depth and learn more. Although this method takes time and depends on a correct understanding of the questions and sincere answers, it is flexible and the interviewer can create an open setting that resembles a conversation more than an interview (Yin, 2014).

In order to achieve a high level of validity, Saunders, et al. (2012) suggested that the interview questions were carefully considered and examined to provide the ability to explore the answers and themes of the interview from a variety of views. The order of questions in the interview guide is therefore logical and the guide allows you to explore and develop the research topics during the interview (Saunders, et al., 2012).

Each employee has to tell his experience and opinions in the purchasing process. I started the interview process with informal questions to build confidence and comfort. And each interview takes about 30 minutes to give participants an opportunity to express their views.

The researcher conducted semi-structured interviews with the key persons of the procurement team of the case study company. The questions were formulated in an open manner and enabled the participant to speak extensively.

The semi-structured interview allowed researchers to ensure that they elicited the same core information from all participants, while also providing them with the flexibility to probe more deeply into their rich descriptions of experiences which the participants shared. (Belotto, 2018)

The researcher could have a personal contact with everyone in the group where interviewees were asked a general questions then move to questions that focused on knowledge of purchasing process at the case study company and how the interviewees deal with suppliers, how they approve new suppliers and control the risks they may face by the case company's supplies. Questions were open-ended; I also did ask follow-up questions to study and analyze specific areas.

The interviews conducted with (7) employees of the case company at convenient and comfortable location for the interviewees in the case study company. To let them share their opinions and

thoughts, each of them was interviewed independently.

The interviews used for the analysis were transcribed then the researcher asked the interviewees to review research transcripts to ensure the accuracy and they accepted them. Following the approval of the transcripts by the interviewees, the researcher translated them into English since the interviews were conducted in Arabic due to some of the interviewees having problems with English. The transcripts were then presented to the translation specialist in order to ensure that the translation is strong and to achieve the best translation results.

Internal Documents

In this research, the internal documents of the case study company used which provided by the case study company's procurement team. Given one of the weaknesses in the interview as a method of data collection, namely the ability of the informant to manipulate reality or to respond to what "seems best" I have used internal documents as an addition to the interview. This is called the method triangulation according to Yin (2014) and is supposed to strengthen the results. The researcher used the data in the documents to study the purchasing process and the new provider approval process in the case study company, so she used two documents: the case study company purchasing policy and the flowchart of the evaluation of supplier and subcontractors (OPS-ESS) that shown in appendixes.

3.3 Data Analysis

The transcripts of the interviews were analyzed using the thematic analysis, method of analyzing the qualitative data used for "identifying, analyzing and reporting patterns (themes) within data" (Braun & Clarke, 2006).

Braun and Clarke (2006) presented a six-stage guide to help in conducting the thematic analysis:

Stage one: "Familiarizing yourself with your data, is focused on reading and re-reading the data, noting down initial ideas" (Braun & Clarke, 2006, p.87). After the transcripts of each interview were completed, researcher read the transcripts many times to start identifying themes.

Stage two: This phase focused on data reduction and initial codes production and focused on the

creation of themes, it is the first and fundamental level of analysis (Braun & Clarke, 2006).

Stage three: "Searching for themes, collating codes into potential themes, gathering all data relevant to each potential theme" (Braun & Clarke, 2006, p.87). In this stage, I analyzed and the codes for identifying the themes (Braun & Clarke, 2006). This step was used as draft of themes development.

Stage four: This phase focused on modifying the themes identified in Phase 3 using a two-level of codes analysis. The first level is reading the codes for each topic and determining whether a consistent pattern has created Braun & Clarke, 2006). In the second level of the analysis I read the whole data to ensure that the themes fit with the data (Braun & Clarke, 2006).

Stage Five: "Defining and naming themes, ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definition and names for each theme" (Braun & Clarke, 2006, p.87). The aim of this stage is "...clearly define what your themes are and what they are not" (Braun & Clarke, 2006).

To achieve this objective, I focused on defining each theme and deciding what aspect of the theme's data fits into it. (Braun & Clarke, 2006).

Stage six: This is the final stage of the data analysis and the writing about the data narrative "...goes beyond description of the data, and make an argument in relation to your research questions"; while it also "...provides a concise, coherent, logical, non-repetitive and interesting account of the story the data tell-within and across themes" (Braun & Clarke, 2006, p. 93).

3.4 Evaluating research quality; Validity and Reliability

A key justification for undertaking research is a more rigorous and credible outcome than ordinary observations, which can be called credibility (Easterby-Smith, et al., 2015). According to (Yin, 2003) the below four tests are commonly used to ensure the quality of any empirical social research:

- **Construct validity:** establishing correct operational measures for the concepts under study. Several sources such as books, articles,

journals and the Internet used for this research, as well as interviews and internal documents of case study company. This guarantees the validity, since all data originated either from previous studies or from the researched company. For this study, Multiple sources of evidence, including interviews and internal documents were used as methods for construct validity.

- Internal validity: establishing a causal relationship which shows that certain conditions lead to other conditions which differ from spurious relations. In order to carry out an internal validity analysis of the data, the employees who know the different aspects of the issue studied were interviewed.
- External validity: setting the field to which the results of a study can be generalized. In this research, the risks face the case study company is very common, but it is most likely impossible to find an identical situation in other companies. However, in other environments, the tool building can also be done, and issues related to a specific organization can be easily addressed.
- Reliability: showing that the study's operations—such as data collection procedures—are reliable. For this study, since there were no processes in place for the topic in the case study company, different individuals may have different point of views that may have a direct impact on the responses of the interview. An additional point of ensuring reliability is that data were selected in two different ways to better fulfill qualitative research reliability requirements.

4. Analysis and Findings

Data analysis starts with reviewing the procurement process and the new supplier approval process to show how the case study company control and manage its suppliers, At any points of the purchasing process the suppliers evaluated and if there are any available tools to do this, then the themes will be presented. Final section will provide the key findings from analysis.

4.1 Background of the Case Company

The case company in this research is Jordan Manufacturing and Services Solutions (JMSS) were established in 2008 as an affiliate of (King Abdullah II for Design and Development (KADDB). JMSS's mission is to refurbish, rebuild, develop, and modify medium and heavy vehicles (wheeled and tracked) and their components and systems.

The below provides a short introduction of the JMSS company as stated in the JMSS company website:

“... It also works to meet all fabrication requirements for various manufacturing sectors in terms of construction, manufacturing, forming metal structures and items, as well as providing private manufacturing solutions, and also providing after-sales maintenance for different customer products and requirements...”

“... JMSS is dedicated to meet all manufacturing and services needs that may arise and be required by the customers. JMSS offers a complete vehicle, metal fabrication finishing services. The company cements its leadership role through the provision of high-quality work, on time delivery, and cost effectiveness for a wide range of products and services and assures guaranteed customer satisfaction. This is ensured through the company's qualified management team that combines the required skills, expertise and multi-disciplinary professionals with focus in the fields of engineering and manufacturing...”

4.2 Procurement Process at case study

In the case study company, the procurement process is integrated into the Enterprise Resource Planning (ERP) system and is defined as shown in the purchasing control flow chart diagram (OP5-ESS) in Appendix (A). The process is started by a purchase order (PO) created by an individual in the purchase cell. This PO is signed and submitted by three different persons and they approve the order. Once the release takes place, the purchasing cell employee can order the goods with the supplier. This occurs outside the ERP system and is therefore not shown on the flow chart. The

supplier shall send the goods and invoice. The accounting department will book the invoice if the invoice is entered into the system. This last activity will lead to a payment.

This process shall assist the case study company in purchasing in an efficient manner and within the highest ethical standards. Ensuring that all purchased products/ services are of high quality, lowest costs and in the time needed. Also, it defines the framework upon which purchasing is organized, administered and implemented.

The policy divides purchase into two categories: low value purchases that amount to less than 250 JD and high value purchases that amount to more than 250 JD.

The requirements of components communicated from the planning department to the purchasing department, initiate the selection of suppliers in the case study company. In the first step, the purchaser submits a request for quotation (RFQ) to potential suppliers; the RFQ includes basic component requirements. The responsible planning department formulates the requirements of its components, the need to purchase parts for a product for customers, the service required to support internal activities or subcontracting parts of a project. Sometimes the need is for a long-term supplier, sometimes only one-time purchase.

4.3 New Supplier Approval Processes at the case study

The case study company has new suppliers' approval procedure. The procedure has defined approved each new supplier based on trial order, test and inspection, on-site audit or by requesting a text/ quality certificate and approved new subcontractor based on QA assessment or quality certificate. Appendix (B) shows the steps required to make a purchase if it is unknown whether the supplier has already been approved.

The purpose of the procedure is to ensure that suppliers to production partners can comply with the agreed product/ service specifications and deliver the products within the scope and approved requirements.

As state in the policy case study company shall follow, implement, and maintain evaluation of supplier and subcontractor procedure (OP5-ESS) Appendix (B). All case study company purchases

In the next step, the suppliers respond to the RfQ and submit a product specification. In the first screening, all suppliers who receive a RfQ are automatically qualified. Two types of evaluation are subsequently carried out. One evaluation is classified as a technical evaluation that checks that the suppliers meet the component's technical requirements. The second evaluation is called a commercial evaluation and the main aspect to be analyzed is the purchase price. Negotiations with suppliers are normally conducted in this phase.

The type, quantity, quality and time of arrival of all externally provided processes; products and services shall be determined by the production, production planning along with the purchasing function at the stage of studying potential projects/ orders once a request for quotation (RFQ) is received and before submitting the offer/ proposal to the customer.

The low value purchase category includes only a few exceptions, for example when the purchase is done through a non-PO process, where the supplier can only issue an invoice and is processed by the procurement team's employees. After the purchase has been confirmed by the purchaser of the case study company, the supplier is only advised to confirm his bank account details in order to avoid fraud.

should be made from the approved list of suppliers. New suppliers can enter the approved list of suppliers (as grade "C") when passing one of the following criteria, a documented evidence and recommendation should be recorded:

- On-site Audit.
- Product Test and inspection.
- Quality Certificate.
- Trial Order.

The approved supplier list should be updated regularly as per the evaluation result. The evaluation result should be out of 100 unless packaging and/or environmental impact criteria are used as part of the supplier evaluation, the evaluation result will be then be out of 105 and/or 110.

Suppliers can be evaluated quarterly (and at after each purchase order) if passing one of the following criteria:

- The supplier is continuously classified as A, A* or A** for one year or more.
- If the supplier is justified sole source.

All material suppliers should be evaluated and rated according to the following criteria: Quality, Quantity “exactly as ordered, no more and no less”, Price, Commitment to Delivery Date, Payment Terms, Services and Cooperation, Commitment to the contract requirements, Environmental Impact (If applicable), Packaging (If applicable),

All service suppliers should be evaluated and rated according to the following criteria: Supplier’s commitment to the contract requirements, Commitment to deliver on due date, Quality of executed service, Supplier’s cooperation with the company’s staff.

4.4 Themes

This research identified the following themes and subthemes that directly helped in finding the weakness in the case study company purchasing process in order to create the desired tool:

Theme A: New supplier approval process

The interviewees were asked directly to describe the current process for new supplier approval, and each of them discussed it in his view as follows:

“Results should be reviewed by a designated person responsible for approving suppliers and for disapproving them; status updates should be provided on the supplier approval list accordingly.” (Procurement manager)

“The approval process does not depend on the importance of each supplier in the supply chain and in the buying process.” (Procurement Coordinator)

“Third - party audits often request supplier approval documentation. This is often discovered by the auditor during the audit.” (Head of procurement)

“As regards the purchaser from abroad, suppliers themselves must confirm their bank details to avoid fraud” (Procurement manager)

In many of the interviews, the new supplier approval process was described as effective in most parts. Some steps, such as the approval of deviating payment terms, were regarded as an

unnecessary inconvenience to be reinforced or reduced.

When procurement employees is about to make a purchase from a certain supplier they expect to be a new one, they can either check an infrequently updated list of approved suppliers.

Theme B: The added value of the new supplier approval process

The interviewees were asked whether they would benefit from the approval process for new suppliers:

“I don’t think that the supplier approval list always reflects the supplier’s status in real-time, The supplier approval list more like a recordkeeping matter” (Head of procurement)

“We use the approved list in the case of high value purchases” (Procurement Coordinator)

“Which documents to request is unclear” (Procurement supervisor)

“I think that in most of cases we don’t get benefit in the approval process” (Procurement manager)

“Basic evaluation of the supplier about their product quality, delivery and price is available.” (Procurement Coordinator)

“We know the person responsible for the approval process, if there is a crisis, we know who to contact directly” (Procurement supervisor)

Interviews have found that it has not always been clear what documents must be requested and that if a supplier fails to supply the information it is not systematically followed up, but relies on reminders of the process that initiates an employee who may not be aware of his role.

Theme C:

When will the new approval process for the supplier be completed?

Few also talked about the timing of the new supplier approval process:

“After we receive the goods with its invoice and before we finalize the payment process” (Procurement Coordinator)

“In long term contract and if there are partial deliveries the evaluation take place after each partial delivery” (Head of procurement)

It can conclude that evaluation checks are often done only after the commitment has been done.

Theme D: Searching for New Suppliers

The participants were talked about several techniques that they use of searching for the new suppliers:

"Exhibitions offer us a great opportunity to talk with several of potential suppliers" (Head of procurement)

"Ask business acquaintances. We are more likely to have a good evaluation of a business' strengths and weaknesses from someone who has used its products/ services" (Procurement manager)

"Suppliers would like to find us" (Procurement supervisor)

"From the list of available suppliers, we find that it could be suitable"

(Senior procurement officer)

"Online is my best way to find suppliers like manufacturers and wholesaler" (Procurement Coordinator)

Based on the answers it is clear that the knowledge and process for finding new suppliers is not available. This indicates that there is no defined process or procedure that informs the people responsible for the search and selection of new suppliers where to find new suppliers.

Theme E: Criteria used for choosing suppliers.

When asked directly about the criteria that they use when selecting suppliers, participants have different criteria as follows:

The most important criteria for selecting suppliers is the price:

"The price is the most important criteria when I collect offers" (Purchaser)

Subsequently, the senior procurement officer regards quality and met requirement as most important:

"The quality needs to be consistent"

"A local supplier may be a better option, if we need something quickly" (Procurement Coordinator)

It is important for head of procurement to provide products that hold good quality even if the price is high:

"Price isn't everything. Lower prices may reflect quality goods and services of poor quality" (Head of procurement)

"We try to select suppliers that recognize the importance of our business to them so that they

make every effort to offer the best possible service" (Procurement supervisor)

Procurement manager have no checklist to select suppliers, he uses his experience:

"I have no documented checklist, but it's in my head"

From the answers given, it is clear that there is uncertainty as it varies according to the individuals involved. An experienced procurement manager may know by mind what to ask, but a heavily business focused employee may only be interested in the product offered by the company and may not notice that the company is on the verge of bankruptcy or that someone has sued the firm.

Theme F: What is always checked?

The most common issues they gave were:

"Stability is of great importance, especially if we enter into a long - term contract with a supplier or are the only supplier of a specific item to our company." (Procurement manager)

"The information that is available on the Business justification form" (Procurement supervisor)

"In the short-term contract I don't care about the financial situation" (Head of procurement)

It can conclude that the supplier selection process is not provides sufficient information to make the decision and whether the supplier is good enough to become the case study company supplier but may be sufficient in some cases and may cause some hesitation.

Theme G: Processes of monitoring suppliers

Many contracts specify the delivery of goods over a long period of time, from weeks to years. There are several objectives to monitor the performance of the supplier throughout the life of the contract. It promotes quality, for example, if the buyer inspects incoming goods in order to ensure that they meet the quality criteria. The monitoring also promotes costs containment: if there is a quality problem it can be identified and paid back to the supplier. However, monitoring is most important for supplier selection itself in so far as it will help the buyer to make more informed supplier selections in the future.

Several interviewees talked about the suppliers monitoring processes as a missing process:

“Not all of the suppliers are monitored. We only monitor supplier who is critical and with long-term and high value contract” (Head of procurement)

“In case of one-time supplier. After we received the ordered goods as requested, we are not giving much care” (Purchaser)

“Following the approval of supplier, no checks are made” (Procurement Coordinator)

“Suppliers of long-term contract are monitored continuously” (Procurement manager)

“We do not have strengths for systematic monitoring or audits Due to the breadth of monitoring activities, no time to monitor every supplier” (Procurement supervisor)

The interview with a procurement manager and head of procurement showed that they are in a continuous contact with the most important suppliers with long-term contract. Other interviews indicated that there is no monitoring process for suppliers.

Theme H: The characteristics of the desired tool

The opinions of the case study company's procurement team should be heard before making too much effort to create something they would not employ, so the interviewees were asked about the specification of the tool they hope to use, the answerers were as follow:

Sub-theme HI: Format and Layout

“An Excel would be good to start with” (Head of procurement)

“Should be easy to use and quick” (Procurement Coordinator)

“Colors should show where the risk is” (Procurement supervisor)

“Scoring should be simple: Low, moderate, high” (Head of procurement)

A simple checklist based in Excel, was the tool interviewees requested to use to obtain an overview of the risk evaluation. It was hoped the tool would use visual and simple scoring, such as Low, moderate, high.

Sub-theme HII: Uses case

“For the supply use” (Procurement manager)

“Should only be used in more critical cases” (Purchaser)

“Should also be used with already existing suppliers when negotiating a new agreement” (Procurement officer)

The staff agreed to apply the tool only to more critical cases whereas low-risk purchases are done using tactical sourcing.

Sub-theme HIII: Supplier risk categories:

The literature presented in Section 2.4 that related to the supplier risk categories was presented to the group of interviewees and they agreed in the following supplier risks categories and subcategories to be used in the tool:

Physical sub-chain risks

- Supplier's supply risk
- Product design risk
- Inventory and storage risk
- Breakdown risk
- Human and organizational errors
- Transportation, logistics and transfer points risk

Financial sub-chain risks

- Business risk
- Competitive risk
- Exchange rate and interest rate risk
- Logistics cost risk

Information sub-chain risks

- Information risk
- IT systems risk

Relational sub-chain: Risks

- Reputational risk
- Lack of trust and opportunism risk
- Dependency risk
- Legal risks
- Cultural/language risk

Theme I: Validation of the tool

After the draft tool was developed, it was presented to the procurement manager of the case study company to get his view about it and perform the validation. His feedback received:

“The tool should include an evaluation of the risk urgency that reflects the critical time of a risk to occur, and to complete the action plan, should add a Due Date column. Finally, after the implantation of the risks response, the risks to be reviewed and risk probability and impact re-evaluated to ensure the minimization of RPN”

The first comment received from the procurement manager is the risk urgency evaluation, which reviews and determines when actions are

necessary which are to take place before the other risk elements. The aim is to identify near term risks with this risk urgency assessment technique. To identify the risks those are urgently to be considered. In other words, those risks need immediate attention. This method is used to classify the risks (being pre-classified by the probability-impact matrix) with respect to time, even a lower classified risk may become more important than the higher one, if it will be in contrast to a higher classified site-it will happen in the very near future.

Another idea presented in the comments is to assign a "due date" for each risk in the risk response plan section of the evaluation tool, where risk responses are time sensitive.

The last comment was on the implementation of risk response; review the identified risk and reevaluate the probability and impact of the risk to make sure that RPN is minimized.

4.5 Finding

This research set out to determine the most important weakness in the current purchasing process of the case study company. The result of thematic analysis according to subthemes, themes and the participants are the following:

- The most important weaknesses in the current purchasing process of the case study company are No documented checklist for selecting supplier.
- The monitoring of suppliers ' performance requires a number of skills and a lot of time which is not available. As per procurement manager: *"The supplier monitoring process for non-critical purchases is missing because it requires a lot of time and trained staff and we have a lot of tasks to do every day and there is no time for monitoring"*
- There is no process for monitoring suppliers, so it is difficult to identify risky suppliers.
- Supplier rejection criteria not clear and there is no knowledge what to demand from suppliers, one participant mentioned that: *"I don't have a documented list of rejection criteria's"*

- No systematic follow-up for supplier data. It could take too much time based on the employee involved and the supplier reply to requested data.
- The employee responsible for the evaluation of suppliers is not trained. The case study company supposes that suppliers are evaluated by sourcing, but usually no responsible or qualified person is given to do so.
- There is no systemic documentation for the evaluation criteria. Supplier's weaknesses on personal computers only. As per head of procurement: *"The forms that used for approving new suppliers and sub-contractors in my computer"*
- The requirements for supplier approval process are one for all suppliers. Noncritical, critical and one-time suppliers might get approved based on same requirements. One interviewee said that: *"There is only one form used for approving all suppliers"*
- The process of selecting suppliers might do based on the individual involved.
- Supplier approval list does not always reflect the supplier's status in real-time.
- No follow up unless there is a third-party audit. Head of procurement assured that: *"Third - party audits often request supplier approval documentation. This is often discovered by the auditor during the audit."* (Head of procurement)
- One method for all suppliers: one-time supplier, high/low value purchases suppliers and critical suppliers.
- Evaluation checks are often done only after the commitment has been done. The company may end up business with an unacceptable supplier.

The analysis showed that the case study company has no consistent way to identify and evaluate risks for its suppliers. As it is not possible to have an explicit list of supplier's requirements because of different cases of business, it helps employees to understand the high-level risks then help them to evaluate the supplier.

It becomes clear from the answers that suppliers are often selected by the purchasing committee on

the basis of supplier offers. This can lead to problems if there are no clear warning signs, because the focus is on the deliverable. Purchasing is only involved in the collection of data and does not decide which suppliers to use and does not engage in any supplier selection.

The processes of supplier selection are not available. How the suppliers are checked depends on the employee involved. However, the supplier's reputation plays a major role and existing suppliers are used wherever possible. To achieve an appropriate level of consistency in the selection of suppliers, checklists for various requirements should be available.

Monitoring suppliers were considered as missing processes, although many of the interviewees said that they monitor the suppliers who they are most involved in almost weekly. Critical suppliers are carefully monitored even if processes are non-existent. It was recognized that no audits were possible with the current headcount. This justifies the need for efficient processes, because without them, time will be wasted, and warning signs may go unnoticed. A careful selection of suppliers also gives insights into what and in what respect suppliers need monitoring.

Most of the supplier management processes were not documented, but each person has different methods. The procurement processes can be improved independently of the changes and can be easily expanded if needed. That is why the study focuses on common practices for supplier evaluation, helping the supplier evaluate quickly and allowing others to access evidence later on.

Since the analysis identified several problems that require a certain resolution. The key findings related to the identification of supplier risks are selected. The key issues chosen to be solved include the lack of common practices of risk evaluation. So, structure is required to determine which suppliers need more investigation, and show the purchasing department the risks they are going to take before they are engaged with supplier.

The conclusion was that the case study company did not fully develop the processes but improved the parts of the processes that do not change, even if the business is changing.

The analysis reports that there is a need for improvement in the case companies' capacity to identify risks for suppliers. The focus is on helping case study company employees to do this part consistently, fast and enable documentation to be created. The next chapter provides a detailed description of the tool construction process.

5. Conclusion

Procurement has become an important part of the supply chain of companies and part of the company's strategy. In recent years, the traditional role of procurement has changed a great many times and it is no longer considered the goal of achieving the cheapest price and material flow for manufacturing. The current strategy of the company focuses on price reduction.

The focus of the research was chosen for the supplier evaluation, since it is the most important point for any company. Supplier evaluation also provides guidance for the future, and in which respect suppliers should be monitored.

This section presents the developed tool that will help the case study company to control the risks faced by its suppliers. In order to prepare the checklist tool, the model presented by Monczka, et al., (2011) (Figure 4.2) is used as a guide. The model used to identify and evaluate risks.

5.1 The tool creation steps

Step 1: Identify key supplier evaluation categories

Suppliers may be a company threat in many ways. The literature provides a range of categorizations of supplier risks. Interviewees have concluded that key categories used are as described in Figure 5.1.

Step 2 - Weight each evaluation category

The weight of each category reflects the category's relative importance. The physical and financial categories in the tool are weighed as most important on the basis of interviews. There is greater value to relational risks than to information risks. The combined weights must be 100 in total.

Step 3 - Identify and weight subcategories

The weight of each subcategory must fall within the broader category of performance evaluation.

The sum of subcategories should equal to the total weight of the main category. Figure 5.1 below shows subcategories.

The subcategories are to be formulated in such a way that users understand the risks behind the category. The weight is determined according to the importance of risk to the case study company.

Step 4 - Define scoring system for categories and subcategories

Step 4 defines the score for each category of performance. The use of numbers was not desired, so that the tool used *Low*, *Moderate* and *High* grades but calculated the scores behind the final scoring. The user rates each category by three levels, but the sub-categories have a score of a weight for that category.

The score represents the likelihood of risk realization. Furthermore, the impact is also considered by adding a column in which the user is asked whether the risk may be Very Likely, Likely or Not likely to actualize.

Step 5 - Evaluate supplier directly

In this step, the reviewer must visit the facilities of the supplier to conduct the evaluation. At least one day and often a few days are required to complete visits to the site. The purchaser frequently notifies the suppliers of any documents necessary to support the evaluation. This can save time once the evaluation starts. If a purchaser does not have previous experience with a supplier, the reviewer may require a supplier to document its performance. For example, a supplier must provide an evidence of its process control systems or delivery performance.

Step 6 - Review evaluation results and make selection decision

At some point the reviewer has to decide whether the supplier should be recommended or rejected. A supplier evaluation before an actual procurement can provide a purchaser with a great deal of flexibility. Once a real need is fulfilled.

The primary output of this step is a recommendation on whether a supplier should be accepted for business. A purchaser could evaluate a number of suppliers that may compete for a purchase contract. This initial evaluation provides an objective means of comparing suppliers together before making final selection decision.

The final step in the creation process of the supplier evaluation survey excluded from the building of a proposal.

In order to allow the results to be easily evaluated and the supplier to be selected, the tool includes visual elements. The evaluation results were hoped to be visual by interviewees, with colors that indicate risk levels. An overview of the risk level should be available quickly.

The tool of use case is defined by different sourcing approaches and supplier categories. It is built on supplier evaluation and selection theory and different smaller theories help create the actual content.

The use cases for the tool will be based on the tactical and strategic sourcing definition in Section 4. The tool is not designed for tactical purchasing of low value but is designed to give an overview of the risk level of more strategic purchasing.

Risk categories with their respective sub-categories and weights are clearly presented. Dropdown menus with three different options: Low, Moderate and High, are available for the probability and impact columns. Depending on the level, the color coding selected is automated to easily draw attention to higher risks.

Once this research is completed, the case study company will have an Excel-based risk identifying tool and a plan to adapt it to the needs of the case study company.

The tool automatically completes a Risk Score for each category using the sub-categories and their defined weights based on the assessment on the probability and impact values and highlight traffic lights results, depending on how high the risk in each category is.

5.2 The Supplier risk evaluation tool

The actual tool the user fills out is Excel sheet, which is given in Figure 5.1. The data used in the tool does not use actual data, but only examples to show what it might be. The tool will automatically indicate the severity of the risk subsection with traffic lights based on the likelihood and impact of the menu options. Both columns have 3 options, and the colors defined in both columns are green, yellow and red.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
4	Project No.:															
5	Date:															
6																
7	Risk Identification			Weight	Risk Analysis				Response Plan			After Response Plan Implementation				Comments
8	Category	Subcategory	Propability		Impact	Risk Priority Number		Mitigation Plan	Responsibility	Due Date	Probability	Impact	New Risk			
9	Physical sub-chain risks	Supplier's supply risk														
10		Shortages in raw material?	4	0.5	0.1	0.05	Low				0.5	0.05	0.025	Low		
11		Product design risk														
12		Supplier able to quickly adapt to design changes?	5	0.3	0.6	0.18	Moderate				0.3	0.2	0.06	Low		
13		Supplier has problems to conform to product/service quality/safety specifications?	5	0.4	0.8	0.32	High				0.4	0.6	0.24	Moderate		
14		Inventory and storage risk														
15		Insufficient storage capacity or inappropriate storage conditions	4	0.4	0.4	0.16	Moderate				0.4	0.1	0.04	Low		
16		Human and organizational errors														
17		Human and organizational errors and misunderstandings	6	0.8	0.4	0.32	High				0.8	0.1	0.08	Moderate		
18	Financial sub-chain risks	Transportation, logistics and transfer points risk														
19		Customs delays or confiscations	3	0.6	0.1	0.06	Low				0.6	0.05	0.03	Low		
20		Theft, sabotage, handling damage, and so on	3	0.5	0.2	0.1	Moderate				0.5	0.1	0.05	Low		
21		Business risk														
22	Supplier bankruptcy															
23	Competitive risk															
24	Supplier able/willing to reduce costs/prices in order to keep prices competitive															
25	Exchange rate and interest rate risk															
	Exchange rate fluctuations in relation to the															

Figure 5. 1 The final Tool

6. Conclusions and Recommendations

6.1 Conclusions

Currently, procurement has become a key part of companies' supply chain and a component of company strategy. The traditional role of procurement has changed considerably over recent years, with the aim of achieving the cheapest price and material flow for production that hasn't been considered the most important. Therefore, the focus of this study is to understand how suppliers are evaluated in the case study company before they start business with them.

The aim was to provide the case study company with a tool to better understand the risks that the case study company faced by its suppliers and to develop a tool to assess those risks. The analysis findings were achieved through an examination of internal documents of the case study company, and interviews with some of case study company' employees.

This tool that help the case study company procurement employees to identify their suppliers' risks, assesses levels of risks, suggest response plans to deal with these risks and reporting the risks arising from the activities of the suppliers in order to avoid future problems. Accordingly avoid the negative impacts of the supplier's risks.

6.2 Recommendations

This study provided a tool to evaluate the risks faced by suppliers of the case study company, the tool is simple and straightforward, and it is customized for the case study company by defining internally the risks that most relevant to its business and then made available to the source personnel. The following are research recommendations based on the results of the study:

The first recommendation is to **Monitoring Progress**, it would be beneficial to determine how processes in the real work environment are used. Data analysis showed that the categories are the main driving force and influence supplier selection significantly, therefore, as a main part of the proposal, a category design was added.

Another suggestion is **the Risk Communication**, Communication during a crisis can be more important than the response itself. Therefore, because communications frequently judge the strength of the response to an unexpected event, it is important for the relevant interested parties to communicate the risk response plan. Consequently, risk response plans should be

communicated in advance, i.e. during project planning, to the corresponding managers. Then, if an unexpected event occurs, the managers going to be off to a running start.

As a future suggestion, **Risk audit must** to be done which is examining and documenting the effectiveness of risk responses in dealing with identified risk and root causes and the effectiveness of the risk management process. A risk audit is a fundamental part of developing an event management plan.

A risk audit involves identifying and evaluating all risks in order to establish a plan to deal with every unwanted event which is harmful to people or to the organization. The objective of the audit is to ensure that every process does what it should do. These audits must be objective because the well-being of the project could be at stake.

7. References

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