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Identifying the Best-Cost Countries for sourcing SKF's direct materials

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ABSTRACT

Purpose - The purpose of this thesis is to identify best-cost countries for SKF to source Rings, an important group of direct materials used in bearing. This exploration would give the major distinction between two sourcing approaches, best-cost country sourcing and low-cost country sourcing. While low-cost country sourcing focuses on low purchasing price, low labor cost and low material cost, best-cost country sourcing builds the foundation on total cost of ownership and country risk analysis.

Methodology - In order to identify best-cost countries, the combination of qualitative and quantitative methods are used. Data was collected from literature, interviews with SKF's global category managers, SKF internal data as well as external sources of information. Potential countries were recommended by SKF's global category managers during the interviews. Statistical data of different parameters were collected for these countries. To make the data comparable, all data was converted into one standard scale. This was made by using mean standard deviation and scoring scheme risk analysis. After that a development funnel method was applied to analyze and conclude the best-cost countries.

Finding - In this project, the requirements for a country to be chosen as a best-cost country for SKF to source Rings are: (1) country should have low total cost of ownership; (2) the risks connected to sourcing from a country should be low and if they exist, they should be manageable; (3) country should have available materials including steel bars, steel tubes, as well as available forging operation and casting operation to produce Rings, and (4) SKF's local and regional sourcing strategy should be met. To meet these conditions, the list of different parameters which impact on the selection and evaluation of best-cost countries are provided.

Contribution - This thesis contributes to the academic knowledge by providing a framework, a list of requirements and parameters which are important for the selection and evaluation of best-cost country. From the business perspective, this thesis' finding at country level enables the company to go further into supplier level, to search for and work with potential suppliers in determined best-cost countries. Besides that, methodologies, insights and sources of information provide the baseline and reference from which, the company may expand the project to identify best-cost countries for other categories. Moreover, the know-how given how to select and analyze best-cost country would be helpful within different companies and industries.

Key words - Best-cost country sourcing, low-cost country sourcing, total cost of ownership, country risk analysis.

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1 INTRODUCTION

The introduction chapter presents a background of the thesis and a short description about SKF – the case company. The case study about SKF's purchasing department on their way searching for best-cost countries (BCCs) to source their direct materials is also discussed. Subsequently, the purpose of the thesis and the research questions that need to be answered in order to fulfill the purpose are given. This is followed by the scope and delimitations of the thesis as well as the outline of the report.

1.1 Background

An increasing level of global competitiveness and a wider geographic availability of materials have led to global sourcing, which means sourcing of products or services from across the global marketplace, to exploit global efficiencies from low cost skilled labor, low raw material cost and other economic advantages like more favorable taxation subsidies, expanding firm's presence in foreign countries or access to new resource and technologies (Holweg et al., 2011). Global sourcing in many cases relates to low-cost country sourcing (LCCS) which "focus on countries with relatively lower production cost, lower labor cost, and geographically substantial distance from buyer's location" (Kusaba et al., 2011, p.74). Moving to low-cost country (LCC) was very common for many western European countries to expand their businesses, establish factories and source materials in Asian countries such as China and India, in order to save cost and increase value adding to their companies.

To achieve inexpensive labor and low cost of materials, LCCS strategy leads to very complex supply chain (Siegfried, 2013). Kotabe and Mudambi (2009) mentioned that firms which have been sourcing from LCC, especially from developing countries, must consider not only manufacturing and delivery costs, availability of infrastructure including transportation, communications and energy, but also the risks at macroeconomic level such as fluctuation in purchasing prices, interest rate, foreign exchange rates, inflation rate. Vestring et al. (2005) notified about the issue of putting too many eggs in the LCC basket where companies may face political risks and a lack of the protection for intellectual property. Besides that, corruption, civil or external war, terrorism, democratic evolution of the host government may disrupt the manufacturing process, delivery process and business of foreign company. Some examples of LCCS problem discussed here are to prove that cheap labor and cheap material cost not always turn into cost savings.

While LCCS contains a lot of risks, best-cost country sourcing (BCCS) emerged as an evolutionary process that is taking hold in many organizations. Siegfried (2013) presented that BCCS is the new approach which builds the foundation on total cost of ownership (TCO) and risk management, not only focus on low purchasing price. Dutzler et al. (2011) also discussed that BCCS is mandatory for global success, in order for a company to be assured of value in their global sourcing; they at least need to progress upward to a BCCS initiative. The center point of BCCS is not low material cost or low labor cost. However, it does not mean that LCCS

are not part of BCCS; it means that firms should search globally for the best place to manufacture and source (Siegfried, 2013). Here, lower TCO is an advantage for BCCS, but must come along with the evaluation of other long term factors regarding to country risks including political, macroeconomic, socio-demographics, environment and sustainability.

Due to the fact that BCCS is an evolving and multifaceted concept, there is no definite definition or particular method for specific industry. Many companies, known as BCCS practitioners, are finding the ways to deal with unfolding BCCS challenges and opportunities (Dutzler et al., 2011). According to Siegfried (2013), this evolution will continue growing and changing in the future. Increasingly prevailing BCCS opens the way for this thesis to contribute to BCC's practitioners by (1) providing the list of significant parameters that need to be focused when selecting and evaluating BCC; (2) providing methodologies and know-how given how to select and analyze BCC, referenced from the case study of SKF's purchasing department.

1.2   Description of the case company SKF

SKF is the world's leader in the design, development and manufacture of high performance bearings. SKF's business also extends to the production of seals, mechatronics, machinery maintenance services and lubrication system. SKF works to minimize the friction make things run faster, longer, cleaner and more safely. With 10 major warehouses and the partnership with more than 17,000 distributors around the world, SKF serves the global industrial market directly as well as indirectly through its worldwide distributor network. SKF has 108 manufacturing units in 130 countries, working with 45,000 knowledgeable employees globally. SKF's business model and strategies are designed to maximize value creation for their stakeholders and to make their customers satisfied (SKF annual report, 2016). The main competitors are Schaeffler group, Timken, NSK, NTN, JTEKT, Rothe Erde, Watongdiam bearing group (SKF annual report, 2016). SKF has two strategically different value propositions. On the one hand, SKF provides products meeting their customer specific performance requirements; deliver on time at very good competitive price. SKF believes in getting involved as early as possible in their customer's development process; add value in their performance and competitiveness. On the other hand, SKF serves additional solutions to help their customers to improve their rotating equipment performance (SKF annual report, 2016).

SKF has continued to develop business with strategic suppliers across all categories over the world. Currently, SKF has about 1,300 suppliers which account for 80% of the global spend volume. In the past SKF had decentralized purchasing structure in which each hub has its own purchasing department to work with local suppliers. One disadvantage of this structure is that different factories belong to SKF corporation may negotiate with the same supplier for the same products, results in different purchase prices and conditions containing service and quality. However, in 2012, SKF started a huge transformation toward centralized procurement structure, which has been called "one purchasing". Centralized purchasing organization means people sitting in different factories even though they have different roles and responsibility, all still report centrally to global purchasing department, head office in Göteborg, Sweden. The main advantage of this transformation is that better conditions regarding to purchasing prices, cost, service, quality from supplier, as well as product and supplier standardization can be achieved through the operation of purchasing group at the corporate level. According to SKF annual report (2016), more than 600 suppliers have been removed during 2016 in order to fulfilling SKF's quality, cost, delivery, innovation and management performance target.

1.3   Identifying best-cost countries for sourcing SKF's direct materials: A case study

Direct materials are those materials which are easily identified, conveniently measured and directly charged to the cost of production. It is also part of the finished product. For SKF's bearing industry, direct materials include Rings, Wires, Bars, Tubes, Balls, Rollers, Cast parts and Electronic components. Figure 1 shows an example of bearing.

Ring is one of the most important elements in bearing platform. There are basically two types of Ring, inner and outer Ring in order to complete the bearing part. SKF deals with hot rolled

rings and turned rings. Most of the hot rolled rings are made from bars followed by forging operation. On the other hand turn rings are made from tubes followed by turning operation. Both technologies also require casting operation. In order to produce the Ring, required materials are steel bars and steel tubes which play very important role. SKF spends high cost on materials to produce Rings from right suppliers in better quality.

Figure 1: Bearing

In term of break-down cost structure of Ring, to make turned ring, 60% cost spent on raw material, 30% on turning process and 10% on heat treatment. On the other hand, to produce hot rolled ring through forging operation, raw material costs 30%, turning process costs 30%, forging process costs 30% and heat treatment costs 10% from the total cost.

For direct materials, SKF's factories are currently sourcing from 41 different countries around the world, see table 1.

Supplier \ Buyer	Argentina	Austria	Brazil	Canada	China	France	Germany	India	Indonesia	Italy	Japan	South Korea	Malaysia	Mexico	Poland	Russia	Spain	Sweden	Switzerland	Taiwan	Ukraine	United Kingdom	United States
Argentina	x																						
Austria		x				x	x								x				x				
Belgium						x				x													
Bosnia		x	x			x	x			x					x								
Brazil			x																				
Canada				x															x				x
China	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x			x	x
Croatia										x													
Czech Republic		x				x	x								x								
Denmark																		x	x				
Estonia																			x				
France	x	x		x		x	x			x					x		x	x				x	x
Germany		x		x	x	x				x							x	x	x			x	x
Hungary										x													
India	x		x			x	x	x	x	x				x			x				x		
Indonesia								x	x														
Italy		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x				x	x
Japan	x	x	x		x	x	x	x	x	x	x	x	x	x								x	x
South Korea		x		x		x		x	x	x				x			x			x			
Latvia																		x					
Luxembourg		x																					
Malaysia																							
Mexico														x									
Monaco						x																	
Netherlands			x			x	x			x				x	x		x		x			x	x
Poland		x				x	x			x								x					
Romania							x			x													
Russia															x						x		
Serbia						x				x				x									
Singapore				x							x												
Slovakia		x				x	x			x					x			x					
South Africa														x				x					
Spain						x	x			x				x				x					
Sweden		x		x	x	x	x			x		x	x	x			x					x	
Switzerland		x				x	x												x				x
Taiwan				x	x														x	x			
Thailand								x						x									
Turkey						x																	
Ukraine																					x		
United Kingdom	x	x	x			x	x	x		x							x	x				x	x
United States		x	x	x	x	x	x	x		x		x	x				x					x	x

There are significant sourcing flows from China, France, Germany, India, Italy, South Korea, Sweden and United States which occupy 83% of total spent on Rings, Wires, Bars, Tubes, Balls, Rollers, Cast parts and Electronic components. Among these major sourcing countries, China and India have been defined as LCC in SKF while the rest countries are often known as being more expensive. While inexpensive labor and low cost of material in China and India are the advantage of LCCS, many disadvantages have been noticed and discussed within SKF. The

significantly long geographical distance from China or India to Europe results in long lead time for delivery and transportation, averagely 3-6 weeks. The situation becomes worse especially in cases of unforeseen natural disaster or political issue that makes transportation lead time even longer. The companies also have to keep inventory levels high for the safety stock to compensate the consumption during long transportation time. In financial viewpoint, sourcing from long-distant countries is not promising due to high capital in the warehouse as well as high cost of warehouse operation, not to mention forecast of what to produce in far advanced and obsolete inventory of some commodities that might not need. LCCS also has some problems related to the availability, flexibility and reliability of commodity's supply, especially when there are quality problems and changes in demand in the home markets. Other notable fact of SKF's bearing industry is that most steel direct materials are very heavy and require transportation in bulk, thus increase the transportation cost. Moreover, since 2006, LCCS has been changing when the average wages in India and China increased significantly. In 2015, labor wage was more than double in China and increased by about 60% in India. Rising living standard in China made its wage growth was faster than elsewhere. Both India and China continue to experience extraordinarily high wage growth according to global wage report from International Labor Organization (2016). This factor makes LCC like China and India become not competitive in the long run.

In the situation that two main LCC China and India are no more promising and sourcing from Western European countries is too expensive, it poses a challenge to SKF's purchasing department to find alternative solution. SKF's centralized purchasing department focuses on global value creation. Being responsible and flexible to adapt to changes in the world and in its supply chain, SKF's purchasing department is currently searching for potential BCCs for sourcing direct materials. According to SKF's global category managers (GCM) for Rings, SKF's strategy is moving from global sourcing to local and regional sourcing. Additionally, GCM for Rolling Elements also mentioned, BCC should be close to SKF's factories. Hence, finding a BCC should meet SKF's purchasing strategy which is locally or regionally close to SKF's factories. Due to the fact that BCCS is an evolving concept, there is no specific definition or particularly applicable method to apply it. This poses challenges to the reality of SKF's purchasing department that how they can be the successful pioneer of BCCS.

1.4 Purpose

The purpose of this master thesis is to identify the best-cost countries for SKF to source Rings, one of the most important groups of direct materials.

1.5 Research question

In order to identify BCCs we are going to firstly understand SKF's current geographically sourcing areas, study SKF's strategy of how SKF chooses a potential country and what future business requirements are. Later on, the focus would be on understanding the different parameters which are associated with respective countries. To keep align with all aspects we are going to focus on following research questions.

Question 1: What is the current state of SKF sourcing in terms of sourcing areas and sourcing practices?

Motivation:

It is important to study and understand the baseline of SKF's current sourcing areas and practices in order to come up with any future sourcing improvement later. This research question can be answered conceptually based on theories of TCO and global sourcing. Practically, interviewing with SKF's GCMs and studying on SKF's sourcing procedure will be the source of information to address this question.

Question 2: What are the different parameters need to be focused while selecting best-cost countries?

Motivation:

Answering this question will provide a range of criteria/parameters for SKF to identify which factors formulating a BCC. Literature review of BCCS, TCO and country risk analysis will be the conceptual framework, along with practical interviews with SKF's GCMs will guide this investigation.

Question 3: Which countries are the most attractive one for SKF to source direct materials in 3-5 years?

Motivation:

The answer of this question will clarify the reasons why a country is chosen to be the BCC among potential sourcing areas for particular categories. The defined criteria in the second question will provide the baseline to analyze the potential countries.

1.6 Scope

The scope of the thesis is narrowed down under the guidance of supervisors from Chalmers and SKF regarding to:

● Direct material: The researchers first analyzed the portfolio of the product, based on business demands and identified which direct material accounted the highest spent in previous years over all of SKF's industries. The final decision is to focus on Rings which accounted for 32% total spent. In such case, selecting BCC for this major direct material is applicable and significantly impact on SKF's value adding.

● Country level: It is impossible to analyze every country in the world. Because of the time limitation and lack of information, the researchers are going to taper it down during the interviews with SKF's GCMs.

1.7 Delimitation

The main focus of the thesis is to identify BCC at country level without touching supplier base. Therefore, due to the time limitation, this thesis will only compare statistical data representing countries at country level. Due to the fact that there are the big differences among regions, cities and areas within one specific country when going to supplier level, in terms of political stability, economic development, quality of infrastructure, etc., it is limping to compare supplier of this country to supplier of another country only based on numerical data at country

level. Taking China and India into account for example, although China has higher competitiveness index (4.95) than India (4.52) (Schwab, 2016), it does not mean the supplier in Suzhou, China is more competitive than another supplier in Mumbai, India. All the statistical data representing countries at country level cannot visualize those fluctuations and differences within different areas belong to different countries thus would be the major delimitation of this thesis.

This thesis will not consider commodity price and transportation cost when evaluating countries. The price of steel in ordinary steel market is commodity and market driven. Particularly for SKF's bearing industry which is one type of engineering steel, the price is driven by the combination of commodity, market, specific supplier and negotiation situation, thus the price is different among different suppliers. Besides that, steel price fluctuates significantly day by day and it is not precise to choose one figure representing a country at the current time to find BCC in the next 3-5 years. The researchers will not work at supplier level so the fixed information regarding to specific origin of supplier and the destination of the buyer cannot be provided to calculate transportation cost. Additionally, the process of evaluating countries also faces to another limitation when the statistical data of some parameters couldn't be found from either external source or SKF internal source.

1.8 Thesis outline

The first chapter mainly presents the background of the thesis and a short description of SKF. It also contains the case study on SKF's group purchasing, purpose, research questions, scope and delimitations of the thesis. Chapter two provides the relevant theoretical background driving the thesis process and used in the analysis and discussion. It starts by introducing global sourcing and its process which focus on TCO and country risk analysis. Thereafter, literature related to LCCS and BCCS is introduced. Chapter three describes the research process which includes all the steps and methods used for data collection and data analysis. Chapter four gathers all qualitative data from literature review and interviews. The answers for the first research question are also given in this chapter. Chapter five shows all the quantitative data including the results from the survey, weighted criterion method, organizational documents, especially the statistical data from external sources. This chapter answers the second research question. Chapter six presents how BCCs are chosen applying development funnel analysis. Chapter seven shows the final result and recommendation for SKF's purchasing department, also for BCCS' practitioners. The last chapters discuss the key findings and contribution from the thesis, and provide suggestions for future research.

2 LITERATURE REVIEW - THEORETICAL FRAMEWORK

Several important topics associated with the purpose of this paper are in this literature review screened. This chapter starts with a broad perspective of global sourcing in terms of its definition, reasons for global sourcing and its cost elements, as a financial framework to evaluate risk and cost when going global. A global sourcing approach with many steps in its process is also provided. Thereafter, academic literature regarding to LCCS and BCCS are introduced, as well as the concept of TCO and country risk analysis are discussed in detail.

2.1 Global sourcing

There are a number of studies about the phenomenon known as global sourcing. For example, Monczka and Trent (1991); Bozarth et al. (1998); Antras and Helpman (2004); Nassimbeni (2006) investigated why and how companies increase the share of purchases bought from suppliers beyond their national boundaries. From these studies, global sourcing was defined as "the practice of sourcing from the global market for goods and services across geopolitical boundaries". The purpose of global sourcing is often to exploit global efficiencies in the delivery of a product or service. These efficiencies include low cost skilled labor, low cost raw material and other economic factors like taxation subsidies and low trade tariffs. Christopher et al. (2011, p.67) mentioned the sourcing of products from across the global marketplace was an increasing trend associated with economic development. This trend was the result of many independent decisions taken by firms around the world looking for new sources of competitive advantage. Monczka et al. (2005, p.304) presented definition of global sourcing which is the "proactively integrating and coordinating common items and materials, processes, designs, technologies and suppliers across worldwide purchasing, engineering and operating locations".

The key motivation for global sourcing is cost reduction, market access consideration (access through a supplier to promising sales market, regional knowledge), technological requirement (some technologies or particular suppliers can only be found in some specific areas), the proximity to customers, legal issues in terms of local content, tax issues, subsidies, certificates (Alard et al., 2009). Holweg et al. (2011) compared three studies of Monczka and Giunipero (1984), Monczka and Trent (1991) and Nassimbeni (2006) regarding to the reason of global sourcing, see table 2. From these comparisons, the reasons for global sourcing can be classified into three main categories: (1) firms can save cost by sourcing materials and components from low cost foreign suppliers, (2) firms establish their presence in foreign countries and (3) firms can obtain the access to new resource and technologies.

Table 2: Reasons for global sourcing, Holweg et al. (2011)

Monczka and Giunipero	*Monczka and Trent (1991)*	*Nassimbeni (2006)*

(1984)		
Lower prices	Cost reduction	Purchase materials and components at lower costs
Firm had worldwide operations and attitude	Quality improvement	Achieve resources not available in the home country
Availability of foreign products	Increased exposure to worldwide technology	Possibility of acquiring less expensive manpower
Improved the quality of foreign products	Delivery and reliability improvements	Global competition
Technology available from foreign sources	Introduction of competition to the local supply base	Global attitudes of the company
To fulfill countertrade/ offset/ local content requirements	Establishing a presence in a foreign market	Possibility of acquiring advanced technologies
Due to developing worldwide competition	Satisfying offset requirements	Reduction of commercial barriers
Improved delivery of foreign products	Increase the number of available sources	Possibilities of developing a presence on foreign markets
	Reacting to the offshore sourcing practices of competitions	Presence of plants in foreign countries
		Possibilities of selling products on supplying markets
		More favorable taxation

Many benefits of global sourcing known as very important part of a company's purchasing strategy have been widely discussed in the academic literature. However, there are only few models that provide a comprehensive risk and cost assessment to guide managerial decision-making (Holweg et al., 2011). In the paper "On risk and cost in global sourcing", Holweg et al. (2011) defined three basic cost elements in global sourcing including *static, dynamic* and *hidden cost*. They also applied this framework to evaluate the cost and risks in global sourcing scenarios and propose a total cost model of how to make global sourcing decision, see table 3.

Table 3: A framework for financial assessment of global sourcing, Holweg et al. (2011)

Static cost	Dynamic cost	Hidden cost
Purchase price ex-factory gate	Increase pipeline and safety stock due, which is amplified by demand volatility and product variety	Labor cost inflation due to rising standard of living and competition of labor market
Transportation cost per unit, assuming no unexpected delays or quality problems	Inventory obsolescence due to long logistic lead-time, e.g. in case of quality problems	Currency fluctuations, in particular for cases of artificially pegged currencies
Customs and duty to clear a shipment for export	Cost of lost sales and stock-outs, as the supply chain is unresponsive to shifts in demand	Rise in transportation cost, e.g. due to higher oil price and carbon offset costs
Insurance and transaction cost	Expedited shipments, e.g. air-freight, to ensure uninterrupted supply	Overhead for managing the international supply base, including travel cost or cost for local personnel in the supplying markets
Cost of quality control and compliance with safety and environmental standards		The loss of intellectual property to contract manufacturers
Search cost and agency fees to identify and interact with local suppliers		The risk of political and economic instability or change

Besides that, Alard et al. (2009) also mentioned global sourcing is a challenging topic containing many significant pitfalls although it is becoming more important. The fact is that nowadays many European companies are more and more interested in Eastern European and Asian supply markets which are very promising for their local markets (Alard et al., 2009). To support firms when going abroad, to optimize benefits from global sourcing and avoid global sourcing risks as mentioned above, Alard et al. (2009) suggested a model of global sourcing process including many steps in detail that all focus on TCO and risk analysis by which the firms can adapt their procurement activities into global sourcing strategy, see figure 2.
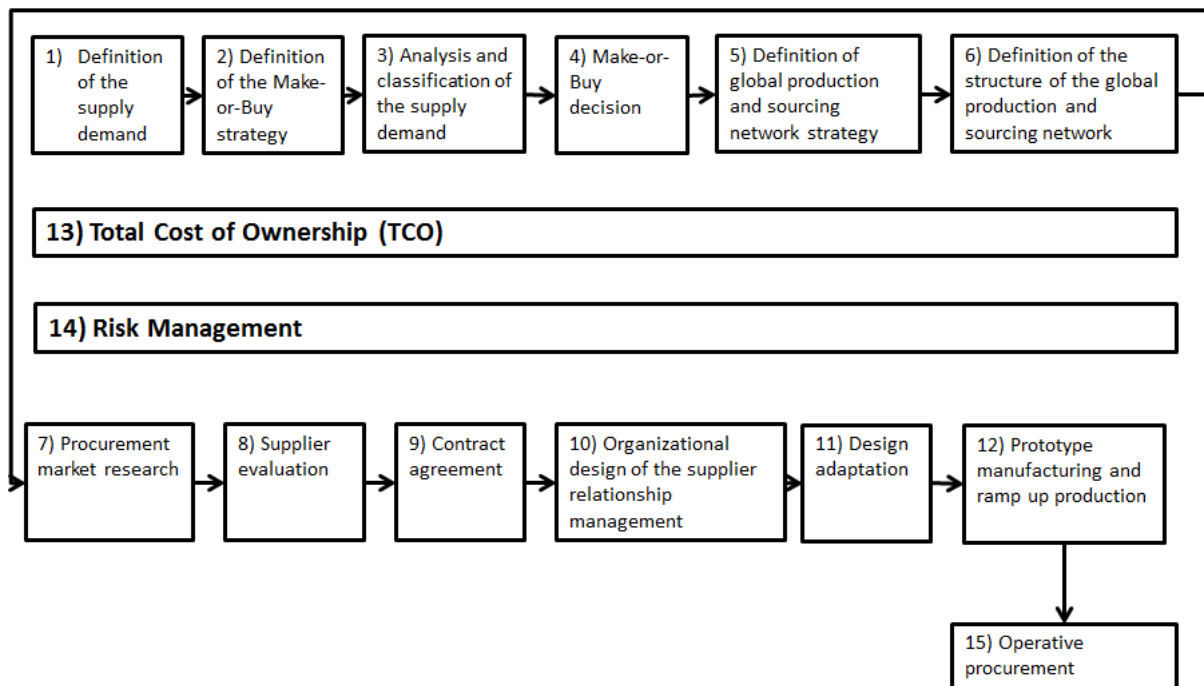
Figure 2: Global sourcing process and its steps_Alard et al. (2009)

In this process, TCO and risk management are the main focus. TCO can be defined as an estimation of all direct and indirect cost associated with a specific procurement step over its entire life cycle (Alard et al., 2009). Here TCO and risk management can strongly support the decision of Make-or-Buy and supplier evaluation.

2.2 Low-cost country sourcing

Global sourcing in many cases relates to LCCS which "focus on countries with relatively lower production cost and a culturally and/or geographically substantial distance from buyer's location" (Kusaba *et al.*, 2011, p.74). The factors that mostly contribute to lower production cost would typically include low raw material cost and low labor costs (Dev, 2017). Weber et al. (2010) provided that LCCS is more labor-intensive. According to Kusaba et al. (2011), global sourcing initially emerged as a reactive strategy to resist the increase of foreign competition in domestic markets. Due to the fact that the purchased price of the commodity of most industries has risen, global sourcing strategy has been considered into more proactive way that allows firms to have more competitive advantages. As a result, LCCS has become unavoidable in which firms in developing countries are very important links in global supply, production and distribution networks (Sawhney and Sumukadas, 2005). Lockström (2006) also presented that LCCS is at heart part of globalization phenomenon, in which LCCS is the way to utilize economies of scales, to harvest benefits from comparative advantages and to leverage internal competitive advantage, in order for the foreign company to improve competitive advantage and obtain superior performance. Lockström (2006) created a table of driving forces for LCCS including four different perspectives in terms of Political, Social-Demographic, Technological and Macro-economic factors, see table 4.

Table 4: Driving force for low-cost country sourcing, Lockström (2006)

Political Factor	Removal of trade barriers such as tariffs and quotas
	New World Trade Organization members
	Weak labor protection law and labor unions
	Low tax and interest rate
Socio-Demographic Factors	Large pool of both educated and low-wage labor
	Highly motivated workforce
	Large consumer base due to large population numbers
	Improved English proficiency
	Cultural openness
Technological Factors	Rapid developments in wireless technologies and Internet
	Adoption of sophisticated computer software such as ERPs, e-procurement solution, etc.
	Improve transportation in terms of infrastructure, logistical systems and vehicles
Macro-Economical Factors	Large wage differentials
	High foreign direct investments (FDI)
	High economic growth in LCC
	Decreasing transportation cost
	Decreasing communication cost

According to Lockström (2006), political factors including regulations and policies set by national government and local authority such as trade barrier, taxation and labor laws. Socio-demographic factors consist of educational levels, language proficiency, and cultural openness. Technological factors deal with the use of new innovation that are able to reduce the cost of transportation and communication such as wireless, new and improved means of transportation. Macro-economic factors include wages, tax, interest rates, and foreign direct investment.

Noteworthy is the fact that many companies were joining the race to China and India, which were the top two destinations for LCCS because of low cost, well-developed capabilities, and a large domestic market of two those countries (Vestring et al., 2005). Najafi et al (2013) also provided that decades ago, Western companies were increasingly replacing their local suppliers with suppliers in LCC such as China and India.

LCCS spans widely across multiple geographical regions. In order to manage and control that large-scale and complex operations and supply chain, it is mandatory required the organization to have adequate and efficient staffing and leadership to undertake such a task (Lockström, 2006). Najafi et al. (2013) presented the main drawbacks and impediment to LCCS are lack of capable supplier, loss of control, inefficient infrastructure for transportation and information technology, local law and regulation, inadequacy of cost/benefit analysis systems and the absence of overall post-outsourcing assessments. Sourcing from long distance country forces the organization to disconnect from its current suppliers and supply chain network, then establish business relationships with new supplier and become a part of new network (Najafi et al., 2013), which results in other issues related to logistic, delivery, reliability, lead time, etc.

Platts and Song (2010) claimed that most buying firms sourcing from China underestimated the true cost of LCCS which includes transportation cost, warehouse cost, cost for different language and cultural issue, cost of inspection, cost of late delivery, etc. Weber et al. (2010) concluded that relying on purchasing price is not sufficient decision making for LCCS. Ruamsook et al. (2009) brought up the issues associated with sourcing internationally from LCC which comprise of transportation and logistics cost, delivery performance, quality, business environment (e.g. laws, cultures and norms, political stability, currency exchange rate fluctuation, and domestic market nationalism), manufacturing and supplier capability, communication network and information technology, logistic infrastructure and local logistic industry competence.

2.3 Best-cost country sourcing

As mentioned from the early introduction that BCCS is new, multifaceted and evolving concept, thus there has not been yet any complete definition of BCCS from academic literature. The researchers have collected a few articles, mainly the case studies from some BCCS practitioners being the pioneers toward BCCS initiative. Dev (2017), from the Fortune 500 Pharmaceutical Company, defined BCCS as a sourcing approach considering not only low material cost and low labor cost but also new factors such as long-term sustainability, inflated wage rates, greener supply chain, safety and compliance requirements, cost of logistics, integration of suppliers, selective demands and preference for different products, as well as the macroeconomics and demographics of a country. These factors result in innovative and cost-saving opportunities, also enable companies to higher its position in global competition (Dev, 2017). That's also the reason Dutzler et al. (2011) mentioned that BCCS is mandatory for global success.

The center point of BCCS is not low material cost or low labor cost. However, it does not mean that LCCS are not part of BCCS; it means that firms should search the whole world for the best place to manufacture and source (Siegfried, 2013). Lower production cost is an advantage for BCCS. However, BCCS must also come along with the evaluation of other long term factors regarding to political, macroeconomic, socio-demographics, environment and sustainability.

Siegfried (2013) stated that BCCS strategy built on the foundation of value creation, TCO and risk management. Firstly, the goal of BCCS is to create value for the organization. There are many ways a best sourcing strategy can create value, such as shorter lead time, fewer quality issues, fewer transportation issues, more stable political policy, more support from host government for favorable taxation and customs duty, less risks of inflation or currency fluctuation, more compliance to environmental and sustainable requirement, more advanced and reliable of transportation infrastructure. Secondly, to get BCCS right, purchasing department should be the driver to exploit the full potential of optimizing the supply chain and employing TCO consideration (Sitte et al., 2014). Dutzler et al. (2011) also mentioned to get the right BCCS, all the issues of global sourcing must be solved in a new and innovative way with TCO in mind. To develop a BCCS strategy, organization must be able to understand all the cost that make up a product or service although this task takes time and costly. Organizations should aware of not only commodity cost, transportation cost, customs duty but also hidden cost of quality, cost of increased lead time, inventory cost (Siegfried, 2013). Dutzler et al. (2011) suggested that TCO should include the price of compliance with social and environmental regulation along with the cost of logistic and currency volatility. The reason is that the organization can no longer avoid the price of implementing green initiatives wherever they do business, to show customer that they are comply with environmental and sustainable responsibility and be good global citizens, as well as to reduce emission in the supply chain and minimize the possibility of costly accident (Dutzler et al., 2011). Thirdly, BCCS decisions also have to take into consideration risks throughout the supply chain (Siegfried, 2013). Many hot spots around the world related to war, terrorism, religious tension, violent protest, economic crisis, inflation, etc. may disrupt the firm's business and supply chain. Risk analysis for BCCS

strategy is to deal with global dynamics that have been changing continuously. This dynamics make organization's strategy which fit today but maybe not fit in two years from now (Siegfried, 2013), thus requires firms constantly make adjustment to their strategies.

2.3.1 Total cost of ownership

TCO is a phrase used to describe "all costs associated with the acquisition, use, and maintenance" of a good or service (Ellram and Siferd, 1993). TCO examines the cost associated with purchased goods and services throughout the entire supply chain (Ellram, 1993). TCO looks at the cost of doing business with a supplier in overall, rather than looking only at the purchasing price of commodity. TCO considers the broad spectrum of acquisition costs and also the life cycle costs which related to using a given item from a given supplier during the entire life of that item (Ellram, 1993). Ellram (1993) developed a TCO framework to understand the true cost of purchasing by dividing purchasing related costs into pre-transaction, transaction, post-transaction elements. Pre-transaction cost includes all the costs arise from the time that anyone in the company starts thinking about and investigating the possibility of buying an item from potential suppliers. Transaction cost is those costs associated with actual placing an order and getting the order into the supply chain of the company. Post-transaction cost consists of all the costs occur after the possession of the company toward the purchased item, such as right after it is received into the company's system, or when it is used, modified, repaired and even disposed of.

- Pre-transaction components:
  - Identifying need
  - Investigating sources
  - Qualifying sources
  - Adding supplier to internal systems
  - Educating
    - Supplier in firm's operations
    - Firm in supplier's operations
- Transaction components
  - Price
  - Order placement/preparation
  - Delivery/transportation
  - Tariffs/duties
  - Billing/payment
  - Inspection
  - Return of parts
  - Follow-up and correction
- Post-transaction components
  - Line fallout
  - Defective finished goods rejected before sale
  - Field failures

- ○ Repair/replacement in field
- ○ Customer goodwill/reputation of firm
- ○ Cost of repair parts
- ○ Cost of maintenance and repairs

For this framework, Ellram (1993) classified and motivated the major benefits of TCO in five different categories: performance measurement, decision making, communication, insight/ understanding and the support of continuous improvement efforts. In terms of performance measurement, TCO is a good framework to evaluate suppliers and measure results of quality improvement efforts, as well as an excellent tool for benchmarking by putting all options and comparisons in one page. In terms of decision making, TCO provides very good baseline for selecting supplier, forces purchasing to quantify trade-offs and creates a structure for problem-solving environment (Ellram, 1993). In communication, TCO supports purchasing decision by involving other functions internally and its suppliers externally (Ellram, 1993). For the purpose of getting insights and understanding in general, TCO provides a big picture of not only the current costs of all pre-transactions, transactions and post-transactions but also the trend analysis which is needed for comparing supplier performance, target pricing and negotiation. This tool also helps to improve the awareness of purchasing personals about most critical non-price factors contribute to TCO and enhance long-term orientation (Ellram, 1993). To support continuous improvement, TCO benefits a company by keeping track of the costs of all activities over time, thus easily recognizing and highlighting which factors are the large cost elements, which activities are increasing cost then identify cost saving opportunities (Ellram, 1993). TCO also drives the suppliers to focus on the right improvement by identifying significant cost elements and their value in order to add value for the company by reducing cost. To conclude, TCO model looks beyond the purchasing price and support purchasing decision both today and in long-term run.

Alard et al. (209) did not stop at supplier level in there study about TCO. They designed an integral TCO concept specialized for global sourcing projects which focuses not only on supplier evaluation but also country assessments, in order to know which procurement markets are the most promising to search for suppliers specialized on specific procurement object. According to Alard et al. (2009), the key modules of the TCO concept are:
- Macroeconomic analysis module
- Microeconomic analysis module, include:
  - ○ Contract price
  - ○ Strategic procurement
  - ○ Operative procurement
  - ○ Transportation and logistic
  - ○ Usage of the procurement object
- Summary module

Macroeconomic analysis module consist of all parameters which are relevant from a macroeconomic perspective such as oil price, tax rate, inflation, exchange rate or labor cost in

a specific country. At the microeconomic level, module *contract price* includes all the parts of the negotiation with suppliers during the request of quotation such as material cost, production cost, taxes, packaging and so on. Module *strategic procurement* includes all the processes related to sample, supplier audit for qualification, supplier development, which is similar to pre-transaction components from the model of Ellram (1993). Module *operative procurement* includes all the processes related to operative procurement of an order such as order processing, order monitoring, stock receipt, product qualification and invoicing. The module *transportation and logistics* includes transportation cost from supplier to the customer's reception point, legal cost, insurance cost, customs duties, and also certificates of inspection cost. Operative procurement and transportation module are similar to transaction components of Ellram (1993)'s TCO model. Module *usage of the procurement object* contains the cost all activities using the purchased item in manufacturing or adapting this item into the operation of the company.

According to Alard et al. (2009), this TCO tool is designed to use independently so it is possible to extract the model and use a single module to fit particular analyzing purpose. For example, module *contract price* can be useful for procurement department to analyze and evaluate the cost structure of suppliers. Module *macroeconomic analysis* can be use separately to look at the cost structure at macroeconomic level when considering different potential sourcing countries (Alard et al., 2009).

2.3.2   Country risk analysis

Meldrum (2000) provided a sufficient definition for country risk that mentions "all business transaction involve some degree of risk. When business transaction occurs across international borders, it carries additional risks not present in domestic transactions. These additional risks, called country risks, typically include risks arising from a variety of national differences in economic structures, policies, social-political institutions, geography and currencies. Country risk analysis attempts to identify the potential for these risks to decrease the expected return of a cross-border investment". Bouchet et al. (2003) stated that country risk exists no matter the level of economic development of the country. Even the most economically advanced nations may generate a significant extent of country risk. According to Bouchet et al. (2003), for a given country, imbalances in the economic, social and political fields are likely to increase the risk of investing there. Hence, they classified country risks into three categories, see table 5.

Table 5: Country risk model, Bouchet et al. (2003)

Social-political risk	Political	Democratic or non-democratic change in the government
	Governmental policy	Change in the policy of the local authorities
	Social	Social movement intending to influence foreign business or host country policy
Economic risk	Macroeconomic	Any macroeconomic risk specific to the host country
	Microeconomic	Any microeconomic risk specific to the host country
Natural risk		Earthquake and other natural disaster

According to Bouchet et al. (2003), social-political risk consists all possible factors issued from any social group, political authority or governmental body in the host country that cause damage to the business of the foreign firm executed in that host country. Miller (1992) divided social-political risk into political risk, government policy risk and social risk. Political risks include any potential or actual changes in political system, civil, of external war, democratic evolution that may disrupt the foreign company.

Governmental policy risk includes any unanticipated actions from local authorities posing disadvantages to foreign company. This type of risk contains expropriation, nationalization, breach of contract including loan repudiation, foreign exchange controls, trade restrictions or trade agreement that could favor some foreign competitors (Bouchet et al., 2003). The big number of studies has outlined the political and governmental stability as critical component to attract Foreign Direct Investment (FDI), which can be used, as a reference to select BCC. Greater political stability in a location is viewed as a higher probability of profits by foreign investor in a host country. Political instability might be the largest deterrent to foreign investors, as it makes all areas of policy uncertain (Chakrabarti, 2001). Besides that, the problem of corruption is widespread in the emerging economies. On the one hand, countries with high corruption rank (e.g. Russia, Ukraine, Egypt, etc.) do not receive high level of FDI, while countries with relatively low level of corruption receive so much investment. It is very important for rules, regulations and administrative procedures to be clear and easy to minimize uncertainties and not to create additional problems. The extent of corruption in public and private sectors of a country may cause barriers on the exchange and the delivery of services for business such as public procurement, license, contract, tax breaks and subsidies, market share,

service of payment for example.

According to Bouchet et al. (2003), social risk include all the actions from organizations like trade unions, non-governmental organizations (NGOs), or other informal groups of people that, peacefully or not, democratically or not, lobby the local authorities or directly impact on the foreign firms, by their policies and their actions. Changing in labor cost for example may be impacted by these social organizations. Higher wage causes lower level of FDI and creates higher price for all goods, making a company less competitive both at home and in foreign markets (Chakrabarti, 2001).

Bouchet et al. (2003) broke down country economic risk into macro and micro level. Macroeconomic risk contains all the fluctuations in the macroeconomic environment such as prices, interest rate, foreign exchange rates, and inflation rate. For instance, inflation rate can cause imbalance that negatively disrupt day-to-day business and results in costly commodity trading. In detail, inflation rate is a measure of the overall economic stability of the country. Asiedu et al. (2002) argued that lower inflation attracts FDI. High inflation is a sign of country's instability and unwillingness of the central bank and the government to balance the budget, to restrict money supply. The issue of exchange rate has been examined in the literature from different aspects. In general, foreign firms are more willing to buy a country's asset when that country's currency is weak. The effect of exchange rates on selection of FDI has been examined both with respect to changes in the level of exchange rate between countries and in the volatility of exchange rates. Rosengren and Klein (1994) stated that exchange rate depreciation increases FDI. Another important factor that influences selection of FDI is tax. Sales tax is "a tax on the sales of a business". A sales tax is normally a fixed percentage of total sales of some classes of goods and services (Black et al., 2012). A conventional sales tax is levied at the point of sale, paid by the end consumer, collected by the retailer and passed on to the government. Country's decisions over the setting of tax level might be different. On the one hand, higher tax rate is a source of income for the state, made by non-resident investors. On the other hand, if taxation is too high, inflows of investment that causes economic growth may be discouraged.

Microeconomic risk covers all the uncertainties related to business environment of the foreign firm in its regular operation at the industry level and at the firm level, including production, financial, human resource, supply chain and logistic, marketing, etc. It negatively impacts on the input and output business transaction and management of the firm in local environment. Risks related to input flow associated with raw materials, labor and capital for the foreign firm to run its business, output risks associated with marketing uncertainties. Bouchet et al. (2003) emphasized that microeconomic risk is especially significant for a multinational company in developing countries where local infrastructure, regulation, safety procedure or environmental, sustainable requirement are not highly prioritized. Well-developed infrastructure attracts potential investors to a country and stimulates flows towards it.

Natural risk means all the natural phenomenon, natural disaster that may impact negatively on the business condition of a foreign firm such as earthquake and storm which cause significant

disruption on the sales and production facilities of that firm (Bouchet et al., 2003).

3   METHODOLOGY

The aim of this chapter is to define research strategy and research process of the thesis. Research strategies are classified into qualitative and quantitative method. Research process includes 10 steps containing the methods for data collection and data analysis. These 10 methods are presented in detail followed the sequence of the research process including literature review, study on SKF's Total Cost of Acquisition (TCA) model, group discussion, interviews, survey & weighted criterion method, organizational documents, statistical data from external sources, data classification using Mean-standard deviation method, risk analysis using +/- scoring scheme and development funnel analysis.

3.1   Research strategy

Following the appropriate research strategy is important since it influences the way a research performs in terms of data collection and data analysis. Research strategies can be classified into two main groups: qualitative and quantitative.

Qualitative method used in this thesis is the *individual interview* with expert who is GCM of SKF, *studying* SKF's TCA model and *group discussion* with internal stakeholders. Qualitative method is used to gain understanding some aspect of social life, and generate words, rather than numbers, as data for analysis (Bricki and Green, 2007). It is also used to recognize the trend in thoughts, perspective and to dig deeper into problem (Monfared and Derakhshan, 2015). This method enables the researchers to understand and describe complex situations, as well as provide the researchers an overview of a situation.

On the other hand, quantitative method is used to quantify the problem by generating numerical data which can be transformed into useable statistic. Data gained from quantitative research are usually numerical or can be translated into numbers (Gillham, 2010). Quantitative methods used in this thesis are *survey, weighted criterion method, organizational document, statistical data from external sources, development funnel analysis, data classification using Mean-standard Deviation method, risk analysis with +/- scoring scheme .*

Besides that, when collecting the data, the researchers should be aware of two different types of existing data: primary and secondary. The primary data are those data which is fresh data and created first time, thus it is original. There are several methods of collecting primary data including interview, observation, through questionnaires, schedules and content analysis (Kothari, 2004). The secondary data, on the other hand, is already available and ready to use which is created by someone else through the statistical process (Kothari, 2004). The researcher should be careful while using the secondary data because the data sometimes might not be useful, unsuitable or not updated in order to answers the research questions. Before starting using the secondary data the researcher must check the following characteristics:

- Reliability of data: in order to check whether the data is reliable or not the researcher should check couple of questions: Who is the author of collected data, from where the data get collected, what are the different method used while collecting data, what level

of desired accuracy of data.

- Suitability of data: sometimes it happens when the data is suitable for one purpose might not suitable for another, in order to implement the data, the researcher should first check the suitability of data following by the research questions.

During this project, primary data was gathered from *interviews* with internal stakeholders at SKF, *group discussion, survey and weighted criterion method*. On the other hand, secondary data was gathered from *literature review* in the beginning of the research. Secondary data also got collected from *statistical data from external sources* like trade economy, global competitiveness, and international labor organization, etc. Adding to that the researchers also used *organizational documents* in order to gather the secondary data.

3.2   Research process

The research process consists of 10 steps classified into *data collection* and *data analysis* where the researchers are going to follow, see figure 3. The researchers firstly focused on literature review and gain the knowledge in the respective fields. Keywords to find the literature are global sourcing, LCCS, BCCS, TCO and country risk analysis. After that the researchers got a training session to study SKF's TCA model from SKF's expert where the researchers gained knowledge about how SKF's TCA, TCO model work in a specific industry and also understood the difference of TCO model from the academic view. Additionally, the researchers got help from group discussion with SKF's internal stakeholders. Following to this the researchers had created interview questions in order to support and drive the interviews with SKF's GCMs. Furthermore, the researchers had several interviews to discuss about the project and gain insights, perspectives and opinions toward BCCS from different SKF's GCMs. The survey was used to collect the evaluation from SKF's GCMs on the intensive level of different parameters impact on the selection and analysis of BCC. The weight criterion method was used to calculate the importance of each parameter in selecting and evaluating BCC. The researchers also got a chance to explore and use internally organizational documents and statistical data from external sources which provide empirical data to support the analysis.
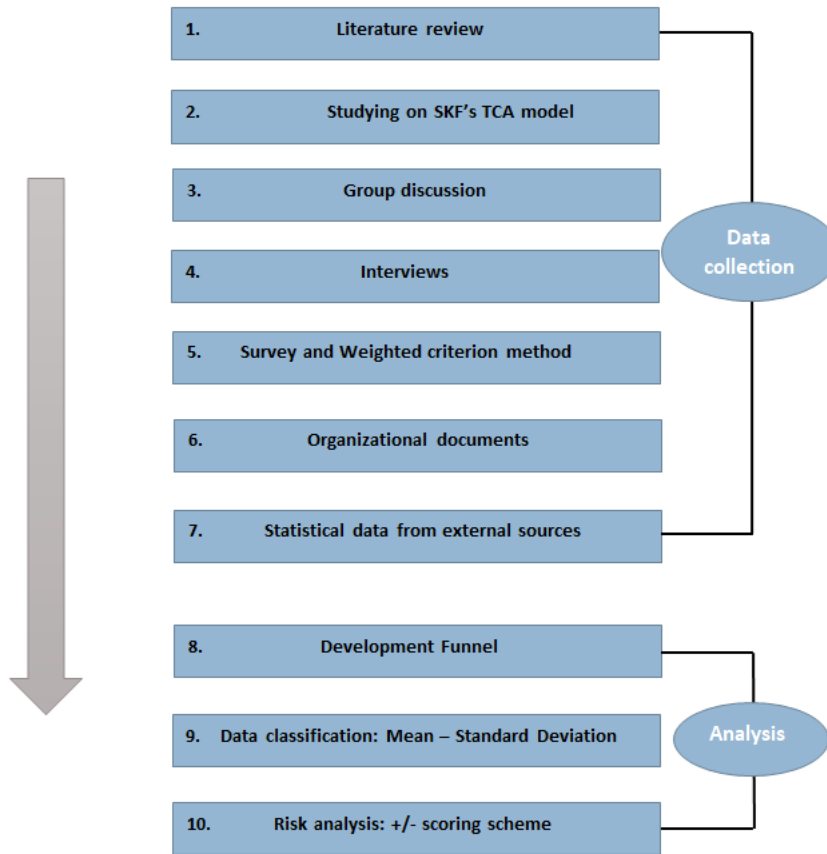
Figure 3: Research process

3.2.1 Literature review

According to Bryman and Bell (2015), a literature review can be seen as one of the most important parts in carrying out a research project. There are numerous reasons why literature review is so important, such as justification of the research question and for building the research design. Literature review "informs how you collect your data and enables you to analyze your data in an informed way" (Bryman and Bell, 2015). Literature is used to gain understanding on the research topic and what kind of similar researches already done in the area. The data collected from literature study is also viewed as the complement to other research methods. In this project, in order to learn more about future sourcing in BCC, an extensive literature review was done. The literature review was mainly conducted through Chalmers library databases, based on the keywords related to the research topic which comprise of global sourcing, LCCS, BCCS, TCO and country risk analysis. Many articles related to global sourcing and LCCS were studied to gain insights about the advantages of these sourcing strategies, explained why these sourcing strategies had been so popular a decade ago. The literature also reviewed the drawbacks of global sourcing and LCCS enabled the researchers to understand the context why BCCS came forth. BCCS is a new research topic. The lack of literature about this topic required the researcher to find different approaches to solve the research questions of this thesis. Studying on very few available articles about BCCS gave the researchers some initial comprehension about TCO and country risks, the corner stones of BCCS. The numerous researches about TCO and country risks gave valuable inputs for the

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thesis; particularly here were the parameters that impact on the selection and evaluation of BCC. Moreover, for further steps of the research process, literature review supported the researchers by strengthening the academic knowledge when the researchers reach out business environment, especially for group discussion, studying SKF's TCA model, survey and interviews with SKF' GCMs.

3.2.2   Studying SKF's TCA model

The researchers got a training session to explore and study SKF's TCA model from SKF's TCA expert. During the training, the researchers got a chance to discuss and ask questions to clarify what SKF's TCA model is, how different it is compared to the ordinary TCO model and how different between business and academic view toward TCO, TCA model. TCA model used at SKF is applied at supplier level. The researchers studied on the data of various parameters where SKF considers while choosing and evaluating the suppliers to source direct materials. From this model, the researchers consider and discuss with the expert about the ability how to apply this model to analyze sourcing country at country level.

3.2.3   Group discussion

The group discussion is a method of data collection which is frequently used to collect in-depth qualitative data in various descriptive studies such as case studies, phenomenological and naturalistic studies. The main goal of group discussion is to provide an opportunity for the participants to talk to one another about a specific area of study. The facilitator is there to guide the discussion. In addition to the classical questionnaire investigation, in which average opinions are formed by the standardization of individual opinions, the group discussion process is carried out alongside qualitative studies (Fiedler, 2002). This method was handled very early in the beginning of the project. The researchers got many opportunities to discuss the topic in group with SKF's internal stakeholders in order to understand the way they approach towards unknown sourcing countries. From group discussion, the researchers got insights from different stakeholders on the same topic thus made ways to find out the various parameters from the business point of view, as well as the ways to collect that information.

3.2.4   Interviews

This chapter deals with types of interviews followed during the project. Semi structured interview means the researchers can ask the follow up questions even though it is not in the prepared questions. It typically refers that the interviewer has a series of questions that are in the general form of an interview schedule but is able to vary the sequence of questions. Once the sampling issues have been taken into consideration, the next stage of the project involves interviews: face to face (individual interview) or telephonic interview (Kothari, 2004).

Individual interview method requires a person known as the interviewer asking the questions face-to-face. The method of personal interview is usually carried by semi structured way where researcher can ask the follow up questions and collect more effective data (Kothari, 2004). The main advantages having personal interviews are presented below:

- More information in great depth can be obtained.
- There is good flexibility under this method.
- The interviewer can control which person can answer the question in detail.
- Personal information can be obtained through this method.

On the other hand, there are some demerits of this method which are presented below:
- The method may be expensive when the largely and widely geographical spread of samples is to be made.
- Certain kind of respondents is afraid to share the data due to confidentiality.
- Respondent will not get time to prepare in advance.

Telephonic interview method follows the contacting the respondent through telephone, it is not widely used but plays an important part in industrial survey (Kothari, 2004).

During the project, the researchers followed both individual and telephonic interview. The researcher interviewed 6 GCMs who are responsible for Rings in order to understand the current sourcing countries and strategies, as well as the potential countries in which GCM interested in. The list of those potential countries will be used for further analysis to search for BCCs. The researchers also received answers from these GCMs regarding to which parameters the GCMs consider to select and evaluate a country to be the BCC. Those valuable insights collected from the GCMs added more parameters in addition to the literature review about BCC.

The questions used in the interview had been sent an email to the GCM in advanced since the chosen respondents are geographically global spread. The interview questions were also decided to be confidential; the underlying reason for this was that respondents might hide their real thoughts if their names are disclosed. Having a confidential questionnaire could therefore help the researchers get more reliable and dependable data. In order to mitigate risks of misunderstandings regarding the interview questions, the researchers conducted a pilot survey where two employees of the SKF were consulted.

The researchers prepare interview questions classified into six sections which can be found in Appendix 1. Section one is about asking SKF's GCM to introduce his/her category and his/her responsibility in SKF. Section two contains questions about current sourcing which focus on GCM's current sourcing strategy and current sourcing countries, in order to answer the first research question. The major break-down cost and the sourcing target of GCM's category is also questioned here. In section three about BCC's criteria, the researchers ask for GCM's perspective about which parameters the GCM considers to select and evaluate a country to be the BCC. This section contains open questions in order to collect GCM's opinions about BCCS which is rarely mentioned in literature. In section four about country level, the researchers seek for specific countries which are of GCM's interest he/she thinks those countries can become the BCC for his/her category in the future. Section five consists of questions about the communication mode in which the researchers search for GCM's recommendation about suitable source of statistical data, business magazine, organizations which are able to provide

information for further evaluation and analysis. Section six poses some questions regarding TCA model of SKF, the ability to apply TCA, TCO model to evaluate sourcing countries and if the GCMs can suggest any other tools or methods to evaluate sourcing countries.

3.2.5 Survey and Weighted Criterion method

The survey has long been a central strategy in social research. However, the name itself 'survey' is very broad, cover many different types in different ways in many contexts. There are two types of survey; qualitative and quantitative (Punch, 2003). Quantitative survey studies the relationship between variables and produces the numerical data. On the other hand, qualitative survey usually deals with open questions and do not normally produce quantitative or numerical data. Usually respondent's answer to the open questions in words and the researchers more often proceed to analyze such responses without somehow transforming the words into numbers (Punch, 2003). Appendix 2 is the survey containing initial parameters/criterion that impact on the selection and evaluation of BCC. The researchers created this survey based on literature reviews, SKF's TCA model, interviews with GCMs and SKF's risk management model. The researchers sent this survey to GCMs by email. For this survey, the GCM was asked to give his/her evaluation on what extent he/she thinks those parameters are important to select and analyze a BCC to source the materials of his/her category. The grading score varies from 1-not important to 10-very important.

The weighted scoring scheme assigns a weighting to each criteria and uses a consistent numerical range for each criteria. The individual weighted scores are either averaged or added. Weighting may be defined as a percentage or as a value in a range. A weighted scoring scheme usually employs a scoring rule that assigns a final numerical value to every object to be ranked (Sung and Hu, 2009). In the thesis, due to the fact that there are some parameters are more important than the other ones while selecting and evaluating BCC, the researcher evaluated in the percentage value in order to identify which parameter is more intensive and prioritized those parameters. Table 6 shows an example of how the researchers calculated the weighted percentage value. From the survey, the grading scores collected from different SKF's GCMs were summed up in column *Total Grading Score*. The weighted percentage of each parameter was calculated by dividing the total grading score of each parameter to the total of total grading score of all parameters. The example below shows that parameter 1 is the most important one because its weighted percentage is the highest among *n* parameters.

Table 6: Example of weighted percentage calculation

Parameter	GCM 1	GCM 2	GCM n	Total Grading Score	Weighted Percentage
Parameter 1	10	8	6	24	28.57%
Parameter 2	5	7	9	21	25.00%
Parameter 3	4	7	10	21	25.00%
Parameter n	9	6	3	18	21.43%
Total				**84**	**100%**

3.2.6 Organizational document

In the beginning of the thesis the researchers were informed that many GCMs of SKF interested and involved in this project. Later, the researchers got an access to internal SKF's portal in order to contact the internal stakeholders including SKF's GCMs. Based on the contacts details, 30 GCMs were identified based on their relevant position to this project. These GCMs were approached, either by mail or phone, in order for the researchers to understand the business requirements. Besides that, the researchers also got a chance to access many internal documents including SKF risk management from SKF annual report 2016, SKF's Maplecroft-Human rights Index. The report related to the sourcing flows from SKF's suppliers to SKF's factories at country level in 2015 and 2016 with specific purchasing volume provided from SKF's purchasing department was also used to analyze the current sourcing countries, in order to answer the first research question. Additionally, the statistical data regarding to energy price, skilled labor wage and unskilled labor wage at the country level were also provided by SKF's cost engineer of global supplier development. Also the researchers got an opportunity to explore the internal document "code of conduct" which is used as the reference for this project.

3.2.7 Statistical Data from External Sources

Based on the weighted ranking model mentioned above in chapter 3.2.5, the researchers had a list of final parameters to evaluate potential countries. Empirical data, figure, statistics at the country level related to these parameters were collected from external sources such as Globalpetrolprice.com, ILO.org, Tradingeconomics.com, Theglobaleconomy.com, Unicef.org, Transparency.org, Efset.org, World economic forum, Unglobalcompact.org etc. These statistical data were collected only for the countries recommended from the interviews with GCMs. From the interviews, GCMs also suggested some statistical data from external sources providing the information related to steel production process, steel price and the production volume of steel raw materials such as Knoema.com and Steelonthenet.com. The results of this method are presented in chapter 5.3.

3.2.8 Development funnel

The original development funnel was developed by Wheelwright and Clark in 1992. The idea was that the overall development process starts with a wide range of inputs, gradually refines and among them, very few outputs are selected. "A variety of different product and process ideas enter the funnel for investigation, but only a fraction become part of a full-fledged development project", according to Wheelwright and Clark (1992). The development funnel used in this thesis (see figure 4) based on the idea of Wheelwright and Clark (1992) but have

some modifications as suggested by SKF's purchasing director. The inputs of the funnel are countries, instead of ideas or products like the original development model. In order to select the final BCC, a number of potential countries were narrowed down the by going through some filter phases containing conditions. The initial screen in this model is different potential countries. The intent in this screen is to dramatically expand the mouth of funnel. This can be done by gathering the data from various information sources. Figure 4 shows narrowing of the funnel occurs at phase 1 based on various parameters, facts and consider relevant data for the research topic. Phase 1 is the blocking point considering most important parameters which decides the *go* or *no go* situation in which the countries meet the requirement of this phase's condition may pass this phase to appear in Screen 2. The same principle is applied for phase 2 which is another blocking point containing other conditions. The countries passing phase 1 and phase 2 to appear on screen 3 are supposed to be BCCs.
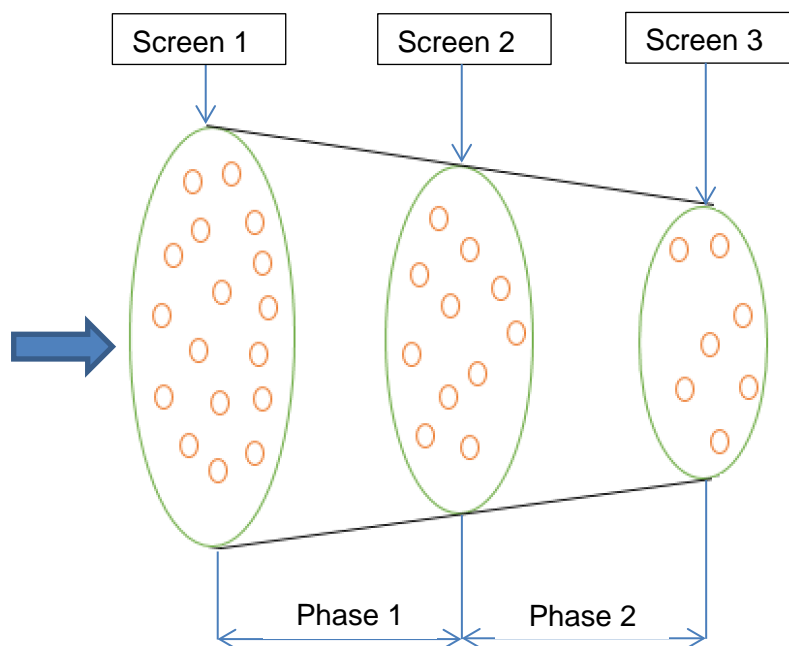
Figure 4: Development funnel

3.2.9 Data classification

In this thesis, collected data from different external sources may contain figures classified in different scales. Data updated from global competitiveness, for instance, is ranked in likert scale from 1 to 7; data from Trading Economics is ranked from 1 to 10 scale; national transparent index from 1 to 100 scale. These scales are in different units, either figure or percentage for example. Using that information for the analysis, the evaluation and comparison among potential countries, in combination with many parameters would be easier if all the data is visualized in the same nature, same unit and same ranking scale. Hence, converting different scales into one scale is necessary. Besides that, GITTA (2011) also mentioned, the human eye only has a limited ability to distinguish a large number of different areal symbol shades. Hence, it is important to classify quantitative data into smaller groups. Data classification in general is to group similar observation and split apart observation that is significantly different. Data classification allows the researchers to create a smaller number of data groups and to choose

the symbol shades that can be distinguish easily (GITTA, 2011). Data classification involves combining raw data into different classes or groups, with each class represented by a unique symbol (GITTA, 2011). GITTA (2011) introduced six common methods of data classification: equal intervals, quintiles, mean-standard deviation, maximum breaks, natural breaks, and optimal.

In any method, it is very important consideration of selecting the appropriate number of classes. If the researchers want to be safe, it is recommended to have 3-7 classes (Axis Maps, 2015). The more classes are created, the less data generalization is. However, the expense of legibility and the associated risk of reading errors should be focused since more classes are more difficult to see. Classification with three classes will be easy to read and remember, but may gloss over some very important aspects of the data and create artificial patterns by grouping together many figures that are in fact quite different (Axis Maps, 2015). Due to the purpose of this thesis is to find BCC, regarding to country risk analysis, it is critical to clearly show which countries contain high risk and which countries have higher potentials. Hence, the researchers decided to classify those statistical data into five groups: very risky, risky, neutral, potential, and very potential. Classification into five classes can neutralize the disadvantages of three classes and seven classes method discussed above.

Mean-standard deviation method is one of several classification techniques that consider how data are distributed along the number line in a holistic sense by trying to fit a normal distribution to the data. In this method, classes are formed by repeatedly adding or subtracting the standard deviation *(s)* from the mean of the data *(μ)* (Slocum, 2005). An advantage of the mean-standard deviation method is that if the data is normal or near normal distributed, the means serves as a useful dividing point, enabling a contrast of values above and below it. Another advantage is that the legend contains no gaps that might confuse the reader. This method is widely used, particularly when the purpose is to show the deviation from the array mean. Table 7 is an example of the legend to classify raw data. This is most effectively accomplished if an even number of classes is used. Slocum (2005) discussed class number 1, 2 and 3 are negative ones and class 4, 5 and 6 are the positive ones.

Table 7: Class limits computations for Mean-standard deviation classification (Slocum, 2005)

Class	Normal Distribution Limits
1	$<\mu - 2s$
2	$\mu - 2s$ to $\mu - 1s$
3	$\mu - 1s$ to μ
4	μ to $\mu + 1s$
5	$\mu + 1s-$ to $\mu + 2s$
6	$> \mu + 2s$

However, Slocum (2005) suggested that five classes classification can also be used if the two middle classes are combined. ESRI (2017) mentioned that class breaks by mean standard deviation methods are created with equal value ranges that are a proportion of the standard deviation, usually at intervals of three, two, one, one-half, one-third, or one-fourth standard deviation using mean values and the standard deviations from the mean. The researchers examined different intervals on the collected data and decided to go for one-half standard deviation as it clearly visualized the deviation of the data into two extremes. The class limits computations for Mean-standard deviation classification used in this thesis is presented in table 8. From that, class number 1, 2 are negative ones; class 3 is neutral; and class 4, 5 are the positive ones.

Table 8: Class limits computations for Mean-standard deviation classification used in this thesis

Class	Normal Distribution Limits
1	$<\mu - 1s$
2	$\mu - 1s$ to $\mu - 1/2s$
3	$\mu - 1/2s$ to $\mu + 1/2s$
4	$\mu + 1/2s$ to $\mu + 1s$
5	$> \mu + 1s$

3.2.10 Risk analysis

"The +/- scoring scheme provides a numerical range centered on zero for various criteria. The ranges are standardized to reflect that values on one side of zero always represent higher risk and values on the opposite side of zero represent lower risk. Scores assigned to each criterion are added together to yield overall risk", according to PQRI (2015). For each statistic related to country risk parameters, +/- scoring scheme will be used to separate potential countries into 2 extremes to see which country are safer and which country contain higher risk. In combination with data classification method mentioned in chapter 3.2.9, "+" will be given to the positive countries which is classified in class 4 and 5. "-" will be given to the negative countries in class 1 and 2. Class 3 is neutral thus receives a "0". The new score will be given to each potential country per each parameter followed the new legend which is showed in figure 5.

Condition:		μ - 1s		μ - 1/2s		μ + 1/2s		μ + 1s	
Score:	-2		-1		0		1		2
Risk level:	Very risky		Risky		Neutral		Safe/Potential		Very safe/very potential
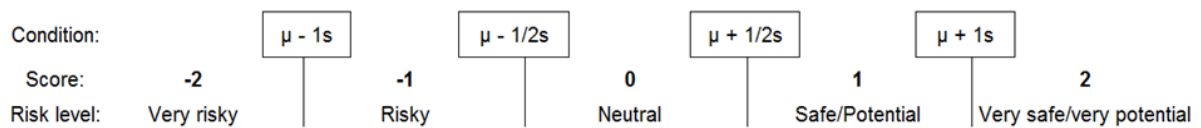
Figure 5: Legend for data classification in this thesis

Table 9 presents an example to compare and evaluate potential countries, country 1 to country n, in terms of different parameters, parameter 1 to parameter n. Regarding to parameter 1, the statistic value of country 1 is higher than $\mu + 1s$, thus it is very safe and it is given the new score "2". The same calculation for parameter 2 for example, the statistic value of country 2 is higher than $\mu - 1/2s$ but lower than $\mu + 1/2s$, thus it is neutral and is received the new score "0". This score will be multiplied with the weighted percentage calculated from the survey answers. All the weighted score then will be summed up and present the performance of each country. The most attractive country, in terms of country risk analysis is the one having the highest weighted score.

Table 9: Country risk/potential analysis based on weighted score

Parameter	Score			Weight	Weighted Score		
	Country 1	Country 2	Country n		Country 1	Country 2	Country n
Parameter 1	2	-1	1	%	+	-	+
Parameter 2	-2	0	2	%	-	0	+
Parameter 3	1	-1	0	%	+	-	0
Parameter 4	+	0	+	%	+	0	+
Parameter n	-2	-1	2	%	-	-	+
Total Score				**100%**	**?**	**?**	**?**

4 QUALITATIVE DATA COLLECTION

This chapter presents the results from qualitative method which was introduced from chapter 3.2.1 to chapter 3.2.4, aims to understand the environment and the selection of the most interesting countries. It starts by summing up the information from the literature review, studying from SKF's TCA model, group discussion and interviews. Subsequently, the first research question will be answered by presenting SKF's current sourcing strategy, current sourcing areas and suggestion for future potential BCCs.

4.1 Parameters from literature review

After going through literatures regarding to global sourcing, LCCS, and BCCS, presented below in table 10 is the parameters which are suitable to select and evaluate BCC, especially focus on TCO concept at country level and country risk analysis.

Table 10: Parameters from literatures suitable for selecting and evaluating best-cost country

Total Cost of Ownership	Commodity price
	Energy price
	Labor cost
	Transportation cost
	Customs Duty
	Tax
	Exchange Rate
Social-political factors	Democratic accountability
	External/internal conflict (war, terrorism)
	Political/ governmental stability
	Trade restriction, trade barrier or trade agreement
Socio-Demographic factors	Consuming market
	English fluency
	Cultural difference/cultural openness
Macroeconomic factors	Interest rate
	Foreign exchange rate
	Inflation rate
Technological factors	Information and Communication Technology
	Physical infrastructure
	Capacity for innovation
	Technological readiness
	Intellectual property protection
Natural factors	Climate condition
	Environmental and sustainable requirement

4.2 Studying SKF's TCA model

For SKF's purchasing department, strategic sourcing which focuses on TCO increases more saving opportunities compared to only purchase cost focus, see figure 6. With TCO mindset, purchasing department goes beyond the perceived opportunity of the purchase cost. They consider all the cost of acquisition, specifications, ownership risk, obsolescence, inventory and risk, which are visualized as the huge sinking part of the iceberg, would be very dangerous to be overlooked.
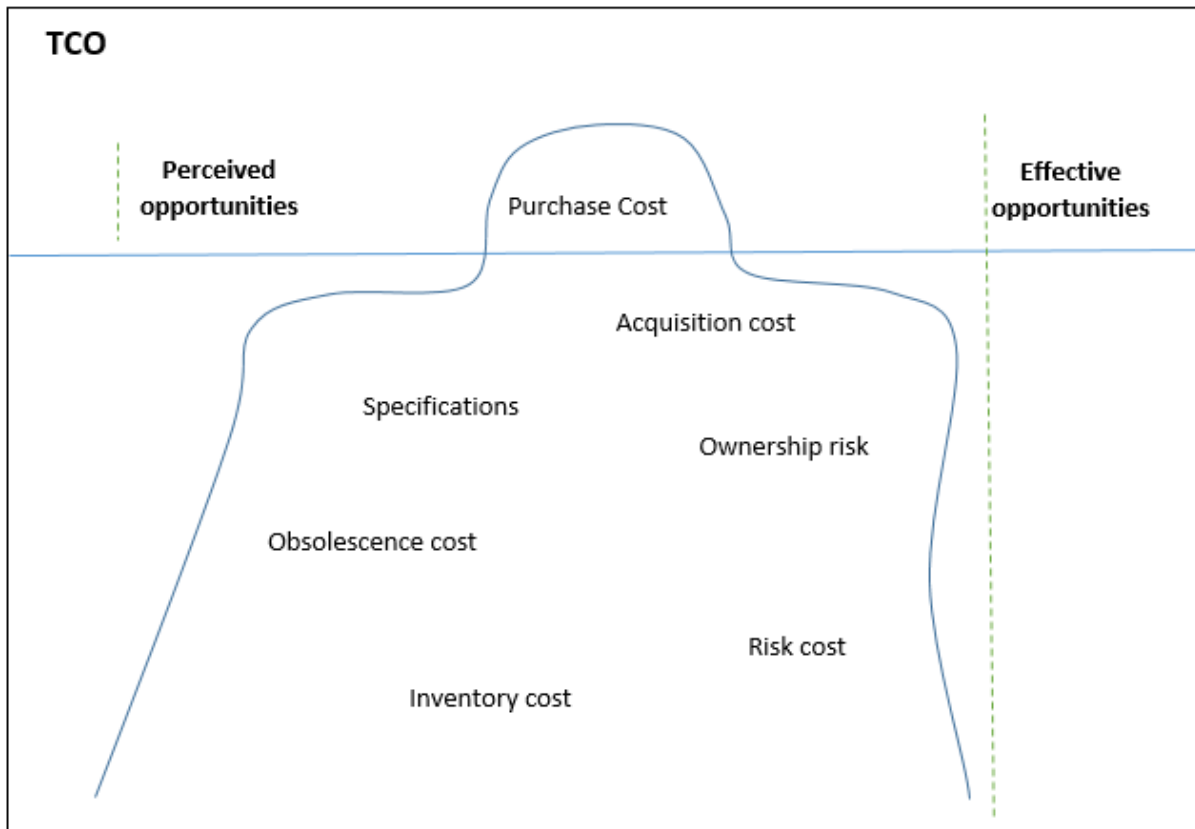
Figure 6: SKF's future TCO model

For SKF, TCO includes Total Landed Cost (TLC) and Total Cost of Acquisition (TCA) as well as all costs related to ownership and usage. The elements of TLC, TCA, and TCO are presented below in table 11.

Table 11: SKF' strategic sourcing (2014)

Total Landed Cost (TLC)	Total Cost of Acquisition (TCA)	Total Cost of Ownership (TCO)
Purchasing price	**Total Landed Cost +**	**Total Cost of Acquisition +**
Additional Fee and Commissions	Tooling cost	Operational cost of manufacturing/delivery
Packaging	Contract cost	Total operating support cost
Transportation/logistic	Vendor Conformance Complaint cost (VCC)	Maintenance cost
Customs Duty	Broken promise cost	Service cost
Transport insurance Premiums	Market research cost	Downtime cost
Port terminal and handling fees	Supplier evaluation cost	Safety cost
Taxes	Product approval cost	Training cost
	Lead time/inventory cost	Utility cost
	Procurement cost	Communication cost
	Minimum quantity of order cost/batch size	Disposal/Phase out/Replacement cost
	Good receiving cost	Overhead cost related to Plants, Property and equipment maintenance
	Payment terms cost	Consumption
	CO_2 cost	

Currently, SKF is working with TCA model. In the training, the researchers asked SKF's TCA expert why the company stops at TCA computation, the answer was that working on TCO would commence after SKF launches the improved version of TCA model. However, all the parameters mentioned above are used to select and evaluate suppliers at supplier level. After some discussions with TCA expert and SKF's GCMs about the ability to apply this model to suit the purpose of the thesis at country level, SKF's TCA expert and the researchers decided to select these parameters: *Purchasing price, Packaging, Transportation/logistic, Customs Duty, Port terminal and handling fees, Taxes, CO2 cost, Lead time/inventory cost.* However,

at the country level, the cost of packaging, port terminal and handling fees can be represented by skilled or unskilled labor wage. CO2 cost is included into environmental and sustainable requirement at country level. Lead time and inventory cost depends on the geographical distances from SKF's suppliers to SKF's factories. Hence, the parameters selected from SKF's TCA model are gathered in table 12.

Table 12: Parameters selected from SKF's TCA model

Purchasing Price
Skilled/unskilled labor wage
Transportation/logistic
Customs Duty
Taxes
Environmental and sustainable requirement
Geographical distance

4.3 Interviews

GCM A who was responsible for Rings described their current sourcing countries and strategy. To produce Rings, the direct materials needed are Bars and Tubes, also forging operation and turning operation. He said the suppliers are currently divided based on product lines. For example the supplier for Bars is different from supplier for forging operation. Bars supplier may be located in Asia while forging operation supplier is in Europe. The direct materials for Rings should not be travel in most of the product lines (for example from Asia to Europe or Europe to America and other way around) which means having the forging and machining process for direct materials Bars and Tubes in same region could be an advantage in order to reduced transportation cost, import and export duties, taxes. The major cost parameter of Rings is raw material. Rings are majorly divided into two sub categories which are hot rolled rings and turned rings. Hot rolled rings are basically done by forging and turned rings are following by turning process. He also mentioned that the current cost driven strategy is to reduce the total spend amount on raw material. At this moment SKF is spending, specifically for Rings commodity, 60% on raw materials, 30% on turning operation and 10% on heat treatment process. Furthermore, he mentioned while selecting the BCC he would like to consider various parameters which are TCO, raw material cost, availability of raw materials, the industries should not have child labor and should pay minimum wages to employees, also there is necessity to check the transportation cost and custom duties, make sure that those respective countries are not facing any political issues internally as well as externally. Additionally, he claimed that in future he would like to source the Rings from Indonesia Argentina, Bulgaria, Slovakia, Czech Republic, Iran and Turkey. The reasons he would choose those countries are majorly based on cost driven.

Adding to this GCM B for rings commodity, mentioned that the raw material price varies in the same ratio all over the world which means if the price of raw material increase in Europe, it goes increase in U.S, it goes increase in Asia and so on, so the main cost driven factor is energy cost which could save the cost cake. According to her, in case if you are transporting the raw materials from country A to B then the other parameters (labor cost, energy cost) should be in optimized way. She also mentioned that for hot rolled rings mainly steel bars and for turned rings steel tubes are used in order to avoid the multiple machining operations. However, she would like to scout the various parameters before dive into the countries which are known about energy cost and labor cost. Adding to that she is interested in future sourcing in Russia, Slovakia, Poland, Czech republic and Turkey because she believed the they have cheap labor and energy cost.

GCM C added the valuable points and he said the strategy is to source regionally/locally. In order to follow the total cost of ownership and reduced cost cake. The countries which have joined European Union recently are the interested countries to see if they have potential figure. The parameters he would to consider are labor cost, distance, delivery, currency fluctuation, political stability and, corruption, or governmental transparency. He said it would be interested to see if Russia, Poland, Czech Republic, Ukraine have potential fulfills to source the rings in future.

The GCM D&E claimed the similar strategy which is, to have supplier base in the same geographical region, well balanced suppliers, the gap between commodity cost and other cost should be align. The parameters they wanted to look upon available of resources in terms of raw materials, skilled labor and electricity. They also agreed that Total Cost of Ownership is very important parameter. Addition to that they also would like to dig into what is the political situation, currency fluctuation, market segment (for example, automotive industry could be an advantage in that respective countries). The countries they have interest in future are Vietnam, Malaysia, Turkey, Iran, Thailand, Mexico, Bulgaria, Czech Republic, Slovakia, Russia and Ukraine.

Furthermore, the researchers had final interview with GCM F to understand if there are any different strategies than others and the researchers did not found major differentiation. GCM F mentioned about her strategy saying that looking at SKF's manufacturing footprint is global one; SKF has factories across the globe and considering that the strategy was product should be available when they need them which means reduced the lead time and have the suppliers on right time on right quality. Try to find out good cost based suppliers close to the factories in order to avoid shipping because she mentioned if you have shipping you have cost of capital for extra time and you have less flexibility for the factory, also you need to order much in advance and in case if you are changing the product line then you have big risk of scraping and because of all these factors she said SKF is has regionally sourcing strategy. The parameters she said important for her are TCO, availability of raw materials, how strong of government rule about Quality of product, distance from sourcing countries to SKF's factory, nature of raw material (if it is cost-sensitive), policy toward anti-dumping, quality of infrastructure (road, rail), stability of labor cost, political stability, labor cost, skill engineer, transportation cost and

human rights. Furthermore, the researchers asked her about the future interested sourcing countries and she said Eastern Europe is high potential because of total cost of ownership. And addition to this she addressed her interested countries for future sourcing areas in Eastern Europe, Serbia, Romania, Russia, North Africa like Algeria, Egypt, Tunisia and Morocco. GCM F also mentioned if cost saving is big enough to pay for all the cost and effort to change suppliers, about 15-20%, she is willing to change into BCC.

From these interviews with GCMs, the current sourcing strategy is to try to source locally and regionally as much as possible. Regional sourcing currently accounts for 85-90%. Global sourcing has to consider the trade-off between low price with the transportation cost, lead time, stock, forecast of what to produce in far advanced and obsolete inventory of some commodities that might not need. Suppliers are divided based on product lines. The current sourcing strategy is try to avoid direct material transportation (e.g. Asia to Europe or Europe to America and other way around) in order to minimize the Total Cost of Ownership and the potential risk over distance countries. GCM also mentioned that, they will organize and develop the necessary suppliers only and if possible do the supplier consolidation. The researchers also conclude that, besides TCO and country risk analysis, local and regional sourcing strategy of SKF and the availability of materials and industries are also important requirements to select BCC.

The potential countries which can become BCC to source Rings, according to SKF's GCM, are Bulgaria, Czech Republic, Poland, Romania, Russia, Serbia, Slovakia, Turkey, Ukraine, Malaysia, Thailand, Vietnam, Iran, Mexico, Argentina, Algeria, Egypt, Morocco and Tunisia.

The parameters which are important to choose BCC from the perspective of SKF's GCMs of Rings commodity are summed up as below:

Table 13: Parameters from interviews with SKF's global category managers

Availability of materials
Availability of industries
Child labor
Minimum labor wage
Customs duty
External and Internal political issue
Energy cost
Geographical distance
Currency fluctuation
Political stability
Governmental transparency
Policy toward Anti-dumping
Quality of infrastructure
Human rights

5 QUANTITATIVE DATA COLLECTION

This chapter presents the results from quantitative method which was introduced from chapter 3.2.5 to chapter 3.2.7, aim to answer the second research question. In this chapter, different parameters need to be focus while selecting and evaluating BCC will be introduced by survey and weighted criterion method. Besides that, the statistical data of each parameter from organizational document and external sources will be shown.

5.1 Survey and Weighted Criterion

Table 14 presents all the parameters gathered from literature reviews, SKF's TCA model and interviews with SKF's GCMs. These parameters are important to select and evaluate BCC. However, to see which parameter is more important than the other one, in another word, which parameter should be prioritized more than the other one, the researcher include these parameters in the survey with the short description of how they impact on SKF's BCC selection and evaluation, and send to SKF's GCMS (see appendix 2).

Table 14: Parameters used for survey grading chart

Total Cost of Ownership	Commodity price
	Energy price
	Labor wage
	Customs duty
	Tax
Social-Political factors	Democratic accountability
	External/internal conflict (war, terrorism)
	Political/ governmental stability
	Corruption
	Trade restriction or trade agreement
Socio-Demographic factors	Consuming market
	Education, English fluency of workforce
	Human rights/ policy toward child labor
	Cultural difference/cultural openness
Macroeconomic factors	Interest rate
	Foreign exchange rate
	Currency fluctuation
	Inflation rate
Technological factors	Information and Communication Technology (ICT)
	Physical infrastructure
	Capacity for innovation
	Technological readiness
	Intellectual property protection
	Availability of materials/industries

Natural factors	Climate condition
	Environmental and sustainable requirement
	Geographical distance

Commodity price: The price of direct materials, steel bars, steel tubes and steel wires for example may impact on SKF's buying decision.

Energy price: The price of electricity, oil and gas of a country impact on the production cost, transportation cost for example, thus impact on SKF's total landed cost to source materials in that country.

Labor wage/salary: the extent of low labor cost of a country will impact on the price of purchased product, transportation cost, handling cost, maintenance cost, etc. thus favor SKF's value adding.

Democratic accountability: the degree of responsiveness of government to its people. Any potential or actual change in political system for example democratic election may disrupt SKF's business

External/Internal conflict: external war, cross-border conflict, terrorism, civil war, religious tension, violent protest, civil disorder occurred in the countries where SKF has suppliers may cause delay on material supply thus disrupt SKF's business.

Governmental stability: the stability of government in the macro environment impacts on the certainty and reliability of the businesses. Suppliers operating in instable countries which contain many frequent strikes, social unrest, and chaos for example, their operations would be disrupted by these problems thus impact negatively on SKF's business.

Governmental transparency: the extent of corruption in public and private sectors of a country may cause barriers on the exchange and the delivery of services for SKF's business such as public procurement, license, contract, tax breaks and subsidies, market share, service of payment for example

Customs duty, Taxes, Trade agreement and Trade restriction: the governmental policy of a country to favor or restrict the entry of foreign trade, including policy on tariffs, quotas, customs duty, number of taxes, trade structure in terms of commodity, method and trade areas can impact on SKF's buying decisions.

Consuming market: opportunity to expand the consumption of SKF's product in the sourcing countries' existing market may impact on SKF' sourcing decision.

Education, English fluency of workforce: the extent of high education and English fluency of the workforces in some countries may favor the sourcing process, save time and effort, thus contribute to SKF's value adding.

Human rights, policy toward child labor: the extent of country's compliance to human rights where SKF invests will ensure SKF's compliance on code of conduct and limit the occasion of human rights and child labor violation.

Cultural differences: the level of cultural differences of sourcing countries, for example: safety culture related to safety procedure, environment and safety regulation, different traditional and behavior may impact on SKF's business cost of handling risk.

Interest rates: different interest rates from different countries may impact on the business of SKF's suppliers, further impact on the purchased price thus impacts on SKF's value adding.

Exchange rates: different rate facilitating the conversion of different national currencies into US dollar or Euro for example may impact on SKF's cross-country comparison.

Currency fluctuations: currency fluctuation of countries where SKF invests would increase or reduce the value of the cash flow and return from the investment in SKF's home currency.

Inflation: the rate of inflation of a country may impact on SKF's buying price and exchange rate.

Information and Communication Technology (ICT): the extent of high quality of ICT in some countries may favor the sourcing process, save time and effort, thus contribute to SKF's value adding.

Physical infrastructure: the availability of port, terminal, powers, road/railroad/air/sea transport infrastructure of the sourcing countries may impact on material price, production lead time, transportation cost and lead time provided by supplier thus impact on SKF's total landed cost.

Technological readiness and Capacity for Innovation: availability of the latest technology and knowledge about specific industry, the extent in which a country invest in research and development to generate the knowledge needed to build new technologies of the sourcing countries may favor the supplier operating in those countries. The suppliers may adopt the advanced technology, enhance the productivity of its industries, improve production process, increase efficiency, enable innovation and competitiveness thus favor the current and future requirement of SKF's product development, brings benefit to SKF's value adding in long term.

Intellectual property protection: The extent in which the intellectual property is protected in a particular country will be a competitive advantage for SKF to cooperate with the suppliers there for product's development and innovation.

Availability of materials and industries: the availability and popularity of materials such as steel bars, steel tubes. As well as the availability of industries to produce Rings such as steel manufacturing, forging, casting may impact on SKF's decision on selecting sourcing areas.

Climate conditions: earthquake, natural disasters for example may cause delay on material's supply and transportation thus disrupt SKF's business.

Geographical distance: geographical distance of sourcing countries may impact on SKF's total landed cost, transportation cost for example.

Environmental and sustainable requirements: regulatory of sourcing countries about CO_2 emission standard, pollution, resource usage such as water, land, forest, mineral where SKF has suppliers will ensure SKF's compliance on code of conduct and limit the occasion of environmental violation.

The researchers received 19 answers from SKF's GCMs on the survey. The scores from each GCM for each parameter are presented in the Appendix 3. The result of weighted percentage of each parameter is presented in table 15 which is sorted from the largest to the smallest percentage, thus all the parameters are arranged in very important to less important order.

Table 15: Weighted percentage of parameters

Parameter	Weighted Percentage
External/ Internal conflict (war, terrorism)	4.57%
Human rights, policy toward child labor	4.49%
Commodity price	4.49%
Corruption	4.24%
Labor wage/salary	4.08%
Trade agreement and Trade restriction	4.08%
Environmental and sustainable requirements	4.08%
Customs Duty	3.97%
Availability of materials and industries	3.91%
Exchange rates	3.83%
Inflation rate	3.83%
Currency fluctuations	3.83%
Governmental stability	3.80%
Physical infrastructure	3.72%
Intellectual property protection	3.69%
Energy price	3.66%
Geographical distance	3.53%
Taxes	3.42%
Information and Communication Technology (ICT)	3.42%
Technological readiness	3.36%
Democratic accountability	3.36%
Education, English fluency of workforce	3.25%
Interest rates	3.25%
Climate conditions	3.20%

Capacity for Innovation	3.15%
Cultural differences	3.06%
Consuming market	2.75%
Total	**100%**

According to the this result, to select and evaluate BCC, the most important parameters need to be focused are *External/Internal conflict (war, terrorism), Human rights and policy toward child labor, Commodity price, Corruption, Labor wage/salary, Trade agreement and Trade restriction, Environmental and sustainable requirement, Customs Duty, Availability of materials and industries, Exchange rates, Inflation, Currency fluctuations, Governmental stability, Physical infrastructure, Intellectual property protection, Energy price, geographical structure, Taxes, Information and Communication technology, Technological readiness and Democratic accountability.* Less important parameters consist of *Education and English fluency, Interest rates, Climate condition, capacity for innovation, cultural difference, and consuming market.*

5.2 Organizational document

This chapter presents the internal data shared by SKF's purchasing department containing documents about the sourcing flow from SKF's suppliers to SKF's factories at country level for Rings, SKF's risk management, energy price, skilled and unskilled labor wage, Mapplecroft-Human rights index.

5.2.1 Sourcing flows from SKF's suppliers to SKF's factories at country level for Rings

SKF currently has factories in 23 countries including Argentina, Austria, Brazil, Bulgaria, Canada, China, France, Germany, India, Indonesia, Italy, Japan, South Korea, Malaysia, Mexico, Poland, Russia, Singapore, Spain, Sweden, Ukraine, United Kingdom and United State. Table 16 shows the flows from SKF's suppliers to SKF's factories at country level for Rings.

Table 16: Sourcing flows from SKF's suppliers to SKF's factories at country level for Rings

Supplier \ Buyer	Argentina	Austria	Brazil	China	France	Germany	India	Indonesia	Italy	Mexico	South Korea	Malaysia	Spain	Poland	Sweden	Russian	Ukraine	United Kingdom	United States
Belgium					x														
Bosnia		x			x	x													
Brazil			x																
China	x	x	x	x	x	x	x	x	x	x		x	x	x				x	x
Czech Republic		x				x								x					
France	x				x	x			x					x	x				x
Germany		x			x	x									x			x	
Hungary									x										
India			x		x	x	x	x	x	x			x				x		
Indonesia								x											
Italy		x			x	x			x	x		x	x	x	x	x		x	x
Japan	x		x		x	x	x		x	x								x	
Latvia															x				
Mexico										x									
Romania						x			x										
Serbia					x				x	x									
Slovakia					x	x								x					
South Africa										x									
South Korea			x	x		x			x	x	x		x						
Spain					x				x	x			x						
Sweden		x	x		x	x	x								x				
United Kingdom																		x	
United States			x						x									x	x

In this table, the biggest suppliers are from China, supply Rings to most of factories in the countries mentioned above except South Korea, Sweden, Russia and Ukraine. The second largest sourcing country is South Korea which is selling Rings to its home market, Brazil, China, Germany, Italy, Mexico and Spain. The third largest sourcing country is Italy which mainly sells Rings to European SKF's factories including Austria, France, Germany, Italy, Spain, Poland, Sweden, Russia, United Kingdom, as well as America including United States and Mexico. Noteworthy is the fact that there is no Rings supplier in Argentina, Austria, Malaysia, Poland, Russia and Ukraine although SKF has factories there.

5.2.2 SKF's risk management

The effective identification, evaluation and management of risks are critical to SKF's short and long term success. SKF has risk management processes highly aiming at ensuring a good understanding of effective and appropriate responses to very relevant risks. SKF categorized risks into two main areas: business risks and reporting risks (SKF annual report 2016).

SKF's core business is based on well-known technology. SKF has a formalized yearly process at group level for identification, planning and mitigation of business risks. The process is gathering the information related to various risks through internal and external sources, a consolidate risk assessment, prioritization of risks and development of strategic action plan to mitigate the risks. Various departments involve to identify and analyze the risks including group staff functions ethics and compliances, audit, human resources, environment health and safety, purchasing and sales (SKF annual report 2016).

SKF is very conscious about various risks which are currency risks, interest rate risks, corruption risks, competitor risks, raw material and component cost fluctuations, labor disputes, climate change risks, human rights. SKF is subject to both translation and transaction exposure. The currency risk occurs when the commercial flows of foreign currencies pertain to exports from Europe to North America and Asia as well as internal European business. The mitigation approach to this specific risk is translation exposures on group account are hedged to some extend by borrowing in foreign currencies (SKF annual report 2016).

The mitigation approach to interest rate risk is by matching the duration of investment and borrowings, the interest rate exposure of the group can be reduced. SKF takes a productive approach to assure awareness of demanded ethical standards through education and compliance programs including anti-fraud in order to reduce the corruption rate. In order to avoid competitors risks SKF offers to their customers very customized, differentiated and acknowledged products working with world class suppliers in terms of productivity, efficiency, cost and waste avoidance (SKF annual report 2016).

SKF has established a globalized supply chain which ensures components and materials are purchased from suppliers in a highly competitive manner to control the raw material and component costs. SKF has maintained an open and positive relationship with the union, internal and external stakeholders. SKF adheres to international standards and guidelines, SKF code of conduct ensure that there is respect to human rights (SKF annual report 2016).

5.2.3 Energy price and labor cost

Energy price per country is extracted from SKF internal source on Apr 6th 2017. Czech Republic, Iran and Ukraine are the countries not covered by internal system. Hence, the latest energy price of Czech Republic (0.08 Euro per kWh) was updated by Eurostat European Commission statistic in 2015. Energy price of Ukraine from October to December, 2016 was 1380.69 UAH per megawatt (Eutoday, 2016). The exchange rate 1 Euro = 28.51 UAH was used to calculated. The price of Iran's energy is similar to the one in Turkey, as suggested by cost engineer, global supplier development of SKF.

Figure 7 shows that Argentina, Algeria and Egypt have the lowest price of energy which is 0.016, 0.021, 0.018 Euro per kWh respectively. Russia and Ukraine keep the price as 0.04 and

0.048 Euro per kWh which is relatively low compared with referenced country Germany (0.151 Euro/kWh). Noteworthy is the fact that Sweden controls energy as the same price with Bulgaria, Serbia, Turkey, Malaysia, Vietnam, Iran and Tunisia which is around 0.065 Euro per kWh. Czech Republic, Poland, Romania and Mexico have quite expensive energy price which is 0.08 Euro per kWh.
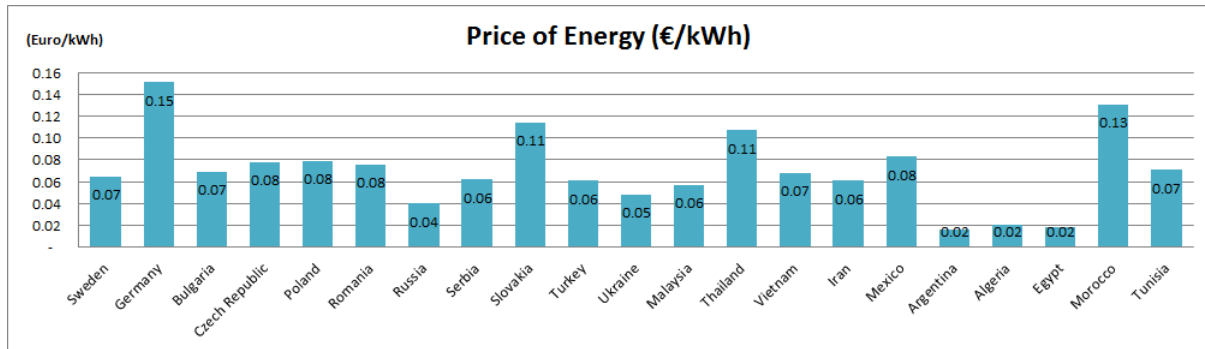
Figure 7: Price of energy

Besides that, skilled and unskilled labor wage per country was also extracted from SKF internal source on Apr 6th 2017. While it costs around 20 Euro per hour for both skilled and unskilled labor in Sweden and Germany, it only cost less than 1 Euro per hour for one labor in Ukraine. Figure 8 and figure 9 clearly present the difference for salary payment in one hour among countries. Although Czech Republic, Poland, Russia, Slovakia and Turkey have higher labor cost than the other one such as Thailand, Vietnam, Mexico, the labor in these countries are still much cheaper than it is in Sweden and Germany.
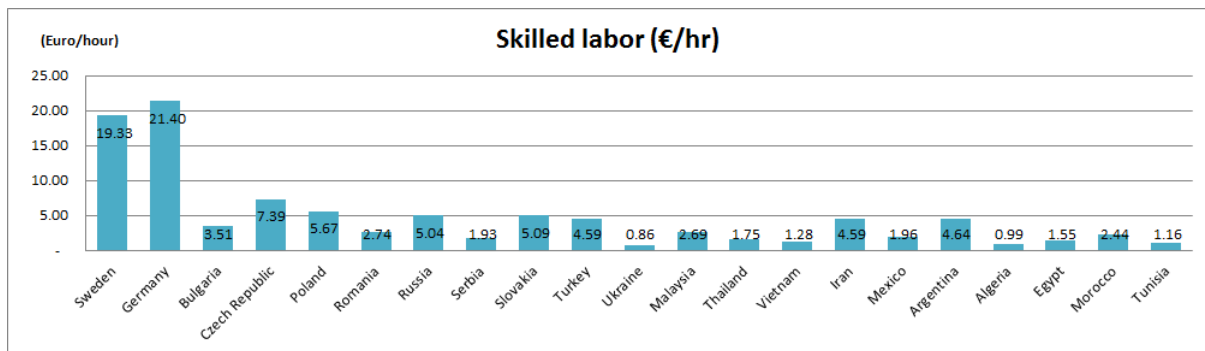
Figure 8: Skilled labor wage
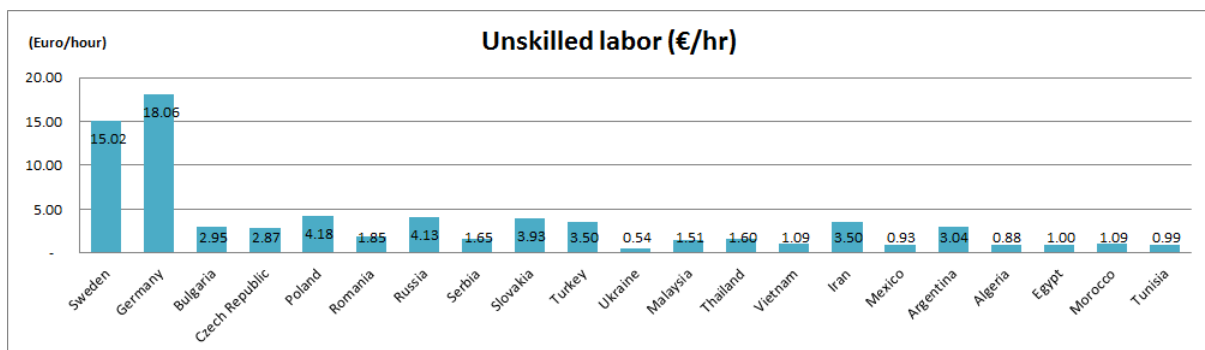
Figure 9: Unskilled labor wage

5.2.4 Mapplecroft-Human rights
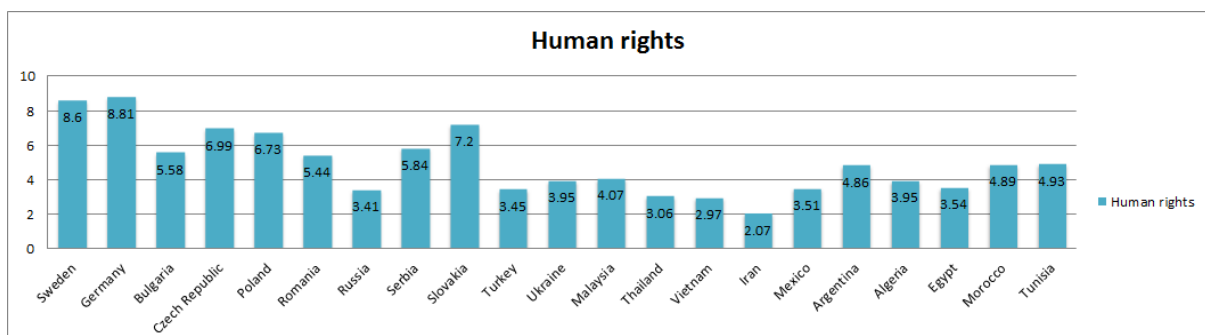
Figure 10: Human rights index

Mapplecroft is the internal tool used within SKF's purchasing department to get reference from the compliance of different countries toward human rights. Its scale varies from 0 to 10. "0" is the highest risk that violates human rights while "10" is the lowest one. Figure 10 show that Russia, Thailand, Vietnam and Iran are the most risky countries.

5.3   Statistical data from external sources

This part will present all the statistical data from external sources collected for the parameters according to the result from weighted criterion method which had been introduced in chapter 5.1. For more detail, see appendix 4. These numerical data will contribute the baseline for further evaluating and analyzing the potential countries.

5.3.1   External/Internal conflict (war, terrorism)

These indexes are collected from Theglobaleconomy.com and Tradingeconomics.com in 2016. According to these websites, war risk covers the risks of external conflicts and the risks of domestic political violence. Domestic political violence includes civil unrest, socio-economic conflicts, racial and ethnic tension and the extreme case of civil war. Countries are classified into seven categories (from 1-low risk to 7-high risk) reflecting the intensity of war risk. For war (figure 11), the highest risk is located in Ukraine, Iran and Egypt. Next level of considerably high risk includes Russia, Serbia, Turkey, Thailand, Vietnam, Argentina, Morocco, Algeria and Tunisia. The rest countries including Bulgaria, Czech Republic, Poland, Romania, Slovakia, Malaysia, Mexico maintain very low risk of war, as the same level with Sweden and Germany.
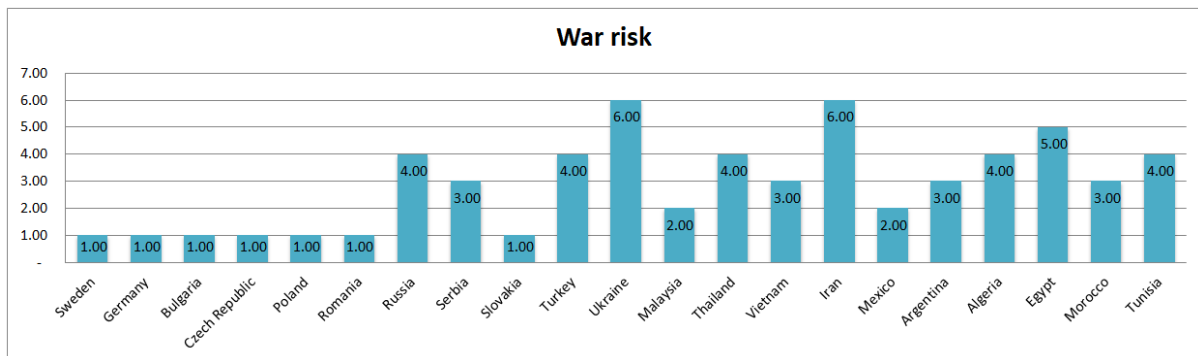
Figure 11: War risk

Terrorism risk index was referred from Tradingeconomics.com. It is a composite score that ranks countries according to the impact of terrorism from 0 (no impact) to 10 (highest impact). The data was updated recently which is in April 2017. As can be seen in figure 12, Turkey, Ukraine, Thailand and Egypt are those countries have the highest level of this risk. Poland, Romania, Serbia, Slovakia, Vietnam, Argentina and Morocco, on the other hand, are very safe. In comparison with this risk in Sweden and Germany, Russia, Iran, Mexico, Algeria and Tunisia have the same level.
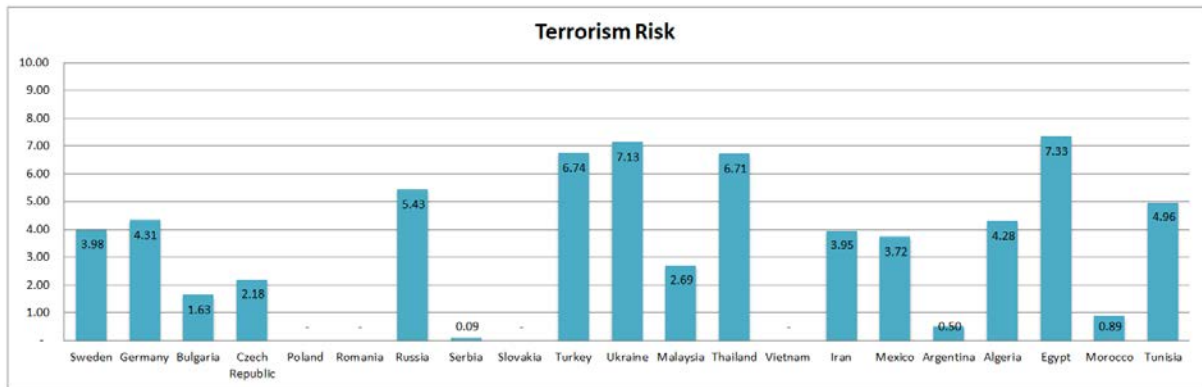
Figure 12: Terrorism risk

5.3.2 Child labor

Child labor is one of the important parameters in the analysis. The researchers referred the percentage of children between 5 to 14 years old involved in child labor at the moment of the survey carried by UNICEF in May 2016. According to UNICEF, a child is considered to be involved in child labor under the following conditions: "(a) children 5–11 years old who, during the reference week, did at least one hour of economic activity or at least 28 hours of household chores, or (b) children 12–14 years old who, during the reference week, did at least 14 hours of economic activity or at least 28 hours of household chores". Figure 13 shows that child labor still exists with high percentage in Serbia, Thailand, Vietnam, Iran, Egypt and Morocco.
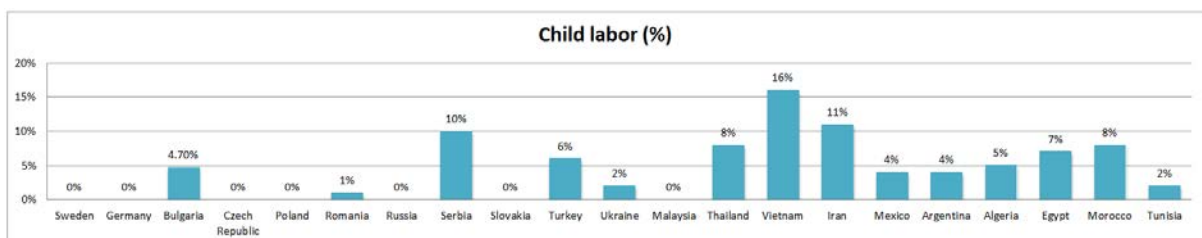
Figure 13: Child labor

5.3.3 Governmental transparency

Governmental transparency was extracted from transparency international index from 2016.

The scale was measured between 0 (highly corrupt) to 10 (highly clean and transparent). Figure 14 show that Russia, Ukraine, Iran and Mexico are the countries with high level of corruption. In contrast, Czech Republic, Poland, Romania, Slovakia and Malaysia are very transparent in their governments.
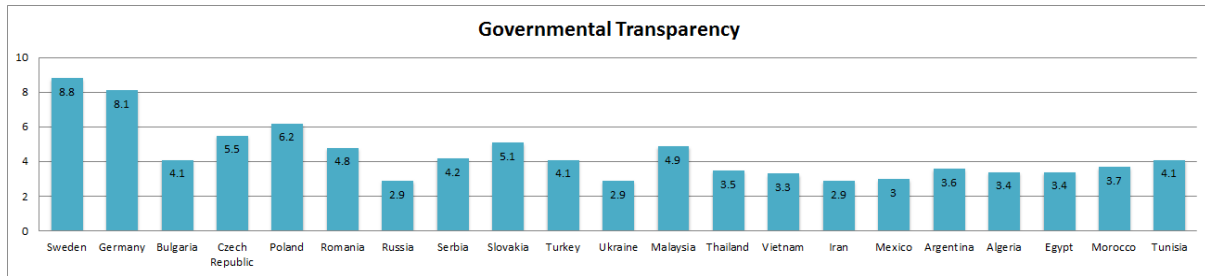
Figure 14: Government Transparency

5.3.4 Wage growth

Wage growth is an important factor should be taken into account with labor wage, which is the fifth most important parameter to select BCC, according to the weighted percentage presented in chapter 5.1. According to monthly wage growth percentage updated from TradingEconomics.com in 2017 (figure 15), Ukraine obtains the significantly highest wage growth among countries. The data for some countries such as Russia, Serbia, Turkey and Malaysia is missing. Four African countries keep the same wage growth as 1.6%.
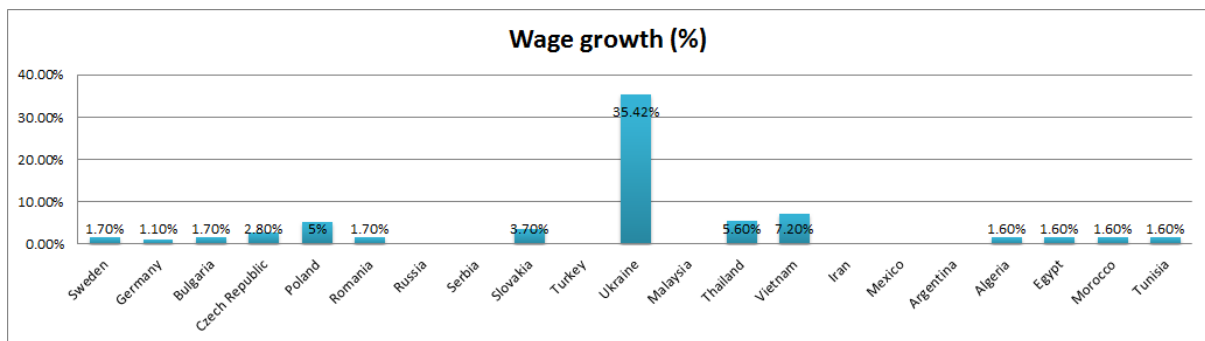
Figure 15: Wage growth

5.3.5 Trade agreement, trade restriction and Customs Duty

Trade agreement, trade restriction and customs duty are relevant parameters. The reduction on customs duty granted between two countries depends on the trade agreement or trade restriction between those two countries. The researchers referred the latest tariff data from World Trade Organization (WTO) using tariff download facility tool. WTO's members reported tariff regimes granted by them to certain trading partners. Table 17 shows an example of 100% free customs duty granted by Morocco to the countries belong to European Communities, Egypt, Tunisia and Turkey for steel tubes, pipes and hollow profiles, of cast iron. Tunisia also applies the same policy. However, this tool does not provide the tariff for SKF's Rings. Moreover, the customs duty from country to country among 19 potential countries is also unavailable or insufficient. Hence, in this thesis, the researchers used the tariff for tubes and bars for reference, not to compare or exclude any countries. This parameter will not be used in country risk

analysis as a blocking point.

Table 17: Free trade agreement and Customs Duty free

Reporter	Year	Tariff Regimes Granted by Reporter (Excluding MFN)	Duty Free TL (%)	HS subheading 6-digit description
Morocco	2016	Free-trade agreement duty rate for EFTA countries	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for Egypt	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for Jordan	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for the Arab League Member Cou	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for Arab Mediteranean Countries	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for Saudi Arabia	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for Tunisia	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for Turkey	100	Tubes, pipes and hollow profiles, of cast iron
Morocco	2016	Free-trade agreement duty rate for the European Communities	100	Tubes, pipes and hollow profiles, of cast iron

The European Union Customs Union (EUCU) is a customs union which consists of all the member states of the European Union (EU) and Monaco. No customs duties are levied on goods travelling within the customs union, according to European Commission (2017). Hence, among 19 potential countries and the countries where SKF has factories in, there is no customs duty charged on the goods travelling within Bulgaria, Czech Republic, Poland, Romania, Slovakia, Austria, France, Germany, Italy, Spain and Sweden. Besides that, trade agreement from EU–Turkey Customs Union allows good traveling between two entities without customs restrictions. EU-Ukraine Deep and Comprehensive Free Trade Area also enables free Customs Duty from EU to Ukraine and vice versa. Free Trade Agreement between Mexico and the EU allows taxes applying to a large quantity of goods to be eliminated or reduced.

5.3.6 Availability of materials and industries

The availability of direct materials (Steel Bars and Steel Tubes) and industries (Forging and Casting operation) to produce Rings in particular country is available on Europages.com where 3 million companies listed on this website. Figure 16 visualizes the supplier base of either materials or industries in 19 countries. In terms of Steel Bar and Casting Operation, Poland, Romania, Turkey and Morocco have the largest supplier base. Bulgaria, Romania, Turkey and Ukraine have high number of Steel Tube suppliers. In regard to Forging industry, Czech Republic, Poland, Romania, Russia, Turkey and Ukraine are very dominant.
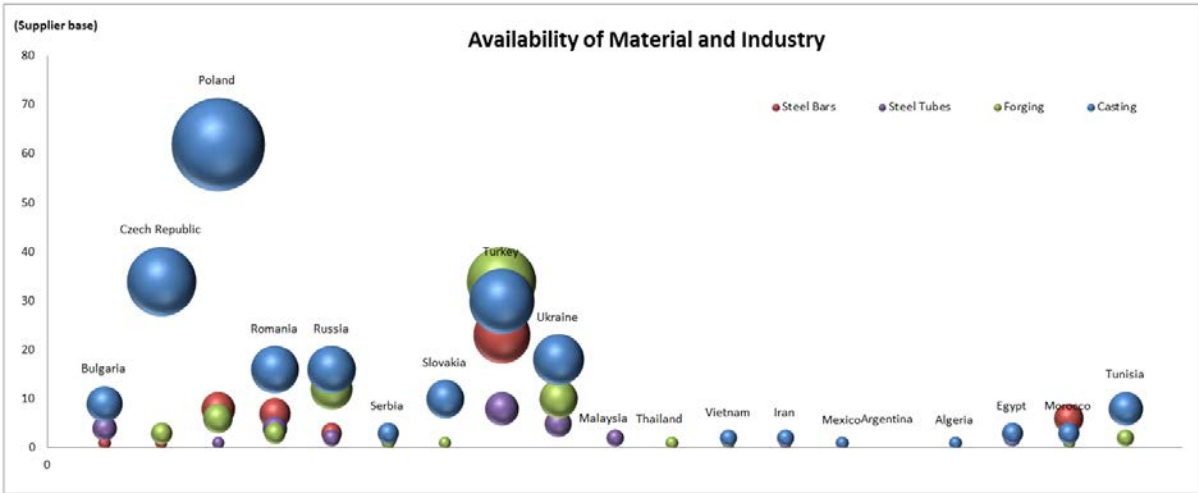
Figure 16: Availability of materials and industries

5.3.7 Inflation

Inflation rate was extracted from tradingeconomics.com in April 2017. The researchers focus both on current inflation rate and forecast inflation rate in 2020, see figure 17. The data is measured in percentage. Currently, Ukraine, Argentina and Egypt experience significantly high inflation in comparison with other countries. However, the forecast show that these rates will go down in 2020.

	Sweden	Germany	Bulgaria	Czech Republic	Poland	Romania	Russia	Serbia	Slovakia	Turkey	Ukraine	Malaysia	Thailand	Vietnam	Iran	Mexico	Argentina	Algeria	Egypt	Morocco	Tunisia
Inflation (% Current)	1.80%	1.60%	1.70%	2.60%	2.00%	0.20%	4.30%	3.20%	1.20%	11.29%	15.10%	4.50%	0.76%	4.65%	10.60%	5.34%	40.50%	8.30%	30.90%	1.60%	4.80%
Forecast inflation 2020	2.60%	2.40%	2.50%	2.60%	2.30%	2.80%	5.00%	2.60%	2.40%	3.80%	4.70%	4.10%	2.60%	3.40%	5.90%	4.00%	10.00%	9.60%	9.50%	2.00%	6.00%

Figure 17: Inflation rate

5.3.8 Governmental stability

Governmental stability was gathered from globaleconomy.com. The latest update is from 2015. The index was measured between -2.5 (weak stability) to +2.5 (very strong stability). The government of Czech Republic, Poland and Slovakia are very stable while it is very unstable in Turkey, Ukraine and Egypt (see figure 18).

	Sweden	Germany	Bulgaria	Czech Republic	Poland	Romania	Russia	Serbia	Slovakia	Turkey	Ukraine	Malaysia	Thailand	Vietnam	Iran	Mexico	Argentina	Algeria	Egypt	Morocco	Tunisia
Governmental stability	0.97	0.72	0.02	0.96	0.85	0.03	-1.05	0.23	1.01	-1.28	-1.99	0.19	-0.96	0.01	-0.91	-0.85	-0.07	-1.05	-1.34	-0.34	-0.87
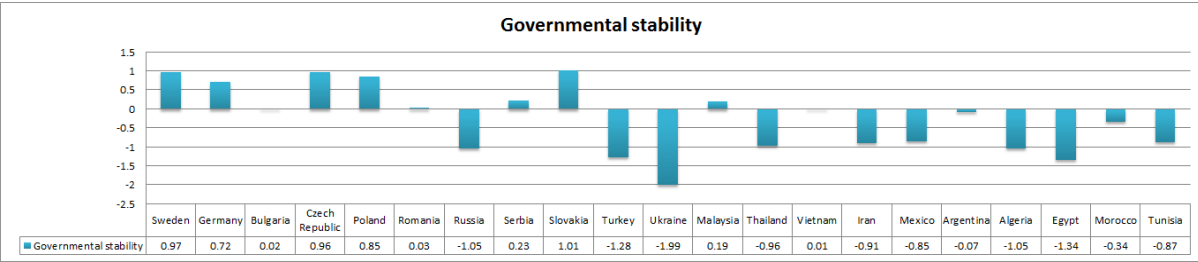
Figure 18: Governmental stability

5.3.9 Physical infrastructure

Physical infrastructure is supportive parameter in order to declare BCC. Physical infrastructure discussed in this thesis is electricity supply and overall transport infrastructure including road, rail road, port, and air transport infrastructure. It is an advantage to have high grades in those respective countries. The data gathered from global competitiveness report which was updated in 2016-2017. The quality score of physical infrastructure is measured between 1 (bad) to 7 (good). Going into detail of electricity supply (see figure 19), countries are ranked at good quality are Czech Republic, Slovakia and Malaysia. The rest countries except Argentina and Egypt have relatively good quality.
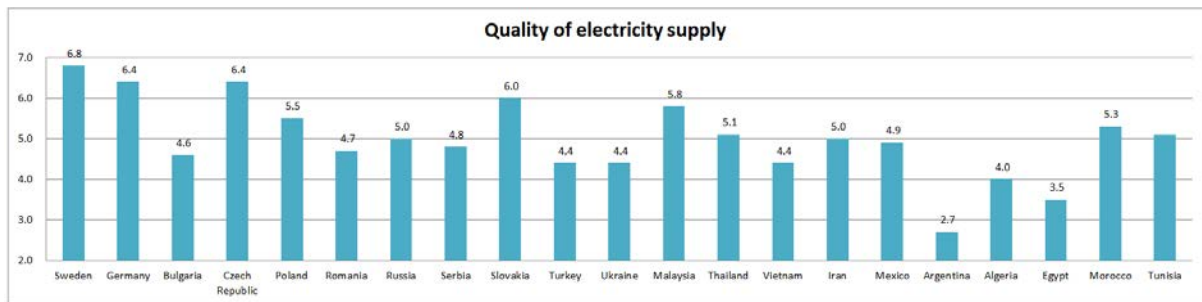
Figure 19: Quality of electricity supply

For overall transport infrastructure, Czech Republic, Turkey and Malaysia are at the best quality while other countries including Serbia, Argentina, Algeria and Egypt are at the lowest (see figure 20).
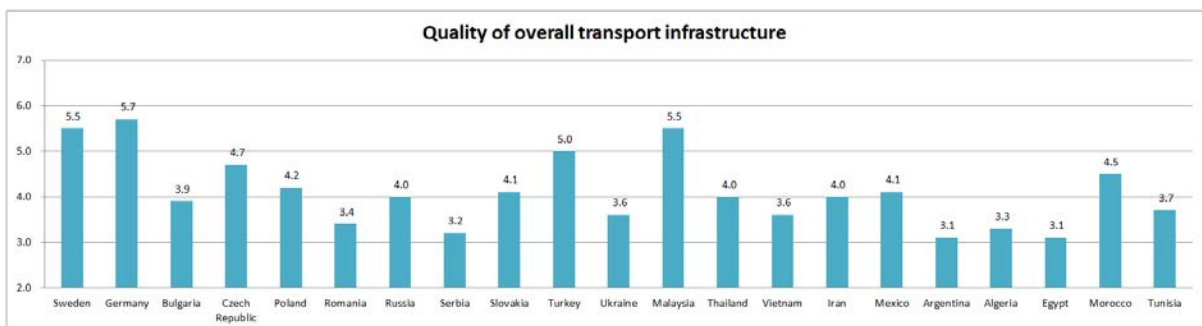
Figure 20: Quality of overall transport infrastructure

5.3.10 Intellectual Property Protection

The data was collected from global competitiveness report in 2016-2017. According to this report, European business leaders see other countries' laws and policy toward intellectual protection is the competitive advantage for them. Figure 21 shows the extent in which the intellectual property is protected in specific country, 1-not at all, 7-to a great extent. Among 19 countries, Czech Republic and Malaysia's laws and policy offer the highest protection.
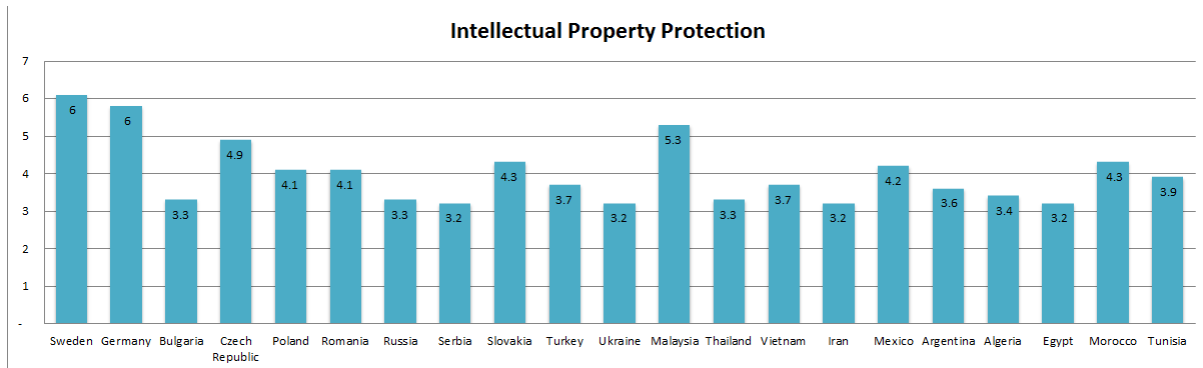
Figure 21: Intellectual property protection

5.3.11 Price of gasoline

Gasoline price was updated from the webpage GlobalPetrolPrices.com on Apr-3rd 2017, see figure 22. According to this external source, the average price of gasoline around the world was 0.95 Euro per liter. However, there is significant difference in these prices among countries due to the various taxes and subsidies for gasoline. GlobalPetrolPrices.com (2017) explains the fact is that all countries have access to the same petroleum prices of international markets but then decide to impose different taxes. As a result, the retail price of gasoline is different in different countries. Among 19 countries which are under the investigation of BCCS for Rings, the lowest gasoline prices is 0.3 Euro per liter in Algeria, 0.32 Euro per liter in Egypt, 0.35 Euro per liter in Iran. The gasoline price is relatively low in Russia, Ukraine, Mexico, Tunisia, and some Asian countries including Malaysia and Vietnam, which are 0.64, 0.85, 0.89, 0.68, 0.45 and 0.79 Euro per liter respectively. Swedish gasoline price is the highest one, 1.48 Euro per liter. Germany, Czech Republic, Serbia, Slovakia, Turkey and Argentina keep quite high price which is around 1.2 Euro per liter. The rest countries including Bulgaria, Poland, Romania, Thailand and Morocco have the same price compared with the global average gasoline price.
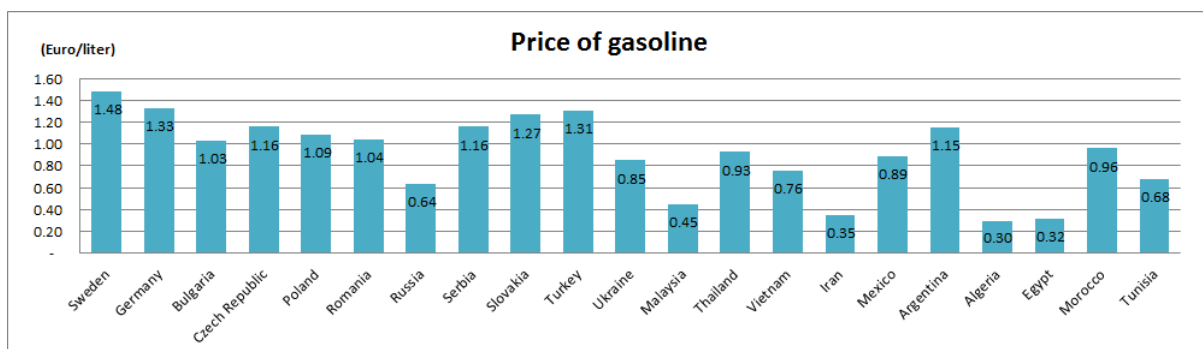
Figure 22: Price of gasoline

5.3.12 Price of diesel

Diesel price was also updated from the Globalpetrolprices.com on Apr-3rd 2017. Globalpetrolprices.com has the general rule mentioned that richer countries have higher prices while poorer countries and the countries that produce and export oil have lower prices. Having the same pattern with gasoline price, Iran, Algeria and Egypt are the countries holding the lowest diesel price which is only 0.09, 0.17 and 0.12 Euro per liter respectively. One notable fact is that average diesel price around the world is 0.84 Euro per liter. As can be seen in figure 23, Russia, Ukraine, Malaysia, Thailand, Vietnam, Morocco and Tunisia keep their prices lower than this average figure. Bulgaria, Poland, Romania and Argentina control their price almost the same while Sweden, Serbia, Slovakia and Turkey put the price much higher than the average one.
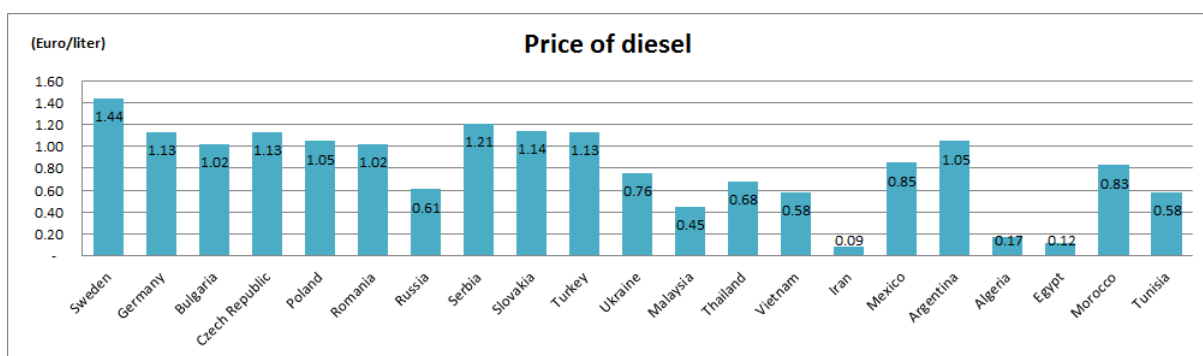
Figure 23: Price of diesel

5.3.13 Taxes

The total number of taxes paid by business in respective countries is available on Theglobaleconomy.com. The latest data is from 2015 whereby Serbia, Vietnam, Algeria and Egypt have applied the highest number of taxes (figure 24). In contrast, having the business in Czech Republic, Poland, Russia, Ukraine, Mexico, Morocco and Tunisia require only from 5 to 8 different taxes.
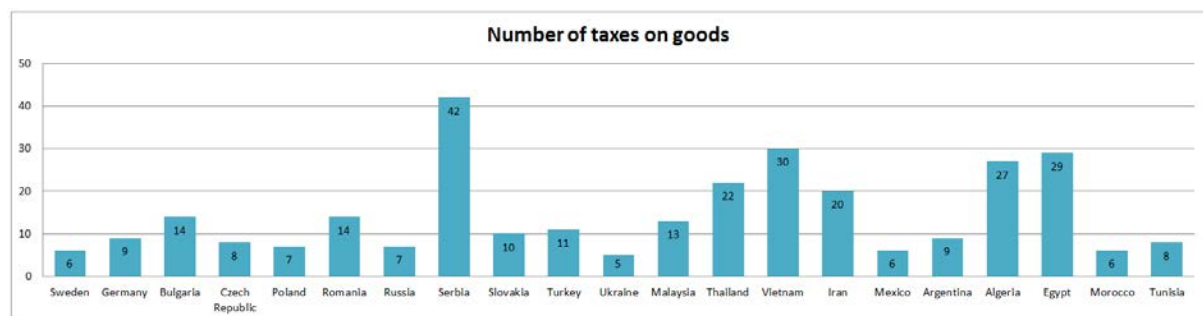
Figure 24: Number of taxes on goods

TradingEconomics.com, 2016 provided the latest actual values and forecasts of sales tax for several countries. Figure 25 visualizes most respective countries apply sales tax around 20%. The applied sales tax in Malaysia, Thailand, Vietnam, Iran and Algeria are lower than 10%. There is one special case of Algeria in which their standard sales tax is 17%. However, the sales tax for certain iron and steel product are reduced down to 9%.

Figure 25: Sales tax

5.3.14 Capacity for Innovation

This information is available on global competitiveness report 2016-2017. There is greater opportunity for innovation in Bulgaria, Czech Republic, Slovakia, Turkey and Malaysia. Meanwhile, Ian, Argentina and four African countries including Algeria, Egypt, Morocco and Tunisia have not yet had sufficient environment supporting innovation (figure 26).
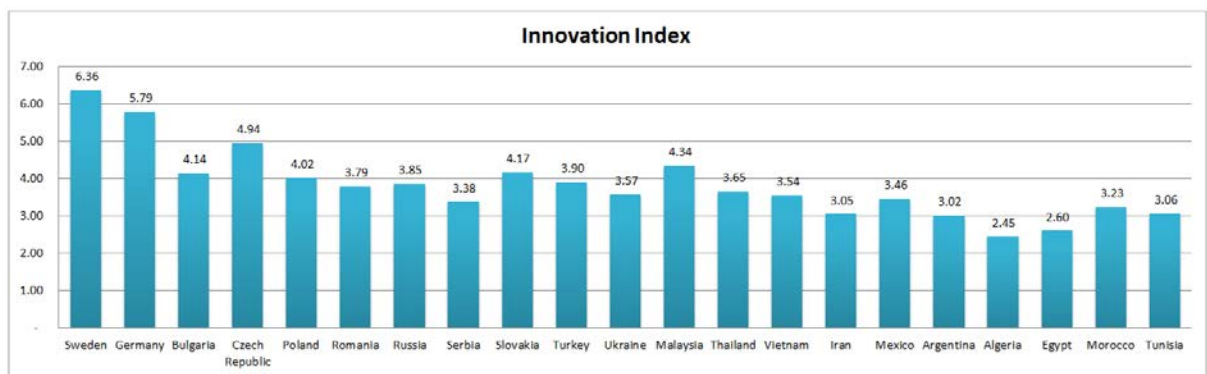
Figure 26: Innovation index

5.3.15 Technology readiness

Data related to technological readiness and the availability of the latest technologies is available on global competitiveness report 2016-2017. The extent of technology readiness (see figure 27) is very high in Bulgaria, Czech Republic, Poland, Romania, Slovakia and Malaysia. This index is lower in Ukraine, Vietnam, Iran and four African countries.
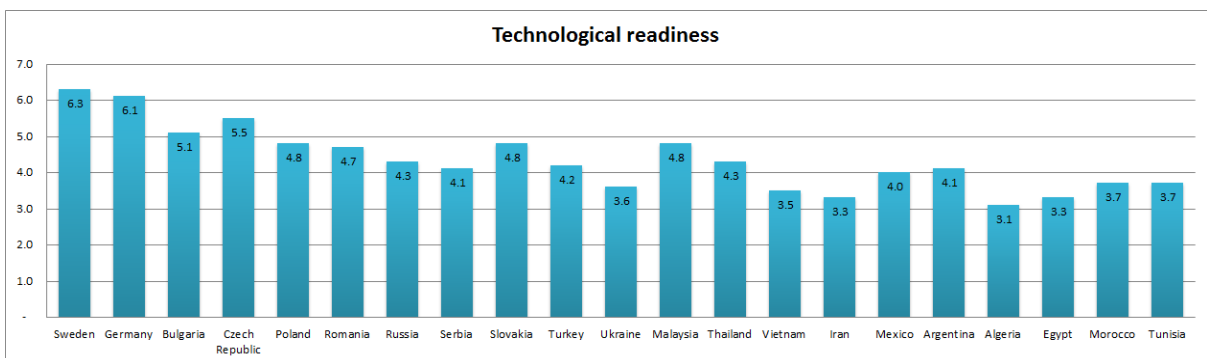
Figure 27: Technological readiness

60

5.3.16 English fluency

English fluency is referred from Education First English Proficiency Index, the world's largest ranking of countries by English skills. Due to the limitation that the latest data in 2016 is available for some countries, this parameter will not be used to compare and select sourcing countries, only for reference. As can be seen in figure 28, Poland, Romania, Slovakia, Malaysia and Argentina have high competitive advantage by speaking English very fluently.
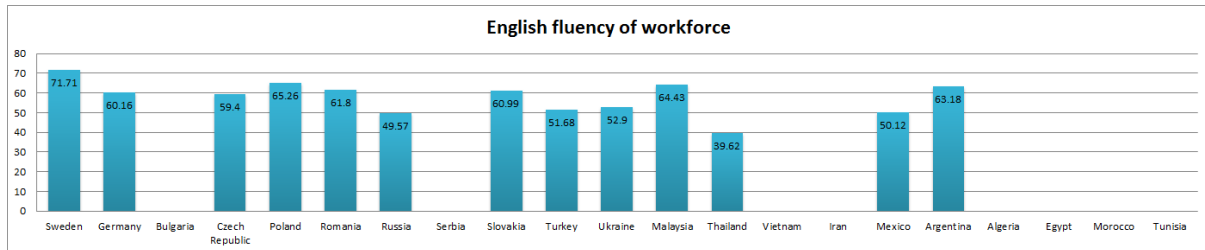
Figure 28: English fluency

5.3.17 Interest rate

Interest rate was updated from tradingeconomics.com in April 2017. Among 19 countries, Ukraine, Iran, Argentina and Egypt apply the highest interest rate currently and in 2020 according to the forecast rate, see figure 29.
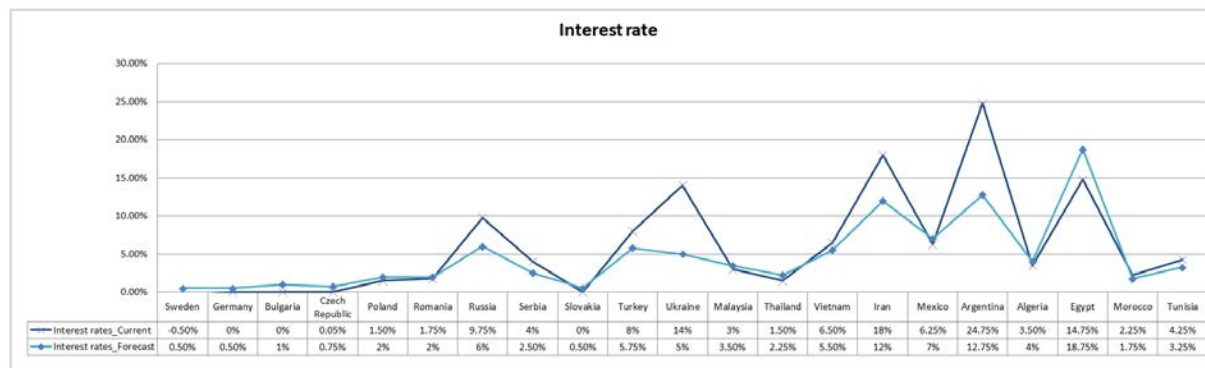
Figure 29: Interest rate

For other parameters which consist of *Climate condition, Democratic accountability, Cultural difference, Consuming market, Environmental and sustainable requirements,* as mentioned in chapter 1.7, there is a limitation that the statistical data of these parameters couldn't be found from either external source or SKF internal source.

6 APPLYING DEVELOPMENT FUNNEL ANALYSIS

Combining the suggestion from the interviews with SKF's GCMs, there are 19 potential countries going into the analysis. The selection of countries to go further into the final decision of BCCS follows development funnel analysis. This method is used to narrow down the number of investigated countries and select the final BCC by going through four filter phases containing conditions related to TCO, risk analysis, industrial availability and current sourcing strategy, see figure 30.
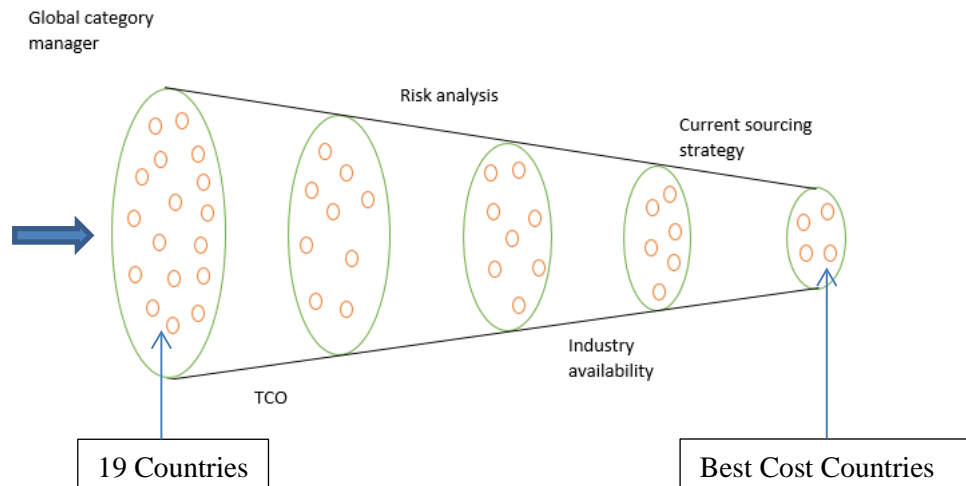
Figure 30: Four-phase development funnel

Phase 1: Total Cost of Ownership

The reason TCO is chosen to be the first condition due to its importance from literature review. TCO was also suggested by many GCMs in SKF. TCO is calculated by summing up the prices of gasoline, diesel, energy, skilled labor and unskilled labor. The prices of gasoline, diesel and energy not only impact significantly on the production cost which decide the price of commodity but also the cost of transportation. In terms of TCO, when comparing all potential countries with each other, Algeria, Egypt, Ukraine, Tunisia, Vietnam and Mexico are the most attractive (see figure 31). However, in the comparison with reference Western countries Sweden and Germany, the TCO of Czech Republic, Poland, Romania, Slovakia, Russia, Turkey, Argentina and Morocco are still potential. Taking Czech Republic into account, although the TCO of Czech Republic is the highest among investigated countries, it only accounts for one-third of Sweden's TCO. It means Czech Republic can still become BCC. Hence, from this phase, all the countries are of potential.
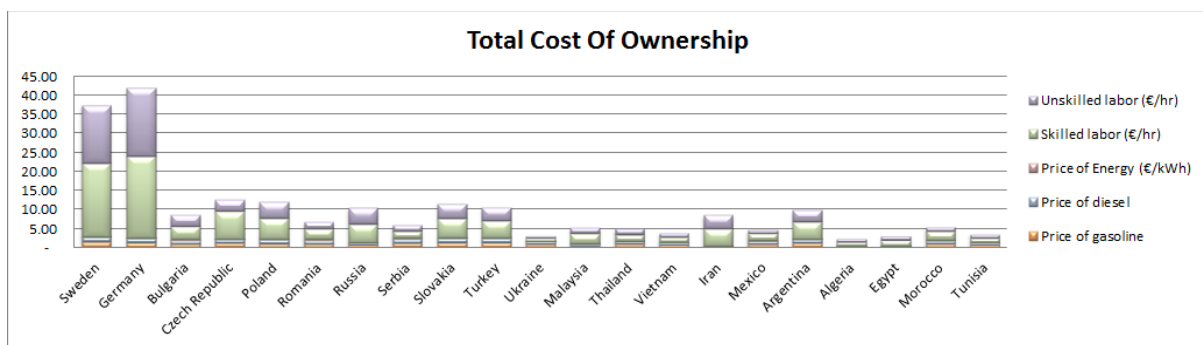
Figure 31: TCO per country

Phase 2: Country risk analysis

Statistical data collected for all parameters from different sources are converted into one scale. In order to establish the classification limit to classify data, the value of Mean (μ) and Standard Deviation (s) of each parameter are calculated based on the actual statistic data (see appendix 4). The result of Mean and Standard Deviation calculation of each parameter in detail are presented in table 18.

Table 18: Calculated Mean, Standard Deviation and ½ Standard Deviation

Country ⁄ Parameter	Mean	Standard Deviation	1/2 Standard Deviation
War risk	3.05	1.65	0.82
Terrorism index_Current	3.06	2.73	1.36
Terrorism index Forecast 2020	3.03	2.51	1.26
Human rights	4.55	1.45	0.73
Child labor	4.67%	4.50%	2.25%
Governmental Transparency	3.98	0.95	0.47
Wage growth	5.81%	9.52%	4.76%
Inflation_Current	8.08%	10.62%	5.31%
Forecast inflation_Forecast 2020	4.52%	2.59%	1.30%
Governmental stability	(0.39)	0.84	0.42
Quality of overall infrastructure	3.95	0.65	0.32
Quality of electricity supply	4.82	0.86	0.43
Intellectual property protection	3.80	0.61	0.31
Sales Taxes_Current	16.16%	5.47%	2.73%
Sales Taxes_Forecast 2020	16.48%	5.20%	2.60%
Number of taxes on goods	15.16	10.38	5.19
Technological readiness	4.15	0.67	0.33
Availability of latest technologies	4.61	0.63	0.31
Interest rates_Current	6.52%	6.88%	3.44%
Interest rates_Forecast 2020	5.07%	4.75%	2.38%
Innovation Index	3.59	0.61	0.31

Among these parameters, the statistical data of *Human rights, Governmental transparency, Government stability, Quality of overall infrastructure, Quality of electricity supply, Intellectual property protection, Technological readiness, Availability of the latest technologies* and *Innovation index* follow positive pattern, which means, the higher the figure is, the more attractive of the country it represents. The legend established to assess these parameters is introduced below in table 19.

Table 19: Legend to analyze positive parameters

Class	Legend	Score	Label
1	$<\mu - 1s$	-2	Very risky
2	$\mu - 1s$ to $\mu - 1/2s$	-1	Risky
3	$\mu - 1/2s$ to $\mu + 1/2s$	0	Neutral
4	$\mu + 1/2s$ to $\mu + 1s$	1	Safe/attractive
5	$> \mu + 1s$	2	Very safe/very attractive

The values of classification limit of these parameters are presented in figure 20

Table 20: Classification limit for positive parameters

Parameter	$\mu - 1s$	$\mu - 1/2s$	$\mu + 1/2s$	$\mu + 1s$
Human rights	3.10	3.82	5.28	6.00
Governmental Transparency	3.03	3.51	4.45	4.93
Governmental stability	(1.23)	(0.81)	0.03	0.45
Quality of overall infrastructure	3.30	3.62	4.27	4.59
Quality of electricity supply	3.96	4.39	5.25	5.68
Intellectual property protection	3.19	3.49	4.11	4.41
Technological readiness	3.48	3.82	4.49	4.82
Availability of latest technologies	3.98	4.30	4.93	5.24
Innovation Index	2.97	3.28	3.89	4.20

In contrast, the statistical data of *War risk, Terrorism index, Child labor, Wage growth, Inflation, Sales Taxes on goods and services, Number of taxes on goods and Interest rates* follow negative pattern, which means, the lower the figure is, the better performance it represents. The legend established to assess these parameters is introduced below in table 21.

Table 21: Legend to analyze negative parameters

Class	Legend	Score	Label
1	<μ - 1s	2	Very safe/very attractive
2	μ - 1s to μ - 1/2s	1	Safe/attractive
3	μ - 1/2s to μ + 1/2s	0	Neutral
4	μ + 1/2s to μ + 1s	-1	Risky
5	> μ + 1s	-2	Very risky

The values of classification limit of these parameters are presented in table 22.

Table 22: Classification limit for negative parameters

Parameter	μ - 1s	μ - 1/2s	μ + 1/2s	μ + 1s
War risk	1.40	2.23	3.88	4.70
Terrorism index_Current	0.34	1.70	4.43	5.79
Terrorism index_Forecast 2020	0.52	1.77	4.28	5.54
Child labor (%)	0%	2.42%	6.92%	0.09
Wage growth (%)	-3.71%	1.05%	10.57%	0.15
Inflation_Current (%)	-2.54%	2.77%	13.39%	0.19
Inflation_Forecast 2020 (%)	1.92%	3.22%	5.81%	0.07
Sales Taxes on goods & services_Current (%)	10.69%	13.42%	18.89%	0.22
Sales Taxes on goods & services_Forecast 2020 (%)	11.28%	13.88%	19.07%	0.22
Number of taxes on goods	4.78	9.97	20.35	25.54
Interest rates_Current (%)	-0.36%	3.08%	9.96%	0.13
Interest rates_Forecast 2020 (%)	0.31%	2.69%	7.44%	0.10

The results from converting every parameter into one ranking scale is presented in table 23.

Table 23: Result from converting every parameter into one ranking scale

Country / Parameter	Bulgaria	Czech Republic	Poland	Romania	Russia	Serbia	Slovakia	Turkey	Ukraine	Malaysia	Thailand	Vietnam	Iran	Mexico	Argentina	Algeria	Egypt	Morocco	Tunisia
War risk	2	2	2	2	-1	0	2	-1	-2	1	-1	0	-2	1	0	-1	-2	0	-1
Terrorism index_Current	1	0	2	2	-1	2	2	-2	-2	0	-2	2	0	0	1	0	-2	1	-1
Terrorism index Forecast 2020	2	0	2	2	-2	2	2	-2	-2	0	-2	2	0	0	1	-1	-1	0	0
Human rights	1	2	2	1	-1	1	2	-1	0	0	-2	-2	-2	-1	0	0	-1	0	0
Child labor	0	2	2	1	2	-2	2	0	1	2	-1	-2	-2	0	0	0	-1	-1	1
Governmental Transparency	0	2	2	1	-2	0	2	0	-2	1	-1	-1	-2	-2	0	-1	-1	0	0
Wage growth	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0
Inflation_Current	1	1	1	1	0	0	1	0	-1	0	1	0	0	0	-2	0	-2	1	0
Forecast inflation_Forecast 2020	1	1	1	1	0	1	1	0	0	0	1	0	-1	0	-2	-2	-2	1	-1
Governmental stability	0	2	2	0	-1	1	2	-2	-2	1	-1	0	-1	-1	0	-1	-2	0	-1
Quality of overall infrastructure	0	2	0	-1	0	-2	0	2	-1	2	0	-1	0	0	-2	-2	-2	1	0
Quality of electricity supply	0	2	1	0	0	0	2	0	0	2	0	0	0	0	-2	-1	-2	1	0
Intellectual property protection	-1	2	0	0	-1	-1	1	0	-1	2	-1	0	-1	1	0	-1	-1	1	0
Sales Taxes_Current	-1	-1	-2	-1	0	-1	-1	0	-1	2	2	2	2	0	-1	2	1	-1	0
Sales Taxes_Forecast 2020	-1	-1	-2	0	0	-1	-1	0	-1	2	2	2	2	0	-1	2	0	-1	0
Number of taxes on goods	0	1	1	0	1	-2	0	0	1	0	-1	-2	0	1	1	-2	-2	1	1
Technological readiness	2	2	1	1	0	0	1	0	-1	1	0	-1	-2	0	0	-2	-2	-1	-1
Availability of latest technologies	0	2	0	0	0	-1	2	0	0	2	0	-1	-1	1	-2	-2	-2	1	0
Interest rates_Current	1	1	1	1	0	0	1	0	-2	1	1	0	-2	0	-2	0	-2	1	0
Interest rates_Forecast 2020	1	1	1	1	0	1	1	0	0	0	1	0	-2	0	-2	0	-2	1	0
Innovation Index	1	2	1	0	0	0	1	1	0	2	0	0	-1	0	-1	-2	-2	-1	-1

The result from multiplying these figures with weighted percentage is presented in table 24.

Table 24: Weighted score for all parameters and countries

Parameter	Weighted percentage	Bulgaria	Czech Republic	Poland	Romania	Russia	Serbia	Slovakia	Turkey	Ukraine	Malaysia	Thailand	Vietnam	Iran	Mexico	Argentina	Algeria	Egypt	Morocco	Tunisia
War risk	4.6	9.1	9.1	9.1	9.1	-4.6	0.0	9.1	-4.6	-9.1	4.6	-4.6	0.0	-9.1	4.6	0.0	-4.6	-9.1	0.0	-4.6
Terrorism index_Current	4.6	4.6	0.0	9.1	9.1	-4.6	9.1	9.1	-9.1	-9.1	0.0	-9.1	9.1	0.0	0.0	4.6	0.0	-9.1	4.6	-4.6
Terrorism index Forecast 2020	4.6	9.1	0.0	9.1	9.1	-9.1	9.1	9.1	-9.1	-9.1	0.0	-9.1	9.1	0.0	0.0	4.6	-4.6	-4.6	0.0	0.0
Human rights	4.5	4.5	9.0	9.0	4.5	-4.5	4.5	9.0	-4.5	0.0	0.0	-9.0	-9.0	-9.0	-4.5	0.0	0.0	-4.5	0.0	0.0
Child labor	4.5	0.0	9.0	9.0	4.5	9.0	-9.0	9.0	0.0	4.5	9.0	-4.5	-9.0	-9.0	0.0	0.0	0.0	-4.5	-4.5	4.5
Governmental Transparency	4.2	0.0	8.5	8.5	4.2	-8.5	0.0	8.5	0.0	-8.5	4.2	-4.2	-4.2	-8.5	-8.5	0.0	-4.2	-4.2	0.0	0.0
Wage growth	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Inflation_Current	3.8	3.8	3.8	3.8	3.8	0.0	0.0	3.8	0.0	-3.8	0.0	3.8	0.0	0.0	0.0	-7.7	0.0	-7.7	3.8	0.0
Forecast inflation_Forecast 2020	3.8	3.8	3.8	3.8	3.8	0.0	3.8	3.8	0.0	0.0	0.0	3.8	0.0	-3.8	0.0	-7.7	-7.7	-7.7	3.8	-3.8
Governmental stability	3.8	0.0	7.6	7.6	0.0	-3.8	3.8	7.6	-7.6	-7.6	3.8	-3.8	0.0	-3.8	-3.8	0.0	-3.8	-7.6	0.0	-3.8
Quality of overall infrastructure	3.7	0.0	7.4	0.0	-3.7	0.0	-7.4	0.0	7.4	-3.7	7.4	0.0	-3.7	0.0	0.0	-7.4	-7.4	-7.4	3.7	0.0
Quality of electricity supply	3.7	0.0	7.4	3.7	0.0	0.0	0.0	7.4	0.0	0.0	7.4	0.0	0.0	0.0	0.0	-7.4	-3.7	-7.4	3.7	0.0
Intellectual property protection	3.7	-3.7	7.4	0.0	0.0	-3.7	-3.7	3.7	0.0	-3.7	7.4	-3.7	0.0	-3.7	3.7	0.0	-3.7	-3.7	3.7	0.0
Sales Taxes_Current	3.4	-3.4	-3.4	-6.8	-3.4	0.0	-3.4	-3.4	0.0	-3.4	6.8	6.8	6.8	6.8	0.0	-3.4	6.8	3.4	-3.4	0.0
Sales Taxes_Forecast 2020	3.4	-3.4	-3.4	-6.8	0.0	0.0	-3.4	-3.4	0.0	-3.4	6.8	6.8	6.8	6.8	0.0	-3.4	6.8	0.0	-3.4	0.0
Number of taxes on goods	3.4	0.0	3.4	3.4	0.0	3.4	-6.8	0.0	0.0	3.4	0.0	-3.4	-6.8	0.0	3.4	3.4	-6.8	-6.8	3.4	3.4
Technological readiness	3.4	6.7	6.7	3.4	3.4	0.0	0.0	3.4	0.0	-3.4	3.4	0.0	-3.4	-6.7	0.0	0.0	-6.7	-6.7	-3.4	-3.4
Availability of latest technologies	3.4	0.0	6.7	0.0	0.0	0.0	-3.4	6.7	0.0	0.0	6.7	0.0	-3.4	-3.4	3.4	-6.7	-6.7	-6.7	3.4	0.0
Interest rates_Current	3.3	3.3	3.3	3.3	3.3	0.0	0.0	3.3	0.0	-6.5	3.3	3.3	0.0	-6.5	0.0	-6.5	0.0	-6.5	3.3	0.0
Interest rates_Forecast 2020	3.3	3.3	3.3	3.3	3.3	0.0	3.3	3.3	0.0	0.0	0.0	3.3	0.0	-6.5	0.0	-6.5	0.0	-6.5	3.3	0.0
Innovation Index	3.2	3.2	6.3	3.2	0.0	0.0	0.0	3.2	3.2	0.0	6.3	0.0	0.0	-3.2	0.0	-3.2	-6.3	-6.3	-3.2	-3.2
Total Weighted Score		**40.8**	**95.9**	**75.6**	**51.0**	**-26.3**	**-3.5**	**93.1**	**-24.4**	**-71.7**	**77.2**	**-23.6**	**-7.5**	**-59.5**	**-1.7**	**-47.4**	**-52.6**	**-113.7**	**18.8**	**-15.4**

Summing up all these figures, the final number arranged from largest to smallest represented each country is shown in table 25.

Table 25: Total weighted score per country

Country	Weighted Score
Czech Republic	95.92
Slovakia	93.14
Malaysia	77.16
Poland	75.59
Romania	51.02
Bulgaria	40.84
Morocco	18.8
Mexico	-1.73
Serbia	-3.5
Vietnam	-7.52
Tunisia	-15.37
Thailand	-23.63
Turkey	-24.35
Russia	-26.34
Argentina	-47.35
Algeria	-52.59
Iran	-59.45
Ukraine	-71.69
Egypt	-113.72

Based on this result, it is clear to see Czech Republic is the safest country while Egypt is the most risky one. All 19 investigated countries are classified into three extreme groups. Group 1 are very safe and attractive countries consisting of Czech Republic, Slovakia, Malaysia, Poland, Romania, Bulgaria and Morocco. Group 2 consists of neutral countries Mexico, Serbia, Vietnam and Tunisia. Group 3 is very risky which contains Egypt, Ukraine, Iran, Algeria, Argentina, Russia, Turkey and Thailand.

Figure 32 visualizes the combination of TCO and country risk weighted score. In some cases it also visualizes the trade-off between these two conditions. All the countries in group 1 although very safe in term of country risk analysis, their TCO are of the highest except Malaysia, Romania and Morocco. The neutral countries in group 2 have advantage of low TCO. As mentioned by many GCMs, SKF is willing to pay more for countries having less serious risks. Countries like Turkey, Russia, Argentina and Iran, not only contain high risk, but are also in the top high TCO countries. Hence, these four countries will be taken out of consideration when going further in this thesis. Thailand, Ukraine, Egypt and Algeria, although are of high risk, they perform as the lowest TCO countries. If SKF decides to select sourcing country only based on low TCO, Ukraine for example, which offers the lowest labor wage, that decision maybe not correct in 5-10 years, see figure 18, in which Ukraine's wage growth is 35.42%. Significantly high wage growth makes Ukraine become less competitive in the long run. In case SKF is more cost-oriented and consider the risk can be controlled at the supply base, these countries can still be potential for further sourcing project at supplier level. However, in this

thesis, the researcher will not process further with these countries.
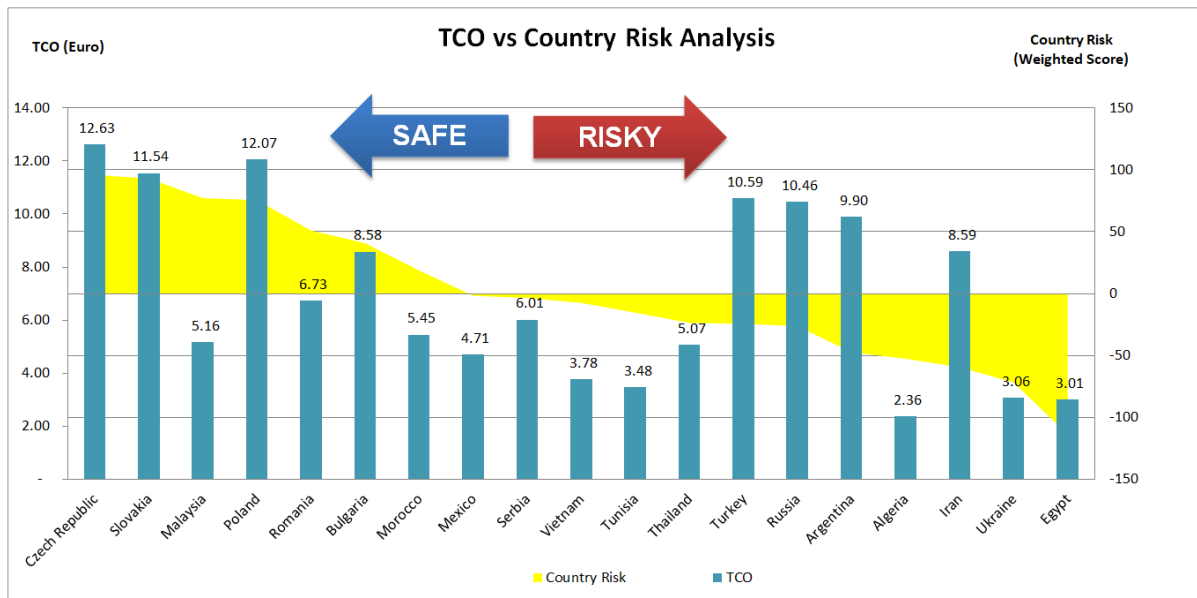
Figure 32: TCO vs. Country risk analysis

Phase 3: Availability of Materials and Industries

Figure 33 presents the available manufacturers and suppliers of Steel Bars, Steel Tubes, Forging operation and Casting operation of the countries in group 1 and group 2. As suggested by SKF's purchasing director, the scale to measure the supplier base should be *few* if the number of suppliers in a country is less than 5; *several* if the supplier number is between 5 to 29; and *many* if it is more than 30. From this chart, countries have very high availability of all four industries are Czech Republic, Poland and Romania. Slovakia, Bulgaria, Morocco, Serbia, Vietnam and Tunisia have several manufacturers and suppliers while Malaysia and Mexico have very few.
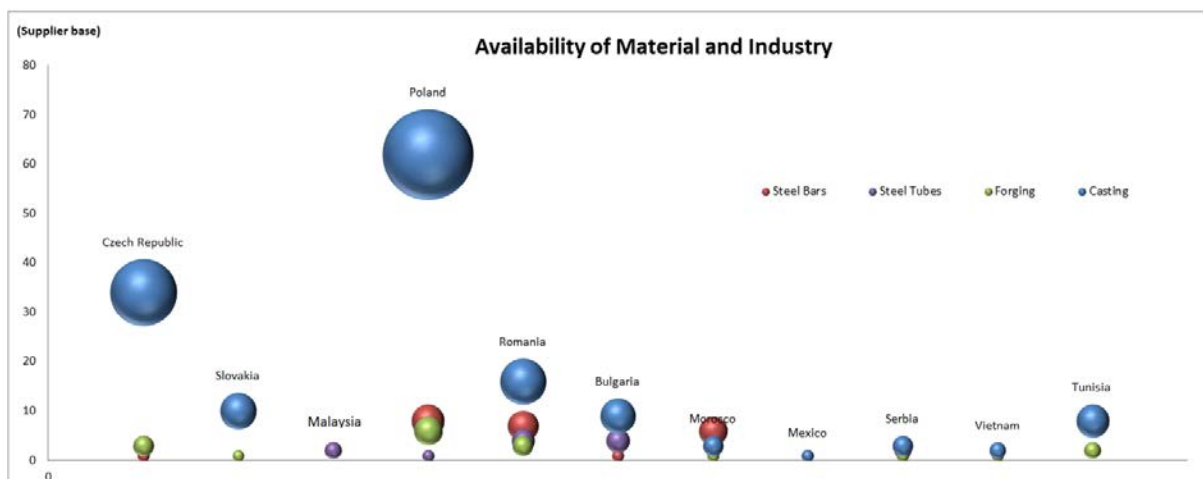
Figure 33: Availability of materials and industries of the safe and neutral countries

Gate 4: Current sourcing strategy

In consideration to the current sourcing strategy that SKF has tried to source locally and regionally as much as possible, also tried to avoid direct material transportation across continents in order to minimize the TCO and minimize the risk which may occur over geographically long distance. Keeping in mind opinions from GCMs which mentioned SKF needs to have supplier base in the region where SKF's factory located, the data about current sourcing flows from SKF's suppliers to SKF's factories at country level (see table 16) should be taken into account.

For European market, notable fact is that SKF has factories in Poland and Bulgaria. However, there is no current supplier there. The same case for Malaysia in Asian market, SKF currently has factory without supplier base in this country. For Latin American market, SKF has factories in Brazil, Mexico and Argentina. However, Mexico only supplies for Mexico, and Brazil only supplies for its own market. Argentina has to source from long distance countries including China, Japan and France. Mexico and Brazil also have to source from China, Japan, South Korea and US. Many GCMs mentioned that they cannot predict political situation in US that contain a lot of uncertainty. Hence, if SKF can find and work with the supplier in Poland, Bulgaria, Malaysia and Mexico, local and regional sourcing strategy will be met. All the problems related to long distance transportation will be eliminated.

7 RESULTS AND RECOMMENDATIONS

Table 26 presents the final results for 19 countries after going through development funnel which consists of 4 conditions: (1) having low TCO, (2) having low and manageable country risks, (3) having high availability of raw materials and industries, and (4) being close to SKF's current factory and meeting the target of local and regional sourcing strategy. Table 27 shows the legend for color visualization of country risk analysis.

Table 26: Final result

Country	Country Risk Analysis	TCO	Industry availability	SKF's current factory	SKF's current supplier	Conclusion	Note
Czech Republic	95.92	12.63	Many	✗	✓	BCC	continue
Slovakia	93.14	11.54	Several	✗	✓	BCC	continue
Malaysia	77.16	5.16	Few	✓	✗	future BCC	work with supplier there
Poland	75.59	12.07	Many	✓	✗	future BCC	work with supplier there
Romania	51.02	6.73	Many	✗	✓	BCC	continue
Bulgaria	40.84	8.58	Several	✓	✗	future BCC	work with supplier there
Morocco	18.8	5.45	Several	✗	✗	future BCC	work with supplier there
Mexico	-1.73	4.71	Few	✓	✓	future BCC	manage risk at supplier base
Serbia	-3.5	6.01	Several	✗	✓	future BCC	manage risk at supplier base
Vietnam	-7.52	3.78	Several	✗	✗	future BCC	work with supplier there / manage risk at supplier base
Tunisia	-15.37	3.48	Several	✗	✗	future BCC	work with supplier there / manage risk at supplier base
Thailand	-23.63	5.07				✗	
Turkey	-24.35	10.59				✗	
Russia	-26.34	10.46				✗	
Argentina	-47.35	9.90				✗	
Algeria	-52.59	2.36				✗	
Iran	-59.45	8.59				✗	
Ukraine	-71.69	3.06				✗	
Egypt	-113.72	3.01				✗	

Table 27: Legend of color visualization

	Very safe/attractive
	Safe/attractive
	Neutral
	Risky
	Very risky

Czech Republic, Slovakia and Romania are the BCCs. These countries are not only the safest countries; their availabilities of materials and industries to produce Rings are also very high. More than that, SKF's factories in Austria, France, Germany, Italy and Poland are currently buying from the suppliers in these countries. Czech Republic, Slovakia and Romania all belong to EUCU which means that Customs Duty is free of charge for the goods travelling from these countries to the countries of EU. SKF can also take advantage from the low TCO in Romania. Romania has proved to be BCC for European market with low TCO, low risk, and sufficiently available materials and industries to produce Rings. The researchers conclude that Czech Republic, Slovakia and Romania are the BCCs and recommend more SKF's factories in Europe to continue sourcing in these countries, also searching for more potential suppliers there to optimize these advantages.

Malaysia, Poland, Bulgaria and Morocco are the future BCCs in 3-5 years if SKF starts investigating and working with the supplier base there. Malaysia belongs to the top countries which perform very well in every parameters mentioned country risk analysis. Also offering very low TCO, having SKF's factory in the country, only one issue is that Malaysia has very few current suppliers available for bearing industry. In this case, as mentioned by SKF's GCMs, the potential country meeting all requirement of TCO and risk analysis only have not had industry, it would be the future BCC in 3-5 years and SKF can ask their supplier to move their business into this country. Poland and Bulgaria have very high availability of industries, manufacturers and suppliers in terms of Steel Bars, Steel Tubes, Forging and Casting. Besides that, Poland and Bulgaria are very attractive and safe regarding to all factors of risk evaluation. With a big advantage that SKF's factories located in these two countries, the researchers would suggest SKF to start approaching potential suppliers there to take benefit from the local sourcing strategy. Poland and Bulgaria are also the members of EUCU thus Customs Duty free is a plus if SKF's factories in EU source Rings from them. Morocco would also become BCC for African market and can also deliver the advantage to European factories since it is close to Europe in geographic view. 100% free Customs Duty granted by Morocco to the countries belong to European Communities, Egypt, Tunisia and Turkey for steel products brings Morocco many advantage to attract SKF's factories. Going through all the phases with conditions regarding to TCO, risk, availability of industry, the researchers claim that Morocco has very low TCO and low risk, but on the other hand Morocco has less number of industries which will get expand in 3 to 5 years in future.

Mexico and Serbia will become the future BCCs if SKF can manage the risk at supplier base. Mexico proves to be very potential with very low TCO, current SKF's factory in the country are working with the local suppliers. So, Mexico can become BCC for the whole Latin American market, regional supply for SKF's factories in Argentina and Brazil to utilize the benefit of geographically short distance. However, the risks related to corruption and human rights should be considered and managed. SKF can also ask current supplier in US to expand their business in Mexico and Latin America. Similarly for the case of Serbia, if SKF wants to utilize the low TCO, current supplier base and geographically short distance to source from Serbia to Europe market, the risks of child labor, relatively low quality of overall infrastructure, high number of taxes should be considered and managed when working with specific suppliers.

Vietnam and Tunisia will be future BCCs if SKF interests in their lowest TCO and available supplier base. In that case, SKF should start investigating and working with the supplier base there. However, SKF also needs to spend more effort to deal with suppliers in the code of conduct to mitigate risks of human rights, child labor, corruption, high number of taxes and relatively low technological readiness.

8   CONCLUSIONS AND FUTURE RESEARCH

The purpose of this thesis is to identify best-cost countries for SKF to source Rings, one of the most important groups of direct materials. Unlike low-cost country sourcing which focus on low purchasing price, low material and low labor cost; the center points of best-cost country sourcing are the total cost of ownership and country risk analysis. Best-cost country sourcing means that firms should search globally for the best place to source. Lower total cost of ownership is an advantage for best-cost country sourcing. However, best-cost country sourcing must also come along with the evaluation of other long term factors regarding to political, macroeconomic, socio-demographics, environment and sustainability.

In this thesis, in order to identify best-cost country for SKF to source Rings, data was collected from literature, interviews with SKF's global category manager, SKF internal data as well as external sources of information. The requirements for a best-cost country were defined as follows: (1) country should have low total cost of ownership; (2) the risks connected to sourcing from a country should be low and if they exist, they should be manageable; (3) country should have available materials and available industries to produce Rings, and (4) SKF's local and regional sourcing strategy should be met, which means best-cost country should be close to SKF's current factories. To meet these conditions, 27 parameters were identified with an impact on the selection and evaluation of best-cost country, follow the sequence of priority: *External/internal conflict (war, terrorism), human rights and policy toward child labor, commodity price, corruption, labor wage/salary, trade agreement and trade restriction, environmental and sustainable requirement, customs duty, availability of materials and industries, exchange rates, inflation, currency fluctuations, governmental stability, physical infrastructure, intellectual property protection, energy price, geographical structure, taxes, information and communication technology, technological readiness, democratic accountability, education and English fluency of the workforce, interest rates, climate condition, capacity for innovation, cultural difference, and consuming market.* The statistical data of these parameters were collected for 19 countries recommended by Rings global category manager. To make the data comparable, all the data was converted into one standard scale. This was made by using mean standard deviation and scoring scheme risk analysis. After that a development funnel method containing 4 conditions mentioned above was applied to analyze and conclude the best-cost countries.

Among 19 potential countries, Czech Republic, Slovakia and Romania are the current best-cost countries. The researchers recommend that SKF should continue working with the current suppliers in these countries and searching for more potential suppliers in these countries to optimize the current advantages. The future best-cost countries for European market in 3-5 years are Poland, Bulgaria and Serbia. Future best-cost countries for Asian market in 3-5 years are Malaysia and Vietnam. In Latin American market, Mexico was found to be the potential best-cost countries in the future. Morocco and Tunisia will become best-cost countries for both African and European market.

This research was conducted on country level only. In future research, identifying potential best-cost countries should also include supplier base analysis. Analysis at country level and supplier base level should go parallel. Hence, future research can focus on supplier base with more parameters related to quality, transportation cost and commodity price.

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10 APPENDIX

Appendix 1: Questions for Category Managers

Section 1: Background information

> Personal introduction: name, school, country
> Thesis introduction: purpose, support requirement from you
> Can you tell us in detail about your role and responsibility in SKF?

Section 2: Current sourcing

1. Could you please explain the process about how your category works? What is your strategy?
2. Which countries is the current sourcing for your category?
3. What is the current sourcing practice/strategy of your category? Is it local or global sourcing? Is it decentralized or centralized procurement strategy?
4. What is the sourcing target of your category? Low purchasing price, Flexibility, Availability, Quality?
5. How do you analyze your current sourcing country? Based on which criteria?
6. According to you, why do you think BCC (BCC) sourcing is necessary for your category because you already have your strategy in place?
7. If you break down the cost, what do you think which is the major cost in your category?

Section 3: Criteria (parameters/attributes)

8. In your opinion, what would be different parameters/attributes do you consider while selecting the BCC?
9. For some reasons, if you need to search a new country, how do you approach?

Section 4: Country level

10. Do you have any suggestion about in future which countries that you are interested in for your category sourcing? What are the reasons? Why do you think these countries are potential and what could be the reasons you did not touch upon those country? What are the troubles do you see in it?
11. According to you, do you think we could claim the particular country as BCCs without touching the suppliers contact?

Section 5: Communication mode

12. How do you communicate with country once you find potential area? What would be the first step?
13. While defining the criteria do you also study the competitors' status in the market? Do you consider any company (competitors, business partners) as benchmarking to set the

criteria?

14. What all resources do you use during your research about selection of countries? (eg public resources, business magazines etc)

15. Could you please suggest the public resource or business magazines related to the above parameters where we could do some research?

Section 6: Evaluate

16. Do you use any tool, model or method to evaluate the country? (e.g. TCO, country risk analysis)

17. Since TCO tool is more focused on supplier base, how do you approach TCO on country level?

18. According to you what all factors or parameters TCO model cover apart from costing on country level? (e.g. social, environmental factors)

19. How do you analyze the risk of a country? Do you have any tool for risk assessment or do you get any consultant service?

20. According to you how do you evaluate the quality criteria without knowing the suppliers? On what basis you define the country is suitable for good quality?

21. According to you, how do you find the ***transportation cost*** without knowing your supplier? Do you have any reference for it?

We are going through literature review about BCC sourcing and come up with the solution that BCC selection should be based on Total Cost of Ownership and country risk analysis. We have worked on SKF's model of Total Landed Cost and Total Cost of Acquisition, as well as country risk analysis. Below is our initial parameters/criterion that has impact on the selection of BCC. We need your evaluation on what extent you think the below criteria is important to analyze and select a BCC to source the material of your category. The grading score varies from **1-not important** to **10-very important**.

Parameter		*Grading from GCM* *1: not important* *10: very important*
Total Cost of Ownership	**Commodity price**: The price of material, steel, rubber, polymer, for example may impact on SKF's buying decision	
	Energy price: The price of electricity, oil and gas of a country will impact on SKF's total landed cost to source material in that country for example	
	Labor wage/salary: the extent of low labor cost of a country will favor for SKF's value adding	
	Customs Duty: the governmental policy of a country to favor or restrict the entry of foreign trade, including policy customs duty, trade structure in terms of commodity, method and trade areas can impact on SKF's buying decisions.	
	Taxes: the governmental policy of a country to favor or restrict the entry of foreign trade, including policy on tariffs, quotas, number of taxes can impact on SKF's buying decisions.	
Social-Political factors	**Democratic accountability:** the degree of responsiveness of government to its people. Any potential or actual change in political	

	system for example democratic election may disrupt SKF's business	
	External/Internal conflict: external war, cross-border conflict, terrorism, civil war, religious tension, violent protest, civil disorder occurred in the countries where SKF has suppliers for example may disrupt SKF's business.	
	Governmental stability: the stability of government in the macro environment impacts on the certainty and reliability of the businesses. Suppliers operating in instable countries which contain many frequent strikes, social unrest, and chaos for example, their operations would be disrupted by these problems thus impact negatively on SKF's business.	
	Governmental transparency: the extent of corruption in public and private sectors of a country may cause barriers on the exchange and the delivery of services for SKF's business such as public procurement, license, contract, tax breaks and subsidies, market share, service of payment for example	
	Trade agreement and Trade restriction: the governmental policy to favor or restrict the entry of foreign trade, including policy on tariffs, quotas, trade structure in terms of commodity, method and trade areas can impact on SKF's buying decisions	
Socio-Demographic factors	**Consuming market:** opportunity to expand the consumption of SKF's product in existing market in sourcing countries	
	Education, English fluency of workforce: the extent of high education and English fluency of the workforces in some countries will contribute to SKF's value adding	

	Human rights, policy toward child labor: the extent of country's compliance to human rights where SKF invests will ensure SKF's compliance on code of conduct and limit the occasion of human rights' and child labor violation	
	Cultural differences: the level of cultural differences of sourcing countries for example safety culture related to safety procedure, environment and safety regulation, different traditional and behavior may impact on SKF's business cost of handling risk	
Macroeconomic factors	**Interest rates:** different interest rates from different country may impact on the business of SKF's suppliers, further impact on the purchased price thus impacts on SKF's value adding	
	Exchange rates: different rate facilitating the conversion of different national currencies into US dollar or Euro for example may impact on SKF's cross-country comparison	
	Currency fluctuations: currency fluctuation of countries where SKF invests would increase or reduce the value of the cash flow and return from the investment in SKF's home currency	
	Inflation: the rate of inflation of a country may impact on SKF's buying price and exchange rate	
Technological factors	**Information and Communication Technology (ICT):** the extent of high quality of ICT in some countries may favor the sourcing process, save time and effort, thus contribute to SKF's value adding.	
	Physical infrastructure: the availability of port, terminal, powers, road/ railroad/ air/ sea transportation mode and infrastructure of the sourcing countries will impact on SKF's total	

	landed cost	
	Capacity for Innovation: the extent in which a country innovates to generate the new knowledge needed to build new technologies of the sourcing countries may favor the supplier operating in those countries. The suppliers may adopt the advanced technology, enable innovation and competitiveness thus favor the current and future requirement of SKF's product development, brings benefit to SKF's value adding in long term.	
	Technological readiness: availability of the latest technology and knowledge about specific industry, the extent in which a country invest in research and development to generate the knowledge needed to build new technologies of the sourcing countries may favor the supplier operating in those countries. The suppliers may adopt the advanced technology, enhance the productivity of its industries, improve production process, increase efficiency, enable innovation and competitiveness thus favor the current and future requirement of SKF's product development, brings benefit to SKF's value adding in long term.	
	Intellectual property protection: The extent in which the intellectual property is protected in a particular country will be a competitive advantage for SKF to cooperate with the suppliers there for product's development and innovation.	
	Availability of material and industry: the availability and popularity of material such as steel, rubber, polymer, for example. As well as the availability of industry such as steel manufacturing, forging, etc. may impact on SKF's decision on selecting sourcing areas	
Natural factors	**Climate conditions**: earthquake, natural disasters for example may disrupt SKF's business	

	Geographical distance: geographical distance of sourcing countries may impact on SKF's total landed cost, transportation cost for example	
	Environmental and sustainable requirements: regulatory of sourcing countries about CO2 emission standard, pollution, resource usage such as water, land, forest, mineral where SKF has suppliers will ensure SKF's compliance on code of conduct and limit the occasion of environmental violation	

Appendix 3: Survey's answers from SKF's GCMs and weighted percentage calculation

Parameter	GCM 1	GCM 2	GCM 3	GCM 4	GCM 5	GCM 6	GCM 7	GCM 8	GCM 9	GCM 10	GCM 11	GCM 12	GCM 13	GCM 14	GCM 15	GCM 16	GCM 17	GCM 18	GCM 19	Total Grading Score	Weighted Percentage
External/Internal conflict	10	9	1	9	10	7	5	10	10	10	9	10	10	10	9	7	10	10	10	166	4.57%
Human rights, Child labor	10	10	8	6	10	5	9	7	9	10	9	10	10	9	7	7	10	10	7	163	4.49%
Commodity price	5	10	8	7	8	10	8	10	10	10	6	8	8	9	10	8	10	8	10	163	4.49%
Governmental transparency	10	6	9	9	9	6	6	8	10	5	10	6	9	9	8	7	10	8	9	154	4.24%
Labor wage/salary, wage growth	6	9	6	6	9	8	8	10	9	10	7	8	8	7	6	7	8	9	7	148	4.08%
Trade agreement and Trade restriction	5	9	4	5	8	9	8	8	10	10	7	8	8	8	10	6	8	7	10	148	4.08%
Environmental and sustainable requirement	10	7	7	6	7	8	9	5	9	10	7	4	8	9	7	8	10	9	8	148	4.08%
Customs Duty	5	9	7	6	5	8	6	10	10	10	7	4	8	7	10	8	8	8	8	144	3.97%
Availability of material	5	10	7	7	9	6	8	6	10	5	7	8	8	8	8	7	8	5	10	142	3.91%
Exchange rates	5	9	7	6	8	9	7	5	10	10	5	6	8	9	9	6	5	7	8	139	3.83%
Inflation	4	9	7	6	6	8	5	8	10	10	7	6	7	8	8	8	8	6	8	139	3.83%
Currency fluctuations	4	9	7	6	8	7	5	8	10	10	7	6	8	8	8	4	8	7	9	139	3.83%
Governmental stability	10	10	10	6	7	5	7	5	9	8	8	6	9	7	5	3	10	5	8	138	3.80%
Physical infrastructure	6	7	6	7	6	5	8	7	9	10	7	6	7	8	8	8	5	7	8	135	3.72%
Intellectual property protection	8	5	8	6	6	5	8	5	7	5	8	5	9	6	9	10	8	8	8	134	3.69%
Energy price	5	8	7	4	7	7	7	8	10	5	7	6	8	8	9	6	8	5	8	133	3.66%
Geographical structure	4	6	5	7	5	9	6	1	9	10	7	6	7	8	8	7	8	7	8	128	3.53%
Taxes	5	3	7	5	4	8	5	8	10	10	6	4	5	7	8	8	5	8	8	124	3.42%
Information and Communication Technology	6	6	6	4	7	3	6	10	7	10	7	4	7	7	8	7	5	7	7	124	3.42%
Technological readiness	4	7	6	5	7	4	7	5	7	5	7	6	7	8	8	7	8	7	7	122	3.36%
Democratic accountability	10	6	1	6	9	3	7	5	8	5	6	6	9	7	6	5	10	5	8	122	3.36%
Education, English fluency of workforce	6	7	7	5	5	4	8	8	8	5	6	4	7	8	6	6	5	6	7	118	3.25%
Interest rates	3	7	7	5	6	7	6	4	10	5	6	4	7	7	8	6	5	7	8	118	3.25%
Climate conditions	7	4	4	4	9	3	7	3	9	5	7	4	7	9	6	6	8	7	7	116	3.20%
Capacity for Innovation	6	8	6	4	8	4	8	6	5	5	7	4	5	8	7	7	5	5	7	115	3.15%
Cultural differences	5	6	6	4	8	3	8	6	5	5	6	2	7	7	6	6	8	6	7	111	3.06%
Consuming market	4	7	6	4	5	9	9	2	5	5	6	2	6	7	1	3	5	6	8	100	2.75%
Total																				3,631	100%

Appendix 4: Data collection

Country / Parameter	Bulgaria	Czech Republic	Poland	Romania	Russia	Serbia	Slovakia	Turkey	Ukraine	Malaysia	Thailand	Vietnam	Iran	Mexico	Argentina	Algeria	Egypt	Morocco	Tunisia
War risk	1.00	1.00	1.00	1.00	4.00	3.00	1.00	4.00	6.00	2.00	4.00	3.00	6.00	2.00	3.00	4.00	5.00	3.00	4.00
Terrorism index_Current	1.63	2.18	-	-	5.43	0.09	-	6.74	7.13	2.69	6.71	-	3.95	3.72	0.50	4.28	7.33	0.89	4.96
Terrorism index Forecast 2020	0.51	2.70	-	0.03	6.50	0.27	-	5.74	7.19	3.57	6.80	0.03	3.50	4.10	1.75	4.40	5.53	2.47	2.41
Human rights	5.58	6.99	6.73	5.44	3.41	5.84	7.2	3.45	3.95	4.07	3.06	2.97	2.07	3.51	4.86	3.95	3.54	4.89	4.93
Child labor	4.70%	0%	0%	1%	0%	10%	0%	6%	2%	0%	8%	16%	11%	4%	4%	5%	7%	8%	2%
Governmental Transparency	4.1	5.5	6.2	4.8	2.9	4.2	5.1	4.1	2.9	4.9	3.5	3.3	2.9	3	3.6	3.4	3.4	3.7	4.1
Wage growth	1.70%	2.80%	5%	1.70%			3.70%		35.42%		5.60%	7.20%				1.60%	1.60%	1.60%	1.60%
Inflation_Current	1.70%	2.60%	2.00%	0.20%	4.30%	3.20%	1.20%	11.29%	15.10%	4.50%	0.76%	4.65%	10.60%	5.34%	40.50%	8.30%	30.90%	1.60%	4.80%
Forecast inflation_Forecast 2020	2.50%	2.60%	2.30%	2.80%	5.00%	2.60%	2.40%	3.80%	4.70%	4.10%	2.60%	3.40%	5.90%	4.00%	10.00%	9.60%	9.50%	2.00%	6.00%
Governmental stability	0.02	0.96	0.85	0.03	-1.05	0.23	1.01	-1.28	-1.99	0.19	-0.96	0.01	-0.91	-0.85	-0.07	-1.05	-1.34	-0.34	-0.87
Quality of overall infrastructure	3.9	4.7	4.2	3.4	4.0	3.2	4.1	5.0	3.6	5.5	4.0	3.6	4.0	4.1	3.1	3.3	3.1	4.5	3.7
Quality of electricity supply	4.6	6.4	5.5	4.7	5.0	4.8	6.0	4.4	4.4	5.8	5.1	4.4	5.0	4.9	2.7	4.0	3.5	5.3	5.1
Intellectual property protection	3.3	4.9	4.1	4.1	3.3	3.2	4.3	3.7	3.2	5.3	3.3	3.7	3.2	4.2	3.6	3.4	3.2	4.3	3.9
Sales Taxes_Current	20%	21%	23%	19%	18%	20%	20%	18%	20%	6%	7%	10%	8%	16%	21%	9%	13%	20%	18%
Sales Taxes_Forecast 2020	20%	21%	23%	19%	18%	20%	20%	18%	20%	6%	7%	10%	11%	16%	21%	9%	16%	20%	18%
Number of taxes on goods	14	8	7	14	7	42	10	11	5	13	22	30	20	6	9	27	29	6	8
Technological readiness	5.1	5.5	4.8	4.7	4.3	4.1	4.8	4.2	3.6	4.8	4.3	3.5	3.3	4.0	4.1	3.1	3.3	3.7	3.7
Availability of latest technologies	4.9	5.7			4.4	4.1	5.5	4.9	4.3	5.6	4.8	4.1	4.0	5.0	3.9	3.7	3.9	5.0	4.6
Interest rates_Current	0%	0.05%	1.50%	1.75%	9.75%	4%	0%	8%	14%	3%	1.50%	6.50%	18%	6.25%	24.75%	3.50%	14.75%	2.25%	4.25%
Interest rates_Forecast 2020	1%	0.75%	2%	2%	6%	2.50%	0.50%	5.75%	5%	3.50%	2.25%	5.50%	12%	7%	12.75%	4%	18.75%	1.75%	3.25%
Innovation Index	4.14	4.94	4.02	3.79	3.85	3.38	4.17	3.90	3.57	4.34	3.65	3.54	3.05	3.46	3.02	2.45	2.60	3.23	3.06